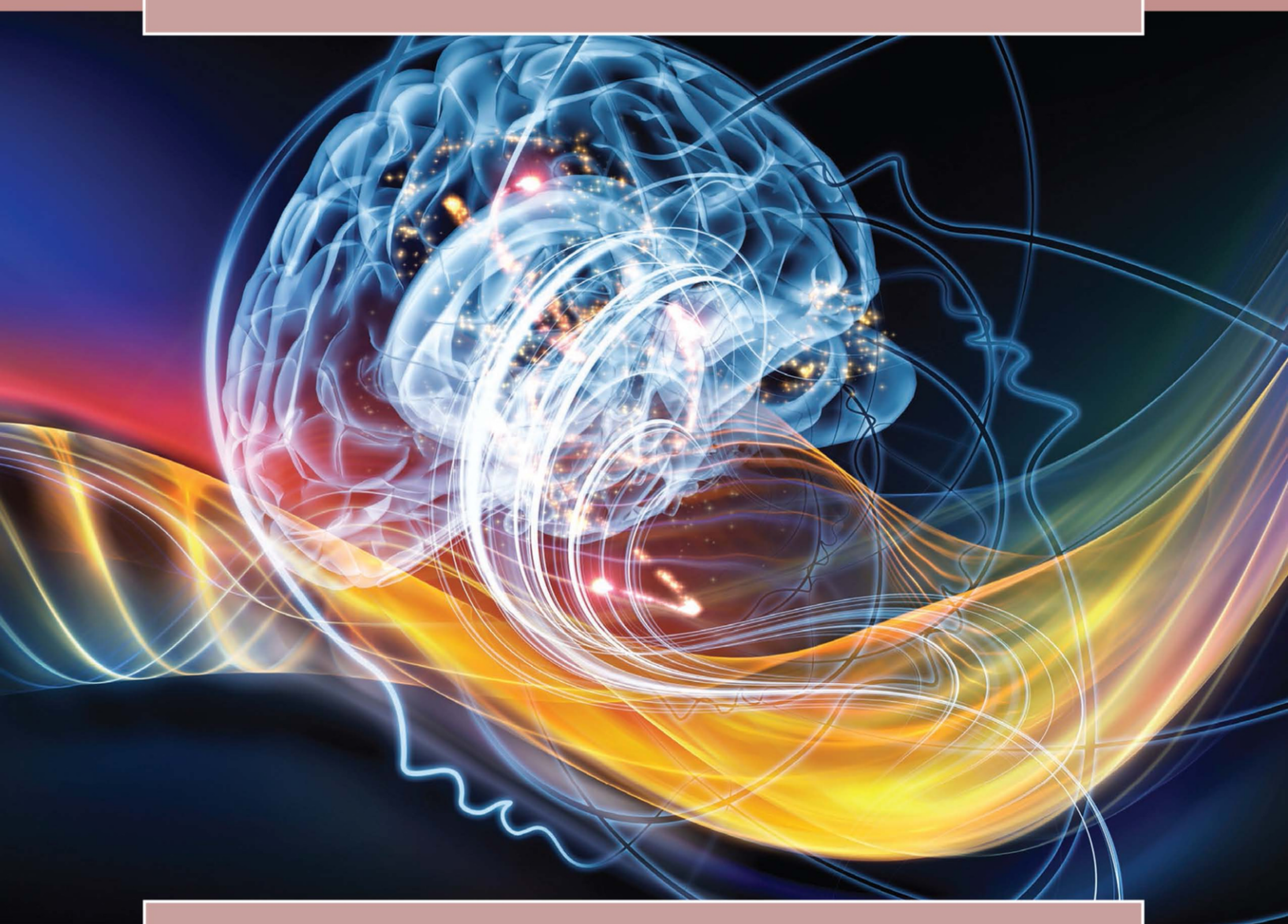
CONTEMPORARY APPROACHES TO RESEARCH IN LEARNING INNOVATIONS

Non-cognitive Skills and Factors in Educational Attainment

Myint Swe Khine and
Shaljan Areepattamannil (Eds.)



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Rationale

Learning today is no longer confined to schools and classrooms. Modern information and communication technologies make the learning possible anywhere, any time. The emerging and evolving technologies are creating a knowledge era, changing the educational landscape, and facilitating the learning innovations. In recent years educators find ways to cultivate curiosity, nurture creativity and engage the mind of the learners by using innovative approaches.

Contemporary Approaches to Research in Learning Innovations explores approaches to research in learning innovations from the learning sciences view. Learning sciences is an interdisciplinary field that draws on multiple theoretical perspectives and research with the goal of advancing knowledge about how people learn. The field includes cognitive science, educational psychology, anthropology, computer and information science and explore pedagogical, technological, sociological and psychological aspects of human learning. Research in these approaches examines the social, organizational and cultural dynamics of learning environments, construct scientific models of cognitive development, and conduct design-based experiments.

Contemporary Approaches to Research in Learning Innovations covers research in developed and developing countries and scalable projects which will benefit everyday learning and universal education. Recent research includes improving social presence and interaction in collaborative learning, using epistemic games to foster new learning, and pedagogy and praxis of ICT integration in school curricula.

Non-cognitive Skills and Factors in Educational Attainment

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PART I

INTRODUCTION

MYINT SWE KHINE

1. NON-COGNITIVE SKILLS AND FACTORS IN EDUCATIONAL SUCCESS AND ACADEMIC ACHIEVEMENT

INTRODUCTION

In the past decades the prediction of academic success has been considered dependent to cognitive factors such as intelligence and academic abilities. However, in recent years researchers in education and social sciences have recognized that non-cognitive factors and skills play a critical role in educational success and achievement (Stankov & Lee, 2014). Researchers firmly believe that non-cognitive factors and skills are equally or even more important than cognitive aspects in educative process and employment potential. When identifying the personal qualities that require to functioning well in the 21st century, the role of non-cognitive factors are often highlighted in the discourse. Increasing attempts are made to investigate the role of non-cognitive factors and how it associates with academic and life success. Barrett (2014) noted that non-cognitive factors should be taken seriously. The notion of 'non-cognitive' has many phraseological collocations. Among frequently used collocators are constructs, traits, skills, factors, abilities, variables, outcomes, attributes, and predictors. In addition myriad of other specific factors have been identified as non-cognitive. To name a few, grit, tenacity, curiosity, attitudes, self-concept, self-efficacy, anxiety, coping strategies, motivation, perseverance, confidence are among those frequently referred to in the literature. In some instances non-cognitive factors are considered multifaceted. Some refer to as soft skills and personal characteristics that fall into the affective domain.

The chapters in this book attempt to address in defining non-cognitive traits, ways to measure them, impact of non-cognitive factors and skills and how they can affect the positive outcomes in academic achievement, influence in employability, and success in social life. Some intervention strategies in improving non-cognitive skills are also described. The book is organized into three parts. After the introduction in the first part, the chapters in the second part address conceptual and theoretical foundations on non-cognitive factors. The third part consists of evidence from empirical studies including correlational and longitudinal analyses that signify the relationship between specific non-cognitive factors and educational attainment.

M. S. Khine & S. Areepattamannil (Eds.), Non-cognitive Skills and Factors in Educational Attainment, 3–9.

CONCEPTUAL AND THEORETICAL UNDERPINNINGS

This chapter in Part I portrays the synopsis of the chapters in the book. The chapters in Part II describe the conceptual and theoretical underpinnings of non-cognitive factors and skills. Chapter 2 on the importance of non-cognitive skills to educational pipeline is presented by Petway II, Brenneman and Kyllonen. The authors noted that the concept of educational pipeline that includes a series of important transitions from high school to graduation and entry to the workforce. They discussed that non-cognitive skills such as social awareness, resilience, self-confidence, self-management and motivation are important for successful transition through the educational pipeline. They suggested that the development of such skills early, starting from childhood to adolescence could help in their success in schools and beyond.

In Chapter 3, Emma Garcia reiterated the need to address non-cognitive skills in the educational process. The chapter reviewed what is known about the non-cognitive skills, what they are, why they are important and how these affect the educational process. Some of the skills listed are critical thinking, problem solving, social, and emotional health. Other skills include self-control, self-regulation, persistence, academic confidence, team work, organizational and communication skills. It is also important to note that the list may grow or shrink and specific definitions of each skill may vary on age and other relevant factors. The chapter proposed some guidelines for how to design educational policy that can nurture the non-cognitive skills in classrooms. The notion of educated person was highlighted and suggested that educational policies must establish the strategies to help individuals to become fully educated.

Sanchez-Ruiz and her colleagues from Lebanese American University noted that variables such as conscientiousness, academic motivation, emotional intelligence and self-efficacy are recognized as non-cognitive factors that can affect academic performance. In their chapter (Chapter 4) the authors focused on self-efficacy constructs such as academic and emotional self-efficacy, highlight the relationship between self-efficacy and academic performance, and discuss the issues related to measurement of variables, research designs and statistical methods. The authors pointed out the lack of cross-cultural research in this area and divergence effects of cultural differences and academic systems that might inhibit in generalizing the results.

In Chapter 5, McIntyre and Vecchione described that "Non-cognitive factors affect learning; they are not its effect". The authors examined the three particular non-cognitive factors, namely grit, persistence and resilience and their relationship to teacher effectiveness. Their study attempts to examine the following issues – (i) nature of cognitive vs. non-cognitive factors in teaching and learning, (ii) evidence of non-cognitive factors – grit, persistence and resilience in schools, (iii) non-cognitive factors and teacher preparation and development and (iv) non-cognitive factors and selection and retention of teachers.

Lipnevich, Gjicali and Krumm introduced the taxonomy of non-cognitive constructs that includes attitudes and beliefs, social and emotional qualities, habits and processes and personality traits in Chapter 6. Among these constructs, attitudes and beliefs were selected and more detail definition and conceptualization of attitudes across several subject domains were presented.

Chapter 7 by Anghelache aims to highlight the influence of non-cognitive factors on learning process and students' outcome. In her chapter, a literature review about non-cognitive factors on learning and academic performance was first described. The review covers the effects of non-cognitive factors such as motivation, self-efficacy, self-trust, attitudes, and emotional intelligence. After drawing examples from the studies found in the literature, the author proposed the learning model in Romanian education.

EVIDENCE FROM EMPIRICAL RESEARCH STUDIES

The chapters in Part III cover evidence from empirical research studies related to non-cognitive factors and skills in academic achievement and educational success. Chapter 8 by Lee and Stankov summarizes the empirical findings on non-cognitive influences on academic achievement based on the international data from Program for International Student Achievement (PISA) and Trends in International Mathematics and Science Study (TIMSS). The authors noted that over 200 non-cognitive constructs were measured in these international benchmarking tests and examined the strength of their correlations with achievement. They found that one of the non-cognitive measures, confidence proved to be the best predictor of achievement at both individual level and country level. The authors cautioned that the emphasis on non-cognitive variables does not challenge the evidence showing that cognitive performance is important for individual level outcomes, but some of the non-cognitive variables may augment the cognitive performance of the students. The chapter concluded with the suggestion to identify non-cognitive variables that has strong cross-national relevance and applicability in these large-scale assessment regimes.

In Chapter 9 Leslie Gutman and Ingrid Schoon from Institute of Education, University College London synthesized the causal evidence linking non-cognitive skills to later outcomes in children and adolescents. The authors noted that non-cognitive skills is an umbrella term and generally refer to attitudes, behaviors and strategies that can lead to success in school and at work. These skills include motivation, perseverance and self-control. They examined the experimental evidence on set of non-cognitive skills including self-perception and self-concept of ability, motivation, perseverance, engagement, grit, and self-control. The authors concluded that many of the non-cognitive skills are interlinked and the enhancement of one of the skills without improvement of the others may not lead to lasting changes in students' lives.

Gray, McGuinness and Owende explored fifteen non-cognitive factors of learning related to personality, motivation, self-regulation and learning approach

and their relationship with academic performance. Chapter 10 presents the study that involved 1207 students in three years period (2010–2012) with the aim of profiling the students during their first year in tertiary education. The study measured personality factor (conscientiousness and openness), motivation (self-efficacy, intrinsic and extrinsic goal orientation), self-regulated learning (metacognitive self-regulation, study effort and study time), learning style (deep, shallow and strategic learner) and preferred channel of learning (visual, auditory, kinesthetic and group work). The chapter then presented the detail analysis of the data and findings. The authors concluded that non-cognitive factors such as motivation, self-regulation and approaches to learning are malleable and important for effective learning.

The measurement of social and emotional skills and their association with academic attainment in British cohort studies is the topic of research presented by Joshi, Nasim and Goodman in Chapter 11. The British Birth Cohort Studies are multi-purpose longitudinal studies with a range of potential applications that allows comparison with each other and cohort studies in other countries. The chapter reviews some of the existing attempts to measure non-cognitive skills and the outcomes and describes how social and emotional skills at age 10 can be traced into the academic attainments of cohort born in 1970. The measurement of non-cognitive skills includes self-perception and self-awareness, self-control and self-regulation and emotional health. The chapter reports the findings from the study and authors have concluded that educational attainment does not solely depend on cognitive skills alone and that there are some non-cognitive skills that contribute in educational success. It is reported that among the non-cognitive variables conscientiousness, internal locus of control, and good conduct have substantial association at different educational levels.

In Chapter 12 Nadirova and Burger define non-cognitive factors as "acquirable personal qualities, attitudes and beliefs". In their chapter the authors described development of non-cognitive assessment instrument and constructs with the use of Student Orientation to School Questionnaire (SOS-Q). The constructs included safe and caring school, peers, external resilience, internal resilience, self-confidence, utility of school and extracurricular activities. The questionnaire was administered to grade 7, 8 and 9 students in Canadian suburban/rural school district. The relationship between student achievement and the SOS-Q constructs were computed using multiple linear regression model. The chapter reports the detail findings from the analysis and concluded that there is a strong link between aspects of student orientation to school, such as self-confidence and extracurricular constructs and academic achievement. The authors have a view that introducing non-cognitive assessment can help strategic planning, evidence-based decision making, and school improvement.

The study on multi-dimensionality of non-cognitive factors in higher education was presented by Thom and Finkelsten in Chapter 13. In order to investigate the multi-dimensional ways that non-cognitive factors influenced academic preparedness, areas such as educational factors, personal factors, affective factors and non-cognitive

skills factors were explored in the literature review section of the chapter. Using the phenomenological approach, the data were collected from 16 college students through semi-structured interviews. Participants were asked about their lived experience related to non-cognitive factors. The open-ended interview allows the researchers to understand how the student's experiences with non-cognitive factors influenced their academic preparedness. The authors reported that the analysis of the interview transcripts reveal four cognitive/non-cognitive distinctions. These are classified as cognitively prepared/non-cognitively prepared, cognitively prepared/non-cognitively underprepared, cognitively underprepared/non-cognitively prepared, and cognitively underprepared/non-cognitively underprepared. The authors concluded the chapter with several recommendations for further research.

In studying the non-cognitive attributes in education, Clough, Oaks, Dagnall, St Clare-Thompson and McGeown proposed the mental toughness framework in Chapter 14. The study utilized 4C's mental toughness model which comprises Challenge, Confidence, Commitment and Control. The study involved the use of mental toughness questionnaire and the mental toughness intervention training lessons. The results showed the statistically significant changes between pre and posttests among the students. Some positive correlations between the mental toughness score and achievements were also found. The chapter concludes that mental toughness is one of the non-cognitive factors that have impact on educational effectiveness.

In complementing Chapter 14, St Clare-Thompson and McGeown report another study using mental toughness as a theoretical framework in Chapter 15. The authors indicated the conceptual similarities and the links between mental toughness and other non-cognitive factors such as resilience, buoyancy, perseverance, self-efficacy, confidence, motivation and personality. The chapter presents some of the studies recently conducted among undergraduate students, children and adolescents. Findings suggested that interventions aimed at enhancing mental toughness have potential effects on attendance, attainment and psychological well-being among students. The authors proposed some research possibilities on mental toughness and the link to academic attainment, test anxiety, academic stress and peer relationships.

Chapter 16 by Carter, Dasson and Kanakis reports the findings from a mixed method study on the practices of educators, principals and teachers in promoting non-cognitive values in preschools in Singapore. In this chapter, non-cognitive elements of learning are considered social norms in a school context. The study attempted to find out the instructional role of educators as change agent and principals' leadership in promoting non-cognitive factors including core values and social conventions with the use of survey and focus group interviews. The results indicated that preschool teachers are "very conscious of teaching non-cognitive schools such as social behavior and rules to the children". The authors concluded that learning social conventions and moral values will provide strong foundations for children to become good citizens.

In Suh-Ruu Ou and Arthur Reynolds' chapter (Chapter 17), the authors presented their findings from their investigation on pathways to college attendance and degree attainment for economically disadvantaged minority youth. The study involved 1379 drawn from Chicago Longitudinal Study. The non-cognitive factors considered in this study were parent involvement, grade retention and classroom adjustment. The study found that the above mentioned factors have direct effects in college attendance and BA degree completion. The authors suggested that their findings have implications for school, educators and policy makers.

The chapter by Areepattamannil and Welch reports the non-cognitive correlates of Emirati adolescents' mathematics performance using a multilevel structural equation modeling. The authors in Chapter 18 highlighted the growing evidence that relationship exists between non-cognitive factors and educational performance, and the degree of their intensity vary from one culture to another. Although research studies that examined the relations of non-cognitive factors with the educational performance of school children in Western countries are prevalent, a few has been conducted in the Middle Eastern countries. The chapter reports the findings from the analysis of relations between non-cognitive factors such as academic motivation, academic self-concept, and academic regulation to mathematics performance among 5116 native adolescents in the United Arab Emirates. The chapter also discusses the implications of the findings for educational policy and practice. The authors in Chapter 19 reviewed the literature on non-cognitive skills and provided evidence that cultural aspect play a role in formation of such skills. The study involved comparing adult education, employment and health outcomes of immigrant groups in the US with different cultural heritage. The chapter reports findings including that the fact that individuals whose cultural heritage places a higher value on qualities are positively associated with conscientiousness and perseverance.

The Part III of the book concludes with the chapter by Afari and Khine. Although several studies have indicated that there is a relationship between non-cognitive variables such as attitudes towards mathematics and achievement in mathematics, few studies have explored the nature of this relationship in the Gulf States. The chapter reports the findings from their study to examine the relationships among enjoyment of mathematics, self-perceptions about students' mathematics ability, and academic achievement in mathematics with the use of Math and Me survey developed by Adelson and McCoach (2011).The results suggest a positive relationship between enjoyment of mathematics and self-perceptions about students' mathematical ability.

The studies on constituents of non-cognitive and skills and how these affect on educational attainment and career and life success are prevalent in the literature (Sparkman, Maulding, & Roberts, 2012; Kautz, Heckman, Diris, Weel, & Borghans, 2014). The concept of non-cognitive factors and skills constitute myriad of variables. The research on the importance and the role of non-cognitive factors and skills has been studied and will continue to be studied in the future. It is hoped that the information contained in this book will provide knowledge, growth and

current thinking about non-cognitive factors and skills and educational and training strategies that can nurture the well-being of individuals.

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PART II

CONCEPTUAL AND THEORETICAL UNDERPINNINGS

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AND PATRICK C. KYLLONEN

2. CONNECTING NONCOGNITIVE DEVELOPMENT TO THE EDUCATIONAL PIPELINE

INTRODUCTION

Understanding the educational pipeline has been of great importance to educators and policymakers as both groups seek ways to help students navigate it successfully. The broadest description of the educational pipeline includes a series of important transitions: persistence through high school, graduation from high school, entry into postsecondary education, persistence through postsecondary education, completion of postsecondary education, and entry into the workforce (Ewell, Jones, & Kelly, 2003; Gándara, 2006). It should be noted that the use of the term *pipeline* as a way to describe this trajectory implies rigidity and linearity that may not accurately represent the fluidity of many of these stages. For example, a high school dropout can proceed into the workforce and then obtain a high-school equivalent degree at a later time. Similarly, a student who graduated from a vocational school and enters the workforce may choose to complete a bachelor's degree in another field after 15 years of work related to their vocational education. Though we continue to reference the *educational pipeline* throughout this chapter, it is important to be cognizant of the limitations of the term.

Traditional K-12 curriculum focuses on the cognitive skills and abilities considered necessary for academic achievement. Consequently, most past research on student transition through the pipeline has limited itself to traditional indicators of academic success such as mathematics performance. However, noncognitive constructs have been more widely endorsed recently as growing evidence suggests that the development of constructs like social awareness, resilience, self-confidence, self-management, and motivation may be just as important as traditional cognitive constructs to student success in school, the workforce, and life in general (e.g., Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Greenberg et al., 2003). In the present chapter, we identify the noncognitive constructs currently considered important for effective transition through the educational pipeline, emphasizing those that link K-12 noncognitive development to college readiness and the workforce. Following, we provide a brief overview of research on the development of noncognitive constructs in K-12 and discuss why it is so important to address the development of these constructs as early as possible.

M. S. Khine & S. Areepattamannil (Eds.), Non-cognitive Skills and Factors in Educational Attainment, 13–29.

WHAT ARE NONCOGNITIVE CONSTRUCTS?

A conversation about noncognitive constructs requires at least a brief attempt at defining the term *noncognitive*. The most basic interpretation of the term can be derived from what it negates – those attributes that are measured in typical cognitive or achievement tests. Unfortunately, the literature has not settled on a stable definition of the term (Camfield, 2015). To add confusion, this collection of skills, traits, behaviors, mindsets, and attitudes is often categorized using other terms: psychosocial factors (likely from Erikson's theory; see Erikson, Paul, Heider, & Gardner, 1959), social-emotional learning skills (Elias et al., 1997), soft skills (e.g., Heckman & Kautz, 2012), 21st century skills (Partnership for 21st Century Learning, 2015), personality (e.g., McDougall, 1932), character skills (e.g., Tough, 2012), and grit (Duckworth, Peterson, Matthews, & Kelly, 2007).

There have been extensive discussions between many over the appropriateness of the myriad terms used to encapsulate these personal attributes. The term *noncognitive* is quite prominent but it has also been a source of controversy for those invested in the study and development of these constructs. Those who consider the term inappropriate often stress its inaccuracy – cognitive processes underlie every thought a person has and every behavior that person exhibits. Relegating non-academic personal attributes to "noncognitive" ignores how fundamental cognition is to them. Unfortunately, comparable general terms such as *soft skills* have their own semantic limitations. To many, "soft" undermines the importance of these attributes, presenting them as less valuable or even less real. Potentially less offensive terms such as *social-emotional skills* come up short in adequately describing the full gamut of attributes many believe constitute noncognitive constructs (e.g., problem solving). Despite reservations about the term *noncognitive*, our chapter proceeds with its use because it can be thought of as the most omnibus term for these attributes as compared to other terms that are more focused or narrowly defined.

WHICH NONCOGNITIVE CONSTRUCTS ARE MOST IMPORTANT?

Though it is useful to examine and dissect the meaning of *noncognitive*, its definition does not provide much utility to policymakers and practitioners. Instead, identifying the constructs that have greater perceived importance might be of more practical use. The benefits of such a task are manifold: It provides researchers with a manageable set of constructs to investigate; it helps educators and other practitioners focus on a key set of developable constructs; it gives policymakers a clear set of constructs to integrate into future education programs and policy decisions; and it presents employers with a larger pool of potential employees that exhibit the types of skills they want.

The last benefit is a key motivator of much of the research on noncognitive constructs. There is a perceived mismatch between what students are learning at school and what people need to succeed in the workforce (and the world;

Greenberg & Nilssen, 2015), which grows more evident over time as the demands of employers shift to accommodate changes in technology and the markets. More explicitly than ever before, employers are voicing their desires for innovators, problem solvers, team players, and a host of other categories of people, highlighting just how important employers consider certain noncognitive constructs to economic stability and growth. This assertion is supported by a 2006 report summarizing findings from a comprehensive study of 21st century skills that employers believed would increase in importance five years later. In the report, Casner-Lotto and Benner (2006) revealed that 11 of the 12 factors that at least 50% of employers indicated would be more important in the future were noncognitive constructs. This list included critical thinking and problem solving skills, teamwork and collaboration, and creativity and innovation. Employers also felt that these skills were important for high school, vocational school, and four-year college graduates, suggesting that these constructs have consistent value regardless of the level of education a student chooses to pursue.

Other researchers have developed similar lists. For example, Kautz, Heckman, Diris, Weel, and Borghans (2014) identified an almost identical set of noncognitive constructs that they considered necessary for lifetime success. Garcia (2014), whose approach to the selection of constructs involved examining the research, understanding the goals of public education, and identifying the factors that affect the relationship between students and teachers, created a list of constructs that she called the *education policy list of noncognitive skills*. This included constructs such as persistence, teamwork, creativity, and communication skills. Despite arriving at her list a different way, many of the constructs that she identified as important from an educational policy perspective align with those that employers are looking for in potential employees. Finally, the University of Chicago (UC) Consortium on Chicago School Research (CCSR) developed a broad framework that encapsulates a large number of noncognitive constructs. The five components of the framework described by Farrington et al. (2012) are: academic behaviors, academic perseverance, academic mindsets, learning strategies, and social skills. Of these, the components that the authors believed best align with college-related outcomes are academic mindsets, social skills, and learning strategies. Figure 1 highlights some of the overlap in noncognitive constructs between several references sources.

The most endorsed constructs in Figure 1 are core self-evaluation, critical thinking, communication skills, work ethic, integrity, and teamwork. For clarity, core self-evaluation is a broad term that encompasses locus of control, self-esteem, emotional stability, and self-efficacy (Judge & Bono, 2001). Surprisingly, creativity was not endorsed as often despite growing demand in the workforce; however, the two sources that did highlight it were those that identified constructs based on their relevance to success in the workforce and life in general.

Unfortunately, this list may still be incomplete. Sedlacek (2011), in his examination of what noncognitive constructs were important for college readiness

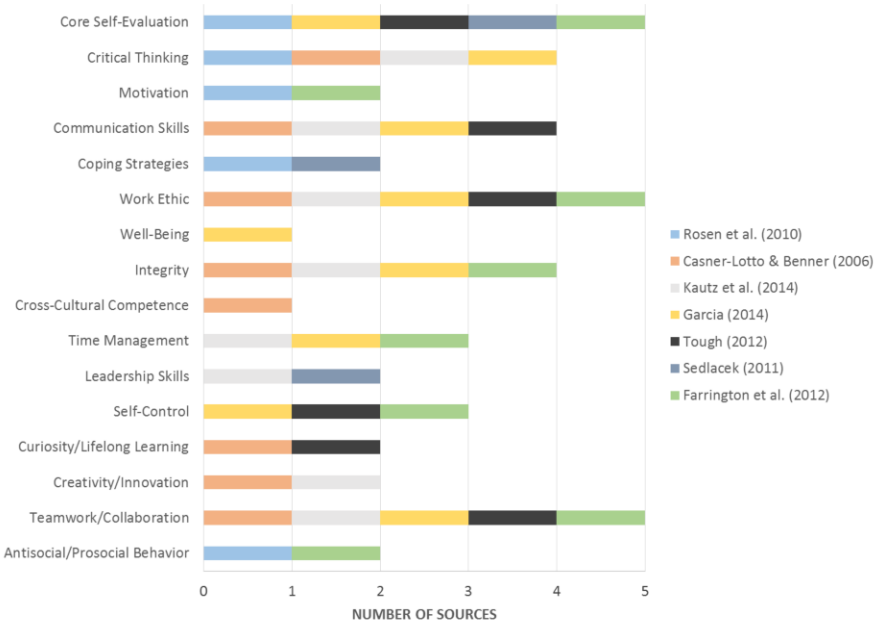

Figure 1. Constructs endorsed by each surveyed source

assessments, argued that the education systems in the United States were designed for *traditional students*, which Sedlacek described as young, White, heterosexual, cisgender males of European origin who do not have disabilities. Those outside of these classifications (in one or many ways) endure certain experiences that may be specific to their identification as "others" in systems that are not tailored to them. For example, Sedlacek highlights the importance of one's ability to understand and handle racism, and considers this one of the eight noncognitive constructs that any assessment of college readiness should include. As an experience that is more acutely felt by people of color, there is often a need to navigate a given system with potential skin-color or racial discrimination overlain, something that would not be felt by those that fall within the traditional group. The report by Farrington et al. (2012) supports this, summarizing research by others that suggests racial minorities, particularly black Americans, have to actively combat negative impressions and stereotypes that can lead to intellectual inferiority (Palmer, Davis, Moore, & Hilton, 2010). Sedlacek notes too that the use of "racism" here does not to exclude other types of "isms" like sexism. A cisgender or transgender women may have experiences unique to their gender identity that can impact their ability to navigate a particular system. While concepts like integrity or cross-cultural competence may suggest a person's ability to deal with any type of discrimination, explicit assessments of concepts like navigating sexism may be more useful from

a sociocultural perspective, and knowledge of this information could help improve development of other noncognitive constructs such as teamwork and communication skills.

WHY ARE NONCOGNITIVE CONSTRUCTS IMPORTANT?

In an ideal world, a desire to develop the whole person would be its own reward. Noncognitive constructs are simply another part of each and every person, and as such should be nurtured and developed for their own sake. However, this type of argument would not resonate with a policymaker or investor. Instead, tangible evidence of the importance of noncognitive constructs is required to demonstrate that these constructs are worth an investment of time, money, and other resources. Fortunately, a host of researchers have investigated this and found a number of meaningful relationships between noncognitive constructs and other factors that we already consider important (e.g., job performance, well-being, and later life success). This section summarizes some of the extensive research in this area.

Academic performance is considered a key indicator of student success, and is one of the most common outcomes explored by researchers interested in noncognitive constructs. Though many practitioners have argued that success in school is driven by more than strict content knowledge, until relatively recently, there were few studies to support this empirically. Several notable cross-sectional and longitudinal studies have been conducted over the last decade that provide clearer linkages between noncognitive constructs and academic performance. For example, an assortment of studies linked the Big Five personality factors, particularly conscientiousness, to academic performance at all levels of schooling (e.g., MacCann, Duckworth, & Roberts, 2009; Poropat, 2009). Related constructs like time management were predictive of achievement in 7th grade students (Liu, Rijmen, MacCann, & Roberts, 2009). Data from several large-scale domestic and international assessments revealed that both self-efficacy and self-concept predicted reading, science, and math achievement for middle school students, even after adjusting for demographics, school attendance, and home educational material (e.g., Lee, Redman, Goodman, & Bauer, 2007). Reeves, Venator and Howard (2014) related student drive and prudence (e.g., self-control) to several outcomes and found that higher levels of these constructs were indicative of higher high school graduation rates. Finally, Wang, MacCann, Zhuang, Liu and Roberts (2009) found meaningful relationships between teamwork skills and grades in both science and math for high school students.

One very comprehensive investigation of in-school intervention efforts was conducted by Durlak et al. (2011), who examined over 200 studies addressing school-based social and emotional learning (SEL) prograßßms for children from kindergarten through high school (ages 5–18). The studies incorporated into their meta-analytic review described research that took place at any point from 1955 through 2007, included a control group, stressed the development of one or more

SEL skills, and excluded studies targeting special populations (e.g., pre-existing behavioral, emotional, or academic problems) and interventions focused on physical health outcomes (e.g., drug use, pregnancy). The results of their meta-analysis suggest that SEL programs not only improve SEL constructs, but also improved academic performance as measured using test scores and grades. In fact, the benefit to academic performance was quite substantial – relative to the control group, students that participated in an SEL program demonstrated an 11 percentile gain in achievement on average.

Outside of school, noncognitive constructs have been found to predict job performance (Barrick, Mount, & Judge, 2001), health behaviors (Ajzen, Albarracin, & Hornik, 2007; Bogg & Roberts, 2004), life satisfaction (Diener & Lucas, 1999), marital satisfaction (Watson, Hubbard, & Weise, 2000), peer relationships (Jensen-Campbell et al., 2002), and several other important outcomes. Others, such as Cohen (2006), as well as Ross, Powell, and Elias (2002), linked noncognitive constructs to successful professional development, decision making, and well-being. Finally, Heckman, Stixrud and Urzua (2006) found associations between increased levels of noncognitive constructs and a number of outcomes: lower teenage pregnancy, less participation in crime, less illegal activity, increased wages, increased work experience, and higher levels of education. Even more intriguing, they noted that noncognitive constructs were usually as predictive of these behaviors as cognitive skills. In some cases, noncognitive constructs were even more predictive than cognitive skills. These relationships were generally nonlinear, with noncognitives often exhibiting steeper slopes than cognitive skills, though the authors notes some variation by gender.

Using data from several past employer surveys, Kautz et al. (2014) revealed that employers tended to rank several noncognitive constructs (e.g., self-management, communication skills) ahead of basic skills (e.g., reading), reinforcing Casner-Lotto and Benner's (2006) findings. They also reported that the difficulty employers have finding candidates is heavily linked to inadequate noncognitive constructs. Job candidates often exhibited basic academic skills, but lacked sufficiently developed noncognitive constructs like problem solving, teamwork, communication, and adaptability. Similarly, employers seeking entry level or hourly workers tended to reject candidates who lacked skills related to time management and work ethic.

HOW DO WE MEASURE NONCOGNITIVE CONSTRUCTS?

There are numerous approaches to measuring noncognitive constructs, and each one comes with a hosts of strengths and weaknesses. It is important to evaluate and understand each approach because the way in which a construct is measured may impact conclusions that can be made about an individual's standing on the construct. This section describes a number of these, including some promising approaches that are not commonly used in K-12 research. Duckworth and Yeager (2015) recommend adopting multiple methods of assessment to measure noncognitive

constructs. Such an approach can greatly improve reliability and validity. Of course, assessment methods demand variable amounts of time, effort, and money. These considerations should be taken into account when making decisions about which methods to use.

Self-Report Likert

This type of measure is by far the most common approach to measuring noncognitive constructs. In fact, many of the findings discussed in this chapter are based on assessments that incorporated Likert-type rating scales. Their appeal is easily understood. They are easy to develop, simple to administer, straightforward to score, and typically succinct. Collectively, this means these measures often "get the job done" with minimal time, money, and effort. However, they are susceptible to socially desirable responding, which is a type of falsification or faking behavior where respondents try to present themselves in the most favorable light (Zerbe & Paulhus, 1987). By design, Likert scales are transparent, where each response point aligns with a hypothesized level of the measured construct. As a result, if respondents recognize what a statement is trying to assess (and they often do), the straightforwardness of the response scale makes it easy to choose the response that provides the most positive impression. This is a major limitation as there is nothing to reliably reduce or prevent such responding. However, despite this limitation, there is evidence to suggest socially desirable responding may not actually affect the relationships between noncognitive constructs and certain criterion variables. Specifically, relationships with personnel selection and job performance seem unaffected when socially desirability is assessed using scales of social desirability (e.g., Ones & Viswesvaran, 1998; Schmitt & Oswald, 2006). In a related effort, Hogan, Barrett, and Hogan (2007) found only negligible changes in personality scores for applicants who were rejected for a job but later reapplied. To the researchers, this suggested limited desire to inflate responses despite being rejected after the previous application attempt. How well these findings generalize to other types of criterion variables and other populations has not been examined enough.

A more unintentional form of misrepresentation manifests as differences in response style (e.g., the tendency to choose the extreme categories; Clarke, 2000). These are considered unintentional because they are related to interpretations of the response scale and not to true differences between individuals or groups. Reference bias is a related phenomenon where respondents rely on different frames of reference to judge their level of a particular construct (King, Murray, Salomon, & Tandon, 2004). This is often observed at the group level, particularly in cross-cultural research, as can be seen from recent analyses of data from the Program for International Student Assessment (PISA). Kyllonen and Bertling (2013) found a discrepancy between within-country and between-country correlations between self-reported conscientiousness and academic performance. Within-country correlations showed a positive relationship while between-country correlations suggested a

negative relationship. They used anchoring vignettes (King & Wand, 2007) to address what they believed to be issues of reference bias.

Self-Report Biographical

These measures allow respondents to provide information about the occurrence of past events. Items in these types of measures generally focus on the frequency of behaviors (e.g., tardiness) or gather information about previous experiences (e.g., "have you ever smoked?"). Since the response scales for these items tend to have less subjectivity than the scales associated with Likert-type items, response style differences are not a problem. However, the items themselves are still quite transparent, which makes them vulnerable to socially desirable responding. In addition, reliable responses can only be obtained if a respondent is able to accurately recall information. This may be more difficult for events or behaviors that are not common, occurred well into the past, or are spread out over a wide range of time.

Self-Report Situational Judgments

This type of item typically presents (via text, audio, or video) a scenario describing a problem, which is followed by a series of possible solutions that respondents can choose to indicate how they would address the problem (Mattern et al., 2014). Situational judgment tests (SJTs) have been used to predict success in college (Oswald, Schmitt, Kim, Ramsay, & Gillespie, 2004) and the workforce (McDaniel, Morgeson, Finnegan, & Campion, 2001), as well as professional schools such as medical school (Lievens & Sackett, 2006) and dental school (Buyse & Lievens, 2011). Oswald et al. (2004) administered a collection of SJTs measuring constructs such as interpersonal skills and adaptability to undergraduate freshmen students. They found that the SJTs added incremental predictive validity to GPA and absenteeism, among other outcomes. Buyse and Lievens (2011) obtained similar results when they used SJTs measuring interpersonal skills to predict academic performance in dental school.

SJTs have demonstrated a resistance to socially desirable responding (McDaniel & Nguyen, 2001; Nguyen, Biderman, & McDaniel, 2005), a reduced tendency to produce disparities by race/ethnicity or gender that have been observed with other types of measures (e.g., cognitive tests; Oswald et al., 2004; Sternberg, 2006; Wang et al., 2009; Whetzel, McDaniel, & Nguyen, 2008), and greater appeal to test takers than traditional Likert-type measures. All of these factors combined suggest that SJTs would be another useful tool to measure noncognitive constructs in K-12. With a couple of exceptions (e.g., Grigorenko et al., 2009; Sternberg, 2006; Wang, MacCann, Zhuang, Liu, & Roberts, 2009), SJTs have not been utilized nearly as much in K-12 as they have been in the workforce or higher education. This may be a product of their limitations. They are often lengthy, quite costly to develop, and require longer tests to achieve acceptable reliability (Oswald et al., 2004). Due

to their (potentially) high reading load and the nature of their design, the intended construct(s) can become muddled and confounded by extraneous or unsolicited constructs (Wang et al., 2009; Whetzel, McDaniel, & Nguyen, 2008). They are also not immune to socially desirable responding, as the best response options may be very obvious.

Self-Report Forced-Choice

Like SJTs, forced-choice items are not often used to measure noncognitive constructs in K-12. However, they have been used in other contexts (see Drasgow et al., 2012; Naemi, Seybert, Robbins, & Kyllonen, 2014) as researchers seek to address the issue of socially desirable responding that plagues other types of self-report measures. To accomplish this, forced-choice items present multiple (usually two or three) competing statements that appear to be equally desirable. A respondent is then asked to choose the statement that is most like them. In the case of three statements, the respondent may also be asked to choose the statement that is least like them, though it is also possible that the respondent may be asked to rank the statements instead of making explicit choices about most and least. A meta-analyses by Salgado and Tauriz (2012) revealed that forced-choice measures exhibited higher correlations with relevant academic and workforce outcomes than self-report Likert-type measures, a finding that may be related to increased difficulty responding in a way that presents oneself favorably. Keep in mind, forced-choice assessments can still be *faked* because a respondent can easily misrepresent themselves by lying. This could be due to disinterest in the assessment, a general desire to "cheat," or a more targeted goal of presenting oneself favorably on certain constructs if the respondent is aware of those constructs that are considered more important to the evaluator (e.g., the employer or school). With forced-choice measures, there is also a risk that requiring respondents to compare equally desirable statements may prove difficult and frustrating, especially for youth who may not be familiar with making such judgments.

Other-Report

Like self-reports, other-reports can vary in a number of ways. The "other" here could refer to a teacher, counselor, parent, peer, coach, employer, subordinate, sibling, or numerous other people. Generally, the goal of other-reports is to gather information from people who may have insight into the attitudes, beliefs, behaviors, and performance of the student. Any of the aforementioned methods *could* be utilized for this purpose, but Likert-type and biographical measures tend to be used almost exclusively. The strengths and limitations of both are the same as those attributed to their use in self-report contexts. While students cannot misrepresent themselves, the other rater *can*, and might even feel incentivized to do so given the right conditions (e.g., if the student's other-reported performance impacts the rater

as well). Biases can also motivate a rater to evaluate a student differently, though whether this is intentional or not may depend on whether the biases are implicit or explicit. Despite these weaknesses, there is evidence to suggest other-reports provide better judgments of actual student skill levels than traditional self-report, and they may also be better predictors of future behaviors (Connelley & Ones, 2010). Aside from Likert-type and biographical assessments, other approaches utilize observations or interview sessions (especially with younger children), where the observer or interviewer is ultimately asked to rate and report on a number of different characteristics about the student (Secondary School Admissions Test Board, 2014). These approaches can incorporate a performance component as well (particularly those that are tied to communication and teamwork), but any resultant score or evaluations rely on the judgments of the observer(s) or interviewer(s). It is important to note that while obtaining input from others is a useful endeavor, this type of assessment can be difficult to accommodate because of the amount of time, money, and/or effort that is needed to secure adequate samples and coordinate the process of gathering ratings.

Performance Tasks

This type of assessment can range in complexity from very simple examinations of the Stroop effect[1] (via the Stroop test; Stroop, 1935) to complex games. Performance tasks can be very appealing to researchers in K-12 because they are often more interactive, which makes them more enjoyable, and they are not as demanding of verbal skills as many of the other assessment methods discussed up to this point. As with self-report Likert and forced-choice measures, they can assess several skills, abilities, or competencies in a relatively short period of time. Finally, one of the key benefits of performance tasks, when designed to account for it, is there resistance to social desirability. Much like a cognitive test, noncognitive performance tasks can be nearly impossible to cheat, which minimizes the risk of socially desirable responding. As with any other type of assessment, faking can still occur if the goal is simply to deceive – that is, a respondent could choose to answer incorrectly or disengage from the task at certain points at their will.

HOW, WHEN, AND WHERE ARE NONCOGNITIVE CONSTRUCTS DEVELOPED?

Noncognitive constructs have traditionally been considered fixed, a product of genetics and early childhood socialization. However, a notable amount of recent research suggests these factors are actually pliable (Kyllonen, Roberts, & Stankov, 2008). For example, a meta-analysis by Roberts, Walton, and Viechtbauer (2006) found that personal qualities like social vitality, social dominance, agreeableness, conscientiousness, emotional stability, and openness to experience all change throughout the lifespan. Similarly, interventions targeting specific attitudes and skills, such as test anxiety, communication, resilience, and self-efficacy, can

positively affect the levels of these in students (e.g., Greenberg et al., 2003; Hembree, 1988; Matthews, Zeidner, & Roberts, 2012). Finally, Durlak et al. (2011) found that students in school-sponsored social and emotional (SEL) programs consistently experienced more noncognitive *and* academic achievement growth than students who did not participate in these programs.

In their review, Kautz et al. (2014) observed two important factors that affected the efficacy of noncognitive interventions: (a) those programs targeting early childhood and elementary school were more effective than those targeting adolescents; and (b) those (often remedial) programs designed for adolescents or children who grew up in disadvantaged communities functioned best when other resources such as mentoring and guidance were provided alongside any skills training. These discoveries make sense for a number of reasons. Early acquisition of critical skills that promote better learning habits and greater school engagement provide students with more time to use and further develop these skills. Some outcomes are better utilization of time in school and a drive towards more self-motivated learning. Development of these skills in adolescence or even after limits their scope of use because they are not present to as notable a degree during critical developmental periods (early childhood and pre-adolescence). However, as Kautz and colleagues suggest, with sustained intervention, guidance, and mentorship, students can still reap benefits from later-life enhancement of noncognitive constructs.

Another finding from the Casner-Lotto and Benner (2006) and Greenberg and Nilssen (2015) reports was that K-12 schools and four-year colleges carry the brunt of workforce readiness, as over two-thirds of surveyed employers felt that these institutions were responsible for the development of relevant skills. The focus on schools is understandable because they are relatively controlled environments, but Kautz et al. (2014) argued that the expectation for schools to supplement learning that should take place at home impacts the ability of schools to develop basic academic skills in students. From their perspective, many of the learning deficits in noncognitive constructs occur well before schooling begins, and K-12 education can only play catchup. As a result, the ideal period for interventions or training is before any formal schooling takes place. These programs influence youth when their brains are most malleable and have the potential for the most long-lasting effects. Kautz et al. (2014) also observed that the most effective of these programs included parents, supporting the notion that environmental factors are just as critical to development as formal training or education. Parenting quality is one of the most important factors influencing child development, so it makes sense that programs also targeting parents led to the most positive benefits for children. This observation holds for programs focused on early childhood education (i.e., kindergarten and early elementary). In their review of many of the early childhood programs evaluated by Durlak et al. (2011), Kautz et al. (2014) found that those with parental involvement tended to show more promising long-term results than those without this involvement.

Many researchers have pushed for research and practice that more actively incorporates knowledge of environmental and sociological factors (e.g., Durlak et al., 2011). Shonkoff and Phillips (2000) assert that these factors have pervasive and cumulative impacts that can start from conception and continue prominently through early childhood. This can lead to notable gaps between groups of students, as can be seen from research that relates proxies for these factors to noncognitive constructs. For example, Garcia (2014) found that there were large gaps in several noncognitive constructs by socioeconomic status (SES). Students in the bottom two SES quintiles (and even those in the middle quintile) tended to be below students in the top quintile by a quarter of a standard deviation or more on self-control, approaches to learning, rule following, persistence, and curiosity. The presence of such a gap in noncognitive constructs may be disheartening; however, given research that suggests these constructs are more malleable, Garcia's findings support the need to first close the gap in noncognitive constructs before attempting to tackle what is often called the *achievement gap*.

HOW DO NONCOGNITIVE CONSTRUCTS RELATE TO THE ACHIEVEMENT GAP?

In the United States, the achievement gap phenomenon expresses itself primarily in three ways. The first is by gender. Girls consistently outperform boys in literacy, but gender differences in mathematics performance vary based on the context that is considered. Research suggests that girls also outperform boys when classroom mathematics performance (i.e., mathematics GPA) is examined (Dee, 2007). However, a 2015 report by the College Board reveals that boys have consistently scored higher on the SAT mathematics test (on average) than girls by at least 30 points between 1972 and 2015 (The College Board, 2015). Further muddling our understanding of mathematics differences by gender, national metrics like the National Assessment of Educational Progress (NAEP) have not observed any notable differences between boys and girls on 4th or 8th grade mathematics performance.

The second form of the gap is associated with race/ethnicity. Black and Hispanic/Latino students tend to exhibit lower levels of academic performance than white students based on a variety of measures, including the NAEP assessment. Further supporting Shonkoff and Phillips' (2000) belief, as well as Kautz et al.'s (2014) findings, research shows that this form of the achievement gap actually occurs well before formal schooling (Gándara, 2006). Finally, the achievement gap manifests itself by SES, which behaves similarly here to Garcia's (2014) findings on noncognitive skills. Students from lower SES families perform worse academically and persist through high school and college at lower rates. Of course, it is possible that the actual problem here may be access, as Kirsch, Braun, Yamamoto, and Sum (2007) suggest. Many individuals from low-income families in particular lack access to proper skill development (e.g., education) that is afforded to others

raised in more financially secure or stable home environments. Therefore, much of the observed gap in achievement by SES, and possibly race/ethnicity, could be tied to what is more accurately considered a gap in opportunity.

So what can noncognitive constructs do about these gaps? Though there is evidence to suggest noncognitive constructs *can* positively impact cognitive skills, a comprehensive review of the literature by Farrington et al. (2012) revealed that much of the present research on noncognitive constructs has yet to adequately support their ability to close the achievement gap. They surveyed the literature to find support for the relationships between the achievement gap and the five noncognitive factor groups that comprise their noncognitive framework. The most promising findings were related to academic mindsets. The reported interventions that targeted mindsets (e.g., stereotype threats) produced positive changes to outcomes like grades for certain subgroups (e.g., black Americans). However, they noted limitations due to how late these interventions occurred (high school) and the extent to which negative mindsets drive the achievement gap. The authors concluded that extensive research is still needed to truly understand how the noncognitive constructs in their framework contribute to achievement gaps.

CONCLUSION

Over the last two decades, researchers have expanded the literature on noncognitive constructs, associating them with a number of important outcomes as well as to effective transition through the educational pipeline. Interest in developing noncognitive constructs as part of the established K-12 curriculum is steadily increasing. In the United States, the Common Core State Standards (CCSS) were, for a time, the basis for curriculum development in K-12. However, the CCSS included no explicit mention of or recommendation for noncognitive constructs. The Every Student Succeeds Act (ESSA), which was signed into law on December 10, 2015 and includes many changes separating it from CCSS, encourages states to use alternative indicators of student success besides standardized measures to evaluate school accountability. Given this shift, it is possible that constructs like grit and growth mindset may join traditional academic skills such as reading, writing, and arithmetic in the next few years.

Though many people involved in education and policy no longer deny the significance of noncognitive constructs, there is much work that needs to be done to develop programs and interventions that can be scaled nationwide and even worldwide. Expanding programs could provide opportunities for more robust longitudinal and randomized control studies, both of which would improve the claims that can be made about the efficacy of these programs. In addition, subsequent research needs to explore the use of a variety of measurement approaches (e.g., forced-choice assessments) to better understand the development of noncognitive constructs in K-12 and beyond.

NOTE

[1] One approach to demonstrating how mismatched information can lead to slower reaction times and increased errors. The original Stroop test used colors to show this by presenting participants with a series color names, each presented in a particular color. Participants had to name the color of the word, not read the word itself. The Stroop effect is the finding that participants react slower and make more errors when the name of the color and the color of the word do not match (e.g., the word "red" is colored purple).

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3. THE NEED TO ADDRESS NON-COGNITIVE SKILLS IN THE EDUCATION POLICY AGENDA[1]

INTRODUCTION

Multiple traits compose a broad definition of what it means to be an educated person. Indisputably, being an educated person is associated with having a certain command of a curriculum, and knowledge of theories and facts from various disciplines. But the term *educated* also suggests a more far-reaching concept associated with individuals' full development. Such development implies, for example, that individuals are equipped with traits and skills—such as critical thinking skills, problem solving skills, social skills, persistence, creativity, and self-control—that allow them to contribute meaningfully to society and to succeed in their public lives, workplaces, homes, and other societal contexts. These traits are often called, generically, non-cognitive skills.[2]

Despite non-cognitive skills' central roles in our education and, more broadly, our lives, education analysis and policy have tended to overlook their importance, and there are currently few strategies to explicitly nurture them within the school context or through education policies. However, after a relatively prolonged lack of consideration, non-cognitive skills are again beginning to be acknowledged in discussions about education, leading to the need for thoughtful and concerted attention from researchers, policymakers, and practitioners—as well as to the contention that non-cognitive skills should be an explicit pillar of education policy. This chapter contributes to the growing interest in these skills by providing a review of what we know about non-cognitive skills, including what they are, why they matter, and how they enter into the education process. This first section includes a definition of non-cognitive skills and explores the evidence-based findings on their role in education and adulthood outcomes, and on how they are nurtured. We then extend this discussion by providing a tentative list of skills that are both important for and can be nurtured by schools. The second section examines how education policy could help schools better nurture non-cognitive skills. Contrasting what we know about non-cognitive skills with how policy currently treats them, we contend that non-cognitive skills deserve more attention in the education policy arena. Toward this end, we propose some guidelines for how to design education policies that better nurture them, and describe the kinds of research needed to inform policy and practice. It includes some suggestions for researchers on how their work can provide new evidence geared toward policymakers, and a discussion of the goals

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of public education, education reform, and accountability. In the current context of debates about how to shape education reforms, a renewed focus on non-cognitive skills could provide an opportune chance to enact a more effective education strategy overall.

WHY DO NON-COGNITIVE SKILLS MERIT CORE CONSIDERATION IN THE EDUCATION POLICY AGENDA?

Resurgent interest in non-cognitive skills is driving the need to fully integrate them into our frameworks of both analysis and action in education policy. The foundations for the assertion that policy should explicitly aim to nurture these skills are threefold.

First, there has always been implicit recognition that non-cognitive skills play an important part in education. Non-cognitive skills represent valuable assets with respect to both traditional school outcomes and the broader development of individuals. Indeed, various strands of scholarship come together to point to non-cognitive skills' centrality. Historically, some scholars—mainly philosophers, psychologists, and sociologists—have noted that education has multiple dimensions, some more specifically cognitive, and others associated with personal or behavioral dimensions.[3] Many educators, policymakers, and societal leaders have argued that the mission of public education includes promoting not only cognitive skills, but also various individual and democratic skills (to paraphrase Martin Luther King Jr., "Intelligence plus character—that is the goal of true education"). And most teachers and parents inherently recognize both the intrinsic importance of certain behavioral skills and their relevance for building cognitive skills.[4]

Second, to the extent that non-cognitive skills can be developed in schools (during the period in which children's personalities are shaped), policymakers must understand the evidence regarding them. This includes identifying which skills are relevant for educational purposes. It also means creating definitions for the major skills that are to be developed (i.e., social skills, such as the ability to get along with others from varied backgrounds),[5] and assessing their role in the education process. Finally, as is true of cognitive skills, it requires recognition that while all students should develop a baseline level of non-cognitive skills that enables them to thrive in school and life, beyond that, variation across students is natural and desirable.

These two findings lead to a third: the need for a more comprehensive education policy agenda. Such a broadened approach will likely be at odds with many aspects of current policies, which have largely neglected non-cognitive skills. In fact, some have led schools to narrow their curriculum to focus on a small set of cognitive skills and to employ test preparation as a major instructional strategy. In his recent book, Paul Tough (2012) echoes the concerns of others that we have been wrongly focused on a "cognitive hypothesis."[6] This failure to pay attention to non-cognitive skills has proven to be quite problematic, as it depletes schools' incentives and capacities to contribute to the socialization and personal development of their students.

Policy must thus be broadened to solve the apparent contradiction between how the system is defined and the incentives are set up, on the one hand, and, on the other hand, the imperative to help children thrive and receive the rounded education they deserve.

Consequently, this chapter adopts the view that the education system should ensure all children have the opportunity to fulfill their potential by exploring these traits in their developmental years in school. In other words, as non-cognitive skills are educational outcomes whose intrinsic value makes them important per se, and whose production or accumulation in children's school years has demonstrated importance, we contend that education policymakers must embrace non-cognitive skills, and design policies that protect these skills and foster their development.[7]

WHAT DOES RESEARCH DEMONSTRATE REGARDING NON-COGNITIVE SKILLS?

In this section we define non-cognitive skills and explore the evidence-based findings on their role in education and adulthood outcomes. We then explore how these skills can be intentionally nurtured and developed. The review of literature is by no means exhaustive. Rather, it aims to highlight some of the most relevant evidence about non-cognitive skills, and we only briefly review some aspects that ought to be more fully addressed in complementary studies building on these initial discussions.

In Search of a Definition and a List of Skills

We begin by explaining the abstract concept of non-cognitive skills and then present a list of specific non-cognitive skills that are relevant to the education process.

What are non-cognitive skills? Defining non-cognitive skills is as challenging an endeavor as it is to identify, classify, measure, and quantify them.[8] Indeed, to illustrate the unique difficulty of defining these skills, we note the ongoing debate about how researchers and writers should refer to these skills (the current list includes such terms as behavioral skills, soft skills, personality traits, interpersonal and intrapersonal skills, non-cognitive abilities, character, socio-emotional skills, and non-cognitive skills), as well as the sometimes controversial delimitations between cognitive and non-cognitive skills, or between personal traits and learnable non-cognitive skills.

To produce the definition used in this paper, we combine several theoretical definitions that, together, capture the essence of non-cognitive skills in education. We define non-cognitive skills as representing the "patterns of thought, feelings and behavior" (Borghans et al., 2008) of individuals that may continue to develop throughout their lives (Bloom, 1964), and that play some role in the education process. Broadly, these skills encompass those traits that are not directly represented by cognitive skills or by formal conceptual understanding, but instead

by socio-emotional or behavioral characteristics that are not fixed traits of the personality, and that are linked to the educational process, either by being nurtured in the school years or by contributing to the development of cognitive skills in those years (or both).

Which non-cognitive skills are relevant to the education process? We recognize that the generic definition developed here may be of little use for the policymaking and practical uses we advance. A more concrete or tangible approach to getting at non-cognitive skills requires listing them. To our knowledge, however, such a list does not yet exist, and indeed, this can represent one major challenge to moving this field forward.[9] The lack of such a classification delays the development of metrics to measure and assess skills, and the design of strategies to nurture them.[10] Additionally, crafting such a list likely engenders controversy, in terms of which skills belong on the list, and how we can know this in the absence of proper metrics.

Our attempt to outline a concrete set of skills builds on both researchers' contributions (evidence- and/or theory-based) and on our understanding of the goals of public education. We subscribe to the idea that education is foundational both to sustaining a healthy democracy and to ensuring the ability of individuals to fulfill their natural personal and productive potentials, and that (public) schools are critical to fulfilling those goals. Given this understanding, we suggest that the following non-cognitive traits and skills should be a primary focus of education policy.

The list includes critical thinking skills, problem solving skills, emotional health, social skills, work ethic, and community responsibility, which are identified by Rothstein, Jacobsen, and Wilder (2008) as aligned with goals of public education similar to those we set forth above. Pianta and colleagues' contribution adds to the list factors affecting personal relationships between students and teachers (closeness, affection, and open communication), self-control, and self-regulation. We suggest, as well, the importance of persistence, academic confidence, teamwork, organizational skills, creativity, and communication skills.[11] We title this list the *education policy list of non-cognitive skills*.

It is important to note that this list is likely to grow (or shrink) as more evidence emerges, and that specific definitions of each skill may vary by age and other factors. We also note that references below either generically to non-cognitive skills or to specific non-cognitive skills are driven by the evidence itself. In some cases, a study has reviewed non-cognitive skills generally, while other studies explore a specific skill or a set of them. Given the relative newness of the field (in contrast to studies of cognitive skills), it is still common practice to refer to the broad type or category of skill, and many key contributions in this area (including most of James Heckman's and his coauthors' seminal works) use the term "non-cognitive skills," rather than anything more specific.

Why Do Non-Cognitive Skills Matter?

Now that we've established which non-cognitive skills matter, we discuss *why* they matter. As explained below, non-cognitive skills matter for their own sake, and they matter indirectly (i.e., they correlate with other individual and societal outcomes, such as academic performance, labor productivity, and earnings).

Non-cognitive skills matter for their own sake. Based on the above definition and list of non-cognitive skills, it is clear that they are valuable in their own right, and that they matter in a direct fashion. The importance of emotional, social, and democratic citizenship skills—or, to cite a few specific skills within those categories, self-confidence, respect for others, ability to build consensus, and willingness to tolerate alternative viewpoints—should be beyond debate. As noted above, nurturing these skills is indeed an implicit—sometimes explicit—goal of public education (Rothstein, Jacobsen, & Wilder, 2008), and from the perspective of schools, such traits as persistence, communication skills, creativity, and teamwork, among many others, should be considered important in themselves. As such, promoting these traits should be among schools' core mission; based on these definitions alone, these skills matter greatly.[12]

Non-cognitive skills matter indirectly. Another angle through which to understand the importance of non-cognitive skills is to explore their correlation with other individual and societal outcomes, from educational attainment and adult earnings to civic participation, among others (Almlund et al., 2011). As summarized by Levin (2012b), "[…] these dimensions play a role in forming healthy character and contribute to productive relations in work-places, communities, families, and politics." It is important to note, though, that in contrast to the extensive evidence documenting the relationship between educational attainment (and cognitive skills) and these other outcomes, the empirical literature on the links between non-cognitive skills and those outcomes is relatively scarce. It is even scarcer when we consider only empirical evidence that results from experimental (and, to a lesser extent, quasi-experimental) analyses. Happily, however, research in this area is increasing, and we acknowledge, in particular (in the economics field), the essential contributions of James Heckman and his coauthors.[13] Moreover, although it is still limited, this body of evidence consistently indicates positive relationships between non-cognitive skills and other dimensions or skills, as illustrated by the following examples.

The association between non-cognitive skills and academic performance

Scholars have long noted the positive association between non-cognitive skills and educational attainment. A century ago, Binet and Simon (1916, 254) noted that performance in school "admits other things than intelligence; to succeed in his studies, one must have qualities which depend on attention, will and character."

Recently, a more detailed explanation of how non-cognitive skills relate to academic performance was provided by Olson (2012). Social skills—children's ability to get along and interact with peers—and the absence of aggressive or disruptive behavior predict and facilitate learning (Olson 2012, 20). Heckman's (2008) core point in support of early investments in education—"skills beget skills"—makes a similar argument.

Several meta-analyses and compendiums of reviewed literature also affirm the positive association between non-cognitive skills and academic achievement.[14] Durlak et al. (2011) conducted a meta-analysis of over 200 interventions aimed at increasing the social and emotional learning of children from kindergarten through high school (ages 5–18). This study is one of the most extensive reviews of such interventions, and it relies on empirical evidence that included control groups for the analyzed interventions. Their conclusions suggest that participants benefited from the interventions, and, specifically, that their social and behavioral skills improved.[15] On average, participating students also exhibited higher academic achievement, with an associated gain in performance estimated to be equivalent to 11 percentile points, approximately constant across grades. Levin (2012a) translates this gain into a measure equivalent to one-third of a standard deviation, a significant increase from an education policy perspective. In a widely circulated newspaper column based on earlier versions of this meta-analysis, Shriver and Weissberg (2005) emphasized the extreme relevance of these findings in demonstrating that policy can effectively target both cognitive and non-cognitive aspects concurrently, and can appropriately balance benchmarks established for the two domains. In sum, this significant meta-analysis shows how non-cognitive skills support cognitive development, and demonstrates that these skills are interdependent and cannot be isolated from one another.

In addition to the evaluations included in Durlak et al.'s meta-analysis, other empirical studies show how specific non-cognitive skills affect academic performance. It is important to note that some of these interventions also affect non-cognitive performance, or affect cognitive performance through their influence on non-cognitive domains, again reflecting the interdependence of these categories of skills and their development.[16] Interesting findings derive from studies of how executive function skills—self-regulation and self-control—are important predictors of achievement. For instance, self-control and self-discipline are predictive of better behaviors in the classroom, which also correlate with improved report card grades and other measures of academic performance (Duckworth, Quinn, & Tsukayama, 2012; Duckworth & Seligman, 2005).[17]

A related area of research that is particularly promising examines how academic performance is affected by factors such as school climate or learning environment (these terms encompass human relationships and other conditions conducive to learning, such as safety, empowerment, collaboration, and an engaging environment). One especially useful reference in this area is the comprehensive examination by Bryk et al. (2010) of components that are critical to helping

struggling schools become more successful. Their work for the Consortium on Chicago School Research, which compares successful and unsuccessful public elementary schools in Chicago, extensively documents how differences in performance across seemingly similar schools can be explained by factors such as lack of safety, level of violence, and whether the school has established a student-centered learning climate (in addition to such critical components as rigorous instruction, leadership, and community participation). Over the years, research on school climate has gained traction, and it is currently an important area of analysis for researchers and institutions seeking to explain what constitutes a good school.[18] Most of the evidence in this area is correlational, but, again, strongly points to the importance of a whole-child development strategy; focusing on the whole child gives improvements in curriculum, instruction, and assessment a much greater chance of succeeding (Comer, 2005). As an example, a recent study (Hanson & Voight, 2014) using two years of data from students in a California middle school shows a positive correlation between performance in math and reading and various measures of school climate (safety and connectedness, caring relationships with adults, meaningful participation, and reduced substance use, bullying and discrimination, and delinquency). We would expect future research on how school climate variables affect non-cognitive skills to further confirm the strength of these associations.

The association between non-cognitive skills and labor productivity and earnings

While it is well-established that additional schooling leads to higher earnings and labor productivity (Card, 1999), there is no exact estimate of the degree to which non-cognitive skills are rewarded in the labor market. There are, though, several studies on the relevance of non-cognitive skills as determinants of long-term labor market outcomes, as well as some attempts to estimate the economic returns to these skills.

One way to document this association is to look at surveys of employers to determine how they value these skills in the workplace. For example, a ranking of the desired skill set needed for new entrants' workforce readiness (Casner-Lotto & Barrington, 2006) provides some interesting information in this regard. For new entrants with a four-year college degree, results from a survey of over 400 employers in the United States indicate that the four most important skills are oral communication, teamwork/collaboration, professionalism/work ethic, and critical thinking/problem solving. More than 90 percent of employers surveyed declared these skills to be "very important." In contrast, writing, mathematics, science, and history/geography were ranked 6th, 15th, 16th, and 19th, respectively, out of 20 skills.[19] These rankings may not be surprising on their face: Few occupations rely heavily on basic academic knowledge developed in school settings. But the fact that employers stress the value of non-cognitive skills in the workplace speaks to both those skills' overall impact and to the need to readjust our perceptions of such constructs as college-and-career readiness.[20]

A body of empirical evidence provides a second way to assess the contribution of non-cognitive skills to jobs and earnings. Heckman, Stixrud, and Urzua (2006) offer two paths through which non-cognitive skills can raise wages: direct effects on productivity, and indirect effects through their impact on schooling and work experience. Using data from the NLSY-1979, the authors' estimates indicated that the effects of cognitive and non-cognitive skills on earnings were very similar (see estimated coefficients in Tables 4 and 5). Murnane et al. (2001), who estimate the impact of adolescent measures of self-esteem on wages received 10 years later, find a positive association between the two. They suggest that self-esteem could be associated with being particularly good at working productively in groups, and also with higher levels of perseverance.[21]

Other evidence is found in indirect estimates of the importance of non-cognitive skills, and in explanations of these indirect connections. Gintis (1971) used the following approach to indirectly test non-cognitive skills' relevance to earnings. He suggested that omitting a variable representing non-cognitive skills in a model designed to estimate the returns to education (a traditional Mincerian equation) would introduce some bias in the estimate of the returns to education. In other words, part of the estimated returns to education are, in fact, due to the effect of non-cognitive skills on earnings. Heckman and Rubinstein (2001) use a similarly indirect method to attribute to non-cognitive skills the difference in earnings between individuals with seemingly equal levels of educational attainment (GED holders and high school graduates). And Bowles, Gintis, and Osborne (2001) estimated that the returns to educational attainment—measured by years of schooling—diminished by about 20 percent when non-cognitive skills were accounted for.

While acknowledging that non-cognitive skills affect many other adult outcomes beyond earnings, we summarize these relationships with a quote from Heckman and Kautz (2012): "The […] message is that soft skills predict success in life, that they produce that success, and that programs that enhance soft skills have an important place in an effective portfolio of public policies." Building on that statement, below we explore how these non-cognitive skills that lead to success in life are generated during children's school years.

What Do We Know about the Origins of Non-Cognitive Skills and How They Can Be Nurtured?

Factors hypothesized to influence the development of non-cognitive skills include genetics, nurturing, practices during early childhood education, health, school environment, teaching practices, and specific teacher characteristics, among others. In this section, we explore some of the processes that create or enhance non-cognitive skills. First, we focus on the importance of the child's environment for the development of non-cognitive skills. Second, we explore how other non-school factors can affect those skills. Finally, we explore how differences in school factors

(teacher and school characteristics, and other education inputs) influence these skills.[22]

The importance of the environment. First, we review evidence regarding how an individual's environment—including such individual, family, and contextual characteristics as social class, poverty, housing, student mobility, culture, etc.—affects his/her non-cognitive skills.[23] An important reference summarizing this is found in Shonkoff and Phillips (2000). The authors point out that "every aspect of early human development […] is affected by the environments and experiences that are encountered in a cumulative fashion, beginning in the prenatal period and extending throughout the early childhood years." While the mechanisms underlying these connections are best explained by developmental psychologists and neuroscientists, whose frameworks and explanations are beyond the scope of this project, current research is working to uncover the connections between environment and development, including the underlying causal mechanisms in early development (Knudsen et al., 2006).[24]

Building on the work of Shonkoff and others, Grissmer and Eiseman (2008) point out that some of the racial gaps in non-cognitive skills may be explained by differences in the "environmental mechanisms driving development from conception to kindergarten entrance." From other correlational studies, we also know that students' personality and incentives provided by their environment are important in explaining absenteeism and disruptive, inattentive, and tardy behaviors (Segal, 2008). Another study that touches on an important category of non-cognitive skills—executive function—explains the potential moderators and mediators between socioeconomic status and inhibitory control, cognitive flexibility, and working memory, which include household composition and family environment (Sarsour et al., 2011).

Data demonstrating the magnitude of the differences in non-cognitive scores when students enter kindergarten also help illustrate the role of the environment. Frequently, researchers use the child's socioeconomic status (SES), or social class, to measure variation in the environment in which he or she lives. This is because SES acts as a mediating variable for the effects of other mechanisms that affect skills acquisition, such as parenting behaviors and engagement, access to higher quality early childhood care, parents' work habits, and intellectual interests emphasized in the home.[25] As early as kindergarten, a relative disadvantage among children in the lowest socio-economic status quintile, versus the other students, is visible across multiple non-cognitive skills (García, 2015).

The impact of environmental-school factors on non-cognitive skills. Having established the general influence of socioeconomic and other environmental factors on non-cognitive skills, we now discuss some examples of interventions affecting the school environment that have been found to either drive or inhibit children's

development of those skills. As noted above, the goal of this section is to document the importance of non-cognitive skills in the educational context/environment broadly. (A detailed analysis of interventions found to effectively nurture one or more non-cognitive skills would constitute its own lengthy paper, see Durlak et al., 2015 for examples of such interventions.)

Research findings regarding the promise of interventions designed to improve behavior and school engagement suggest how different approaches and services (some of them outside the standard competencies of education policy) can influence them. For example, a community schools approach—which includes wraparound student, family, and teacher supports—has been found to be helpful in promoting students' sense of school as a welcoming place, which is in turn associated with improved motivation and academic confidence (see, e.g., Castrechini & London, 2012). A community school strategy in New York City led to improved academic performance and attendance, increased parental involvement, and created safer learning environments and better student–teacher relationships (Quinn, 2003). School-based health clinics, one of the supports found to be a factor in positive community schools outcomes, have likewise been linked to improved student mental health, and to reduced tardiness and increased attendance, as well as to a trusting relationship with a caring adult in the school setting (Anyon et al., 2013).[26] Finally, afterschool programs and others that address out-of-school time gaps in opportunity have been found to have positive impacts on student engagement, attitudes toward school, and other behavior-related non-cognitive skills (see, for instance, Quinn, 2003 for a review of the literature, and Durlak and Weissberg, 2013 regarding improvements in positive social behaviors, reduction in problem behaviors, and improved school attendance from "afterschool programs that follow evidence-based practices to promote social and emotional development").[27] A few detailed, evidence-based examples are discussed below.[28]

Cook, Murphy, and Hunt (2000) found that the School Development Program, an initiative serving disadvantaged students in inner-city Chicago schools that seeks to improve their interpersonal relationships and social climate, had a positive impact on student beliefs, feelings, and behaviors that led to reduced disruptive behavior.[29] Initiated in 1968 and designed by James Comer, the program seeks to improve children's social and emotional (and academic) outcomes through the cooperation of parents, educators, and the community by offering problem-solving initiatives conducive to creating a healthy school culture and environment. The program entails the development of an improvement plan for each school that is then overseen by a team composed of administrators, teachers, parents, other school staff and professionals (such as counselors), and, in some cases, students, taking a whole-student development approach (Comer, 2005). It has been adopted in more than 1,000 schools in over half of the states in the country (as well as internationally).[30]

Other studies have focused on school violence and disciplinary behaviors to diagnose how these affect students' performance in both cognitive and non-cognitive domains. Gottfredson (1987) describes an organizational development

method implemented by researchers and school staff to reduce school disorder in two junior high schools in Baltimore. The program consisted of modifying the schools' planning, rewards, and administration systems, and the school and classroom environment, which increased students' sense of belonging in school and prosocial peer support. Another example of these complex interconnections is the evaluation of Fast Track, a comprehensive program for students in grades one through 10 that seeks to reduce conduct problems and promote academic, behavioral, and social improvement. Fast Track's recent evaluation under the What Works Clearinghouse standards showed positive effects on emotional/internal and external behavior and had social benefits for children classified as having an emotional disturbance (as well as for those at risk of classification). The program also demonstrated benefits in reading achievement and literacy (U.S. Department of Education, 2014).

Finally, in studying the development of non-cognitive skills, it is of particular interest to understand how out-of-school and extracurricular activities help adolescents form their identity by developing skills and preferences, and building a relationship with others (Eccles & Barber, 1999; Valentine et al., 2002; Youniss et al., 2002).[31] Other studies examined the link between participation in extracurricular activities and adolescent functioning (Gilman, Meyers, & Perez, 2004; Huebner & Mancini, 2003; Zaff et al., 2003). Recently, Baker (2013) and Durlak and Weissberg (2013) highlighted that quality afterschool and summer learning programs have positive effects both on students' learning and on their personal and social development.

The importance of school and teacher factors. Empirical research on the production of education—in which a combination of inputs is used to produce a given school outcome (Todd & Wolpin, 2003)—has traditionally focused on studying how school and teacher factors (in addition to individual-level factors) correlate with cognitive performance,[32] but not so much on how they correlate with non-cognitive skills. If we accept the broad definition of education as encompassing both cognitive and non-cognitive skills, however, this framework can also be used to examine the connections between teacher and school variables (e.g., teacher experience, educational attainment and certification, or class size) and non-cognitive skills.

One example of this research is Dee and West's (2011) study of the effects of class size in eighth grade on students' engagement with school.[33] Their findings indicate that smaller class sizes are associated with small improvements in the measured skills, with effects between 0.05 and 0.09 standard deviations. Using a quasi-experimental approach, García (2013) finds that teachers' experience is positively associated with performance in non-cognitive skills.[34] In particular, students' non-cognitive skills are expected to increase by 0.06 standard deviations for each standard deviation increase in teacher experience. Some indicators of the effects of school inputs on non-cognitive performance skills suggest an improvement in skills among students who transferred to a school with a lower concentration of minority students (between 0.07 and 0.11 standard deviations). Also, students

whose class size decreased seemed to improve their behavioral performance (0.02 standard deviations from the index), a smaller coefficient than Dee and West's.

Thinking more specifically about particular non-cognitive skills, we also highlight the importance of evaluations of programs targeted at improving executive function skills. For instance, some additions to school curricula and computerized and interactive games have been found to have a positive impact on improving children's executive function skills, as summarized by Diamond (2013). The studies underlying her explanations (which also examine early childhood programs such as the Chicago School Readiness Project, or the practice of martial arts) used randomized evaluations to assess their impacts.

The importance of simultaneous effects. Several works cited in this chapter have indicated a mutual relationship between cognitive and non-cognitive skills. Indeed, although these skills are not often studied in an integrated way, multiple authors suggest that the processes of socio-emotional development and cognitive development are intertwined (Levin, 1970; Cunha et al., 2006; Cunha, Heckman, & Schennach, 2010; Olson, 2012; Shriver & Weissberg, 2005). Building on Levin's (1970) earlier work, a recent attempt to study the two types of skills in an integrated way within the school setting is provided by García (2013). Her framework models the production of both cognitive and non-cognitive skills, allowing for simultaneity (or interrelationship) between the two skills by using a simultaneous equation model.[35] García's study uses data for students between kindergarten and eighth grade (from the Early Childhood Longitudinal Study, Kindergarten Class of 1998–1999) and two indices that represent the two main types of educational outcomes—cognitive and non-cognitive. She finds that the interdependent relationships between the two types of skills are statistically significant across the entire analyzed school period in both directions: Non-cognitive skills are important predictors of cognitive performance, and cognitive skills are also influential in the level of non-cognitive performance. The patterns over time suggest that the importance of non-cognitive skills as a determinant of cognitive performance increases very little over the earlier grade levels, but steadily increases across the later grades. Meanwhile, the absolute importance of cognitive skills as a determinant of non-cognitive skills significantly increases through the earlier grade levels (kindergarten through third), and then decreases in later grade levels (fifth through eighth).[36] Although the exact pattern may be driven by the items that compose the indices used and by their measurement,[37] the simultaneous relationship is very strong and raises important questions with implications for the evaluation of education policy.

In line with the research in this area, the findings affirm the importance of better understanding the interconnections between skills, so that the evaluation of interventions in one area—in particular, those targeting cognitive skills—also includes an assessment of how those affect the other domains (Olson, 2012, 23; and previous citations in this subsection). As such, they point to the difficulty of trying to boost cognitive skills while ignoring the need to nurture non-cognitive skills.

POLICY IMPLICATIONS

The above sections convey the importance of non-cognitive skills. These skills matter because they correlate with civic and democratic participation. They also matter because they correspond to what employers look for, and there is some evidence that they correlate with higher productivity and earnings. Non-cognitive skills correlate as well with academic performance. We also know that non-cognitive skills are developed in the school years, that their development is dependent on family and societal characteristics, and also on school and teacher factors, and that they are affected by the instruction and social interactions that take place in school.

Since non-cognitive skills matter and can be nurtured in schools, developing them should be an explicit goal of public education. Even though there is still much to learn about these skills' impacts and how to best nurture them, these conclusions indicate that education policy should be, at the very least, responsible for establishing structures that are conducive to their development, as is the case for cognitive skills.

Which Changes to Education Policy Can Help It Best Fulfill This Mission?

To ensure that non-cognitive skills are encouraged (and are not harmed), policy should shift in accordance with the following recommendations, which build both on theory and on practices already in place. While the recommendations require changes to some aspects of current education policy, they also reflect recent momentum in this direction that points to increasing recognition of the importance of non-cognitive skills.

In particular, we suggest a three-part set of actions: (1) build on growing momentum to shift to more positive and supports-based approaches to teacher and school accountability and student discipline; (2) learn from and adapt policies and practices in the areas of early childhood education, afterschool and summer enrichment, and special education—which have long emphasized non-cognitive skills—to make them core components of K–12 policies; and (3) look to districts that are piloting non-cognitive skills–related strategies as potential models and to state- and federal-level policies that support such strategies.

Broadening and refining accountability. Accountability practices and policies must be broadened in a way that makes explicit the expectation that schools and teachers contribute to the development of non-cognitive skills. Making the development of the whole child central to the mission of education policy would help improve evaluation and accountability through changes to curriculum, teacher preparation and support, other aspects of schools' functioning, and evaluation systems. Specifically, incentives promoted by the enhanced accountability system would be aligned with widening the curriculum, cultivating the proper climate within the school, promoting teachers' investment in relationships with students,

and ensuring teaching time for strategies that are conducive to the development of non-cognitive (as well as cognitive) skills.

Designing such a system requires ensuring that new policies avoid replicating the mistakes of current accountability systems focused on cognitive skills, which have turned out to be too rigid and too narrow (Ravitch, 2013). Indeed, such a broader education policy agenda could reverse some of the dysfunctional aspects of current systems, leading to fairer and more realistic education policies generally.

Curriculum and teaching methods

The identification of the non-cognitive skills that play important roles in education should prompt a discussion of how to design a broader curriculum as well as specific instructional strategies to promote those skills. Some non-cognitive skills can be taught both directly and also indirectly, i.e., they are outcomes/products of training in specific academic subjects.[38] That broader curriculum should thus include ways to both directly promote specific non-cognitive dimensions and to develop them indirectly, by leveraging other kinds of skills (Olson, 2012, 19). For example, having students work on group projects has been found to effectively nurture skills such as collaboration, critical thinking, and communication (Friedlaender et al., 2014).

For teachers to effectively convey these new curricular domains, they will need new and different kinds of preparation and support. Education policy thus must also be enhanced to ensure that teachers are appropriately supported and trained, and that they receive instruction in both the subject and content, and also help in learning how to teach it. For example, in their research into student-centered learning approaches, Diane Friedlaender and her colleagues list a number of supports for teachers, from higher-quality preparation and induction to increased time for planning and collaboration (Friedlaender et al., 2014).

Evaluation of teachers' performance

If teachers are expected to help students excel in both cognitive and non-cognitive dimensions, as is needed for those children's full development, then teachers should be incentivized to do so and held accountable for doing so. Indeed, many critics of current accountability systems see the lack of such balance as a key flaw. If teachers are held accountable only for their part in developing students' cognitive skills (essentially math and reading), there is an inherent disincentive to focus on developing their broader skills.

Given concerns regarding current evaluation systems—in particular, those that rely on student test scores and growth, like value-added models—adding non-cognitive skills to those models poses both added concerns but also the potential for improvement. Current models do not validly capture teachers' contribution to students' learning even in the few tested subjects (Baker et al., 2010; Haertel, 2013; American Statistical Association, 2014). Rather than trying to tweak such

models to also capture teachers' contribution to another, even harder-to-measure set of skills, we should therefore explore other options. These likely include some combination of higher-quality observations directly tied to support for teachers to improve in areas identified (Darling-Hammond, Wilhoit, & Pittenger, 2014; Friedlaender et al., 2014); school-level observations/inspections geared to helping struggling schools improve (Darling-Hammond, Wilhoit, & Pittenger, 2014; Rothstein, Jacobsen, & Wilder, 2008); and district- and state-level comparisons of similar student groups' test scores and other outcome data to identify best practices (Rothstein, Jacobsen, & Wilder, 2008). There are currently few options available, but the hope is that the demand to evaluate teacher performance more broadly will spur the development of more appropriate evaluation systems overall.[39]

As three prominent education scholars emphasize in their recent report on developing a new accountability paradigm, it is also critical that accountability be reciprocal: "Each level of the system – from federal and state governments to districts and schools – should be accountable for the contributions it must make to produce high-quality learning opportunities for each and every child" (Darling-Hammond, Wilhoit, & Pittenger, 2014, 2).

Adjust school disciplinary policies. Many of the existing disciplinary measures used to combat specific students' misbehavior are at odds with the goal of nurturing non-cognitive skills. Harsh measures, including in-school and out-of-school suspensions and expulsions, referrals to law enforcement, and even arrests (often called, collectively, zero-tolerance policies), are increasingly used to punish low-level infractions (Noguera, 2011).[40] Such responses to uncooperative, disorderly, or disruptive behaviors are not only unlikely to prevent such behaviors in the future, but have been found to be counterproductive for the child's development. Such strategies correlate negatively with school achievement and school climate and positively with dropouts (Emmer et al., 2013).

Disciplinary measures need to be rooted in an ability to support and promote better non-cognitive behavior, and in prevention of misbehavior, rather than in just sanctioning wrongdoing. These policies could include restorative practices such as peer mediation, group responsibility, and counseling, among others. And evidence points to the increased efficacy of such positive approaches, shifting from zero-tolerance to preventive and supportive policies that embrace support and promotion of safe learning environments (Boccanfuso & Kuhfeld, 2011; Skiba & Knesting, 2002; Skiba, 2010).

The Supportive School Disciplinary Initiative (spearheaded by the Department of Education and Department of Justice) was launched in 2011 with the goal of supporting the use of school discipline practices that foster safe, supportive, and productive learning environments while keeping students in school. One useful resource is a new guide explaining how states can develop such practices and how policymakers can work to enact and implement them (Restorative Practices Working Group, 2014).

Finally, there are encouraging examples at both the state and district levels of a shift away from harsh and punitive disciplinary practices and toward these types of supportive measures. California recently became the first state to ban suspensions for "willful defiance" (Siders, 2014). And a number of large school districts—including Baltimore, Boston, New York City, Minneapolis, and Oakland—have adopted restorative policies that steer students toward positive and reinforcing means of addressing problem behaviors (Restorative Practices Working Group, 2014, 10–11).

Learn from out-of-mainstream school settings: early-childhood education, special education, and after-school activities. There are at least three prominent education contexts in which experts know quite a lot about how to effectively nurture non-cognitive skills. These include early childhood education, after-school and summer programs, and special education. Adapting lessons learned in these settings to K–12 education is another path toward making the development of non-cognitive skills a core component of U.S. education policy.

In contrast to the heavily cognitive focus in K–12 settings, the early childhood field has long acknowledged the importance of socio-emotional skills and, as such, made their development a key part of curriculum and measurement strategies. Early childhood education thus provides examples of how to ensure that non-cognitive skills are nurtured, and also of how the assessment of outcomes and practices can be adapted to include non-cognitive skills.[41]

Key contributions from the early childhood field include the importance of playtime in helping children to develop certain non-cognitive skills, such as self-regulation and confidence (Galinsky, 2006; Albert Shanker Institute, 2009). Scholars also point to the role of strong teacher–student relationships in building other skills, including trust and curiosity (Galinsky, 2006). And many point to the need for nurturing classroom environments and student-centered learning in order to boost these and other skills (Pianta et al., 2005). A whole-child approach to both curriculum and experiences is the norm; it is assumed and emphasized across the board (Barnett et al., 2009; Galinsky, 2006).

Indeed, Paul Tough (2012) points to these factors in his observation of how a high-quality prekindergarten classroom helps disadvantaged preschoolers develop their non-cognitive skills. And Robert Pianta and his colleagues have drawn on this evidence to develop and refine their CLASS (Classroom Assessment Scoring System) method, which is intended both to promote the classroom and teacher attributes that research finds help children to thrive, and to assess the degree to which providers have achieved them (reviewed below, La Paro & Pianta, 2003; La Paro, Pianta, & Stuhlman, 2004; Pianta, La Paro, & Hamre, 2008).

In light of findings regarding the positive impacts of quality after-school experiences not only on students' academic progress, but on their personal development (as discussed earlier), this is another area of focus from which K–12 education policy can learn and adapt. Afterschool enrichment activities that have been the focus of studies range from music, arts, and drama programs to organized

sports and more academically focused initiatives such as tutoring, mentoring, and help with homework. Scholars point to the range of activities, and of skills targeted, as a key reason for their efficacy in nurturing a range of both non-cognitive and cognitive skills.

Indeed, research shows that participation in extracurricular activities helps adolescents form their identity by developing skills and preferences, and by building relationships with others (Eccles et al., 2003; Valentine et al., 2002). Other skills, such as engagement and confidence, are also critical to the mission of out-of-school activities. In fact, there is growing recognition of the need to bring the kinds of engaging, hands-on, project-based activities that are the norm in afterschool and summer settings into classrooms, so that their promise can be harnessed to a much greater extent (Performance Standards Consortium, n.d.; Friedlander et al., 2014). Recently, Baker (2013) and Durlak and Weissberg (2013) have shown that quality afterschool and summer learning programs have positive effects on both students' learning and on their personal and social development. These evaluations can also constitute good additional examples to provide education policy with instruments to assess non-cognitive skills that can be incorporated into standard assessments.

Finally, the inherent recognition that students eligible for special education services have unique needs and capacities has spurred the development of practices and policies that could be adapted to better address every student's unique needs and capacities. Perhaps most prominent, the individualized education plan (IEP)—to which special education students are legally entitled—offers potential to help schools support students' development of non-cognitive skills. The Schott Foundation for Public Education, which is devoted to whole-child learning, has translated the IEP into a similar concept—a Personal Opportunity Plan—intended to support both the cognitive and non-cognitive needs of a broader set of students throughout their academic careers (Lieber, 2014). Project-based learning, which is gaining traction in K–12 policies and, as noted above, features prominently in many afterschool settings, also has its roots in special education (Ferretti, MacArthur, & Okolo, 2001; Webster, 2014). Again, recognition of each student's unique needs and capacities, which has long been a staple of special education, is a key foundation for ensuring that schools and teachers are equipped and incentivized to promote non-cognitive skills among all students.

Learn from and expand pilot efforts.[42] While no state yet stands out as a model of the policies and practices advanced here to better attend to non-cognitive skills, a growing group of school districts has embraced this as part of their core mission.[43] These include Boston, where the City Connects initiative has been scaling up for over a decade to serve the broad range of students' needs in 16 Boston public schools. Full-time site coordinators meet with every classroom teacher to discuss each child's strengths and needs in the areas of academics, social/emotional/behavioral growth, health, and family.[44] Each student is then linked to a personalized set of services and enrichment opportunities in the school and/or community that address his or

her unique strengths and needs. In the rural Black Oak Mine School District in the Georgetown Divide region of California, this mission is manifested in the form of student-centered classroom and extracurricular activities that encourage youth development, participation, and sense of empowerment.[45]

The Collaborative for Academic, Social, and Emotional Learning (CASEL) works with several pilot districts to effect similar improvements. Based on the premise that district-level leadership is critical to securing and sustaining the type and level of supports needed to ensure whole-child education, in 2011 CASEL launched the Collaborating Districts Initiative. Among the best examples is Austin, Texas.[46] As CASEL reports, the Austin Independent School District (AISD) "is a recognized leader in urban education and one of the first districts in the nation to commit to the development of the whole child by incorporating social and emotional learning [SEL]. In AISD, SEL implementation focuses on three core areas: positive culture and climate, SEL skill and concept integration, and explicit SEL instruction."[47]

The Developmental Studies Center, which has worked for over three decades to promote students' academic, ethical, and social development, offers another source of guidance. The center's activities focus on providing professional development to teachers to help them support whole-child development, both in school and after school. As part of that work, it has developed a number of programs and evaluation instruments that have been shown to improve students' academic performance and prosocial skills, and to reduce problem behaviors such as drug and alcohol use.[48]

While neither any state nor the federal government has yet made nurturing non-cognitive skills a core component of its education policy, there are promising examples at both levels that could be enhanced or scaled up. For example, the New York State Board of Regents Social and Emotional Developmental guidelines serve as a useful model that other states could adapt to fit their resources, priorities, and needs.[49] These initiatives were incorporated into the Board of Regents' P-16 Plan Action 11 in 2008 as a way to reduce barriers to learning. And across many districts that have developed targeted strategies to advance schools' capacity to support non-cognitive skills, federal 21st Century Community Learning Center Grants are one important source of funding and policy support.

Unfortunately, these examples also highlight the continuing conflict between such supportive laws and others, particularly narrow accountability and disciplinary policies, that overshadow these positive strategies and greatly dilute their positive impact. Ensuring that policies at all levels are better aligned, and that they do not work at cross-purposes, will thus be key to effectively promoting non-cognitive skills in education contexts.

These district-level examples of intentional strategies to nurture non-cognitive skills, and sample state and federal policies that support them and others like them, also illustrate the influence of a small but growing group of foundations that have embraced the importance of non-cognitive skills and are working to incorporate them more fully into the education policy agenda. Individual philanthropists and

foundations have played an increasingly prominent role in shaping education policy in recent years—through both research and advocacy—so these contributions merit consideration. A few of the more prominent include the Ford Foundation, the Charles Stuart Mott Foundation, the Nellie Mae Foundation, the Annie E. Casey Foundation, the Atlantic Philanthropies, the Schott Foundation for Public Education, the NoVo Foundation, and the Lumina Foundation (among others).[50]

How Can Research Help Education Policy Achieve These Goals?

The policy recommendations, which build on existing research, also pose significant demands for researchers. In this section, we discuss the need for researchers to identify definitions of non-cognitive skills and develop good metrics systems. We offer some examples of existing instruments that could be expanded to assess non-cognitive skills in the K–12 period. The recommendations related to accountability outlined above also suggest new areas of study for researchers, which are needed to inform enhanced curriculum, teacher training and preparation, and assessment of school performance.

Also, researchers' added examination of the role of non-cognitive skills in education processes could certainly improve our understanding of these processes (sometimes called "black boxes"), and thus further improve educational interventions. Finally, although not exclusively associated with research, we include a discussion of how all actors involved in children's education must join forces to achieve successful adoption and implementation of more effective policies.

Design good metrics and systems to measure non-cognitive skills. As discussed above, integrating non-cognitive skills into the education policy agenda requires, first, the identification of a satisfactory and concrete list of these skills, as well as systems or scales to measure them. Measurement and methodological research are required to validate an *accurate and complete* list of education-related non-cognitive skills,[51] and to provide us with metrics that are both reliable and valid.[52]

While we recognize the many challenges entailed in developing these metrics, we note two strong examples to which researchers can look and upon which they could build. Robert Pianta's CLASS method for classroom protocols documents the interactions between teachers and students in domains like behavior management and instructional dialogue, and accounts for other classroom features and environmental factors (La Paro & Pianta, 2003; La Paro, Pianta, & Stuhlman, 2004; Pianta, La Paro, & Hamre, 2008). Substantive work has validated the instrument at younger ages, and some work to extend it to kindergarten through third grade has also been pursued. A second example is the work developed by the Educational Testing System on the integration of non-cognitive dimensions in its assessments. Patrick Kyllonen and his colleagues provide a framework for the whole-person assessment in education, including a set of non-cognitive constructs such as affective

competencies and attitudes (see Kyllonen, 2005, Figure 1). This work is specifically relevant for measuring older students' college readiness, and it provides some solutions to problems with measurement, such as the tendency of those surveyed to provide false information about their own socio-emotional status.

An additional challenge is ensuring that in designing metrics, researchers do not suggest a given skill level is generally appropriate or desirable. For example, we may expect all children to identify a certain set of words within a text, but not necessarily to attain a specific high measure of creativity, though we may appreciate improvements in both over time. While we recognize that researchers are not responsible for misuse of "value-added" and similar measures, it is critical that they fully explore the implications of their work while it is being conducted, and that any relevant caveats are issued along with it, not after the fact. Perhaps the biggest lesson learned from problems with accountability systems is that researchers' concerns sometimes come too late—after such systems have been institutionalized to great detriment and at a point at which fixing the problem becomes politically and/or logistically difficult.

As such, as they embark on important work in this emerging field, we call on researchers to incorporate some safety measures. For example, when designing measurement systems, they must include both quantitative metrics (e.g., scores on a psychological scale) and qualitative ones (e.g., the degree to which a specific characteristic is manifested). And when designing longitudinal assessments, they must take into account information on child development, in order to balance the goal of growth of skills with expected variation across children.[53] This caution needs to be stressed as education policy evolves in this area.

Using research to inform the teaching profession. Research also has the potential to inform the teaching profession through improving teacher preparation and support, and by guiding the appropriate design and utilization of assessments.

Teacher preparation and support

Fully integrating non-cognitive skills into student curriculum requires that researchers produce evidence on a number of issues related to teachers' preparation and professional support. Research should contribute to informing how the curriculum used in schools of education could include training specifically geared toward the development of students' non-cognitive skills.[54] Similarly, there is substantial room for research to inform how professional development can provide teachers with knowledge of how to support the socio-emotional skills that are sought to be developed in schools. Through the provision of pedagogic, leadership, and organizational skills training, this professional development could complement existing training designed to improve teachers' effectiveness as instructors by incorporating a new component that is more focused on the child's full development and that gives them insight in using the principles of child development (Comer, 2005).

It is also critical to ensure that schools are appropriately staffed with experts on mental and emotional health; i.e., teachers cannot and should not supplant the role of counselors or psychologists (or others). As set out above, education is not confined to what happens within school walls, nor can the nurturing of cognitive or non-cognitive skills be the sole responsibility of teachers. It takes the whole school, family, and community to do so effectively.

Research to inform both learning and teaching: Assessment versus utilization of the assessments

In light of some misuses of assessments for accountability purposes, research is needed to guide the appropriate design and utilization of assessments so that they can inform both learning and teaching.[55] Research should devote significant effort to improving current systems by rethinking the assessment of cognitive skills, redesigning how accountability is utilized, and building solid assessment and accountability systems that are based on inclusive, quantitative and qualitative procedures that inform performance, teaching, and learning. If individuals' full development is the ultimate goal of education, assessments and accountability should be tools to reflect learning and development, and to inform pedagogical strategies, learning pathways, and cognitive abilities and other knowledge acquired.

Using non-cognitive skills to improve educational policies: Opening the black box of educational processes and interventions. Students, teachers, and school performance are not the only aspects that would be subject to evaluation when non-cognitive skills are incorporated into the education policy agenda. As Heckman (2004) states:

[C]urrent policies regarding education and job training are based on fundamental misconceptions about the way socially useful skills embodied in persons are produced. By focusing on cognitive skills as measured by achievement of IQ tests, they exclude the critical importance of social skills, self-discipline and a variety of non-cognitive skills that are known to determine success in life. Furthermore, this preoccupation with cognition and academic "smarts" as measured by test scores has led to the exclusion of social adaptability and motivation and causes a serious bias in the evaluation of the human capital interventions.

This statement highlights the multiple areas in which *education effects* could be reassessed: transitions across educational levels, investment in education, assessment of the quality of education, returns to education, or benefit – cost analysis in education, etc.

Opening up "black boxes" in the education process means trying to better understand how what we do in education policy, and how we structure policies, influence cognitive and non-cognitive outcomes. It also indicates the need to design interventions and conduct research that satisfactorily explains how non-cognitive skills can be enhanced (Durlak et al., 2011; Levin, 2012b), and that ascertains which specific roles they play in the education process.[56]

Research, policy, and politics: An opportunity to reinforce joint work among education institutions and agents. The development of children is not solely schools' responsibility. Parents, of course, play the primary role, and many components of society, including schools, must provide support in a collaborative manner. To fulfill its role, policy must help establish connections across the research and academic worlds, as well as with the testing and measurement industry. Given the growing influence of philanthropy in education, donors and individuals must coordinate their work with that of these various actors, in an appropriately limited manner.

An expansion of the policy agenda to include non-cognitive skills could provide the opportunity for joint work among schools, parents, and education policy agents (research, academia, and industry, in multiple disciplines, and policymakers). Such collaboration is also required if we are to meet each child's various needs.

CONCLUSION

Non-cognitive skills are reemerging as an important issue in education policy discussion. This paper offers some reflections on how the integration of non-cognitive skills in the education policy agenda could substantially improve how education policy is conceptualized and implemented, and discusses a number of challenges entailed in doing so. We began with reflections about accepted notions of what constitutes being an educated person, and of what happens during children's school years to move toward that goal. We then reviewed various perspectives on the importance of non-cognitive skills and contrasted that importance with the relative lack of curricula and standards to nurture them in our children. We also explained how the interaction between cognitive and non-cognitive skills means that this failure to pay attention to the full development of children will greatly limit the potential for success of current attempts to improve curriculum, instruction, and assessment (Comer, 2005).

We then discussed that, in considering how to make non-cognitive skills key ingredients of the education process and education policy, we face three major challenges. First, non-cognitive skills in the education process need to be defined: We need to know *which ones matter*—i.e., we need to reach a consensus regarding which skills can and should be promoted in the school years. We contribute to this discussion by providing *what we call the education policy's list of non-cognitive skills.* This list includes skills that all students should possess to some degree, and that should be nurtured by schools in order for children to thrive in school and life, while recognizing each person's own individuality and a natural variation in skill levels, as we do with cognitive skills.

Second, it is necessary to establish *how they matter*, i.e., their roles as both inputs and outcomes. As such, we must design systems to represent, measure, and quantify these skills. Such systems must reliably and validly capture all important skills and be applied appropriately, giving educators the information they need to nurture

skills without losing sight of children's unique needs and capacities. *Empirical research* needs to validate these, as well as to assess whether and how students' learning and development is occurring.

Third, we set forth guidelines for changes to the education system that are necessary to achieve improvements around non-cognitive skills. In discussing this framework, we also called on researchers to provide new evidence in a range of relevant areas. We also noted the need for coordinated work by students, teachers, parents, the measurement and testing industries, foundations, and policymakers. Indeed, as the district-level examples above illustrate, such major change to how education systems operate requires nothing less than the full alignment of goals, actions, policies, and incentives, at the federal, state, and local levels.

We present these ideas to those in charge of guiding our policy in education with the belief that, in the current context of debates about how to shape education reforms, rethinking the role of non-cognitive skills provides an opportune chance to enact a more effective strategy overall. Also, this chapter is written with the conviction that education policy needs to take action around these important skills that are nurtured in classrooms. Given the key contributions of both cognitive and non-cognitive dimensions to our understanding of what it means to be an educated person, education policies must establish the strategies, actions, and safeguards needed to help individuals to become *fully* educated.

NOTES

[1] This chapter was first published by the Economic Policy Institute (www.epi.org). The original version has been slightly modified to adapt it to the requirements of the current publication and to incorporate a few publications released since then. Still, the acknowledgments of the original paper apply here. I gratefully acknowledge Elaine Weiss, who cowrote the policy implications section of this paper and contributed substantially throughout the process. I also offer sincere appreciation for the extraordinary guidance provided by Jane Quinn, who reviewed multiple versions of the original paper. I also thank Richard Rothstein, Robert Pianta, and Lawrence Mishel for their helpful comments and advice on earlier drafts of the paper. Finally, I am grateful to Michael McCarthy for his edits of that work.

[2] Other terms used to describe these skills include soft skills, personality traits, non-cognitive abilities, character skills, and socio-emotional skills (Heckman & Kautz, 2013). The terms interpersonal and intrapersonal skills are also used in the literature (Levin, 2012a, 2012b, 2015).

[3] These contributions date from a few decades ago, and in some cases, centuries ago. For an introduction to the philosophy of education, with references to the meaning and goals of education from Plato to the 20th century, see Phillips and Siegel (2013). See Castaneda (1968); Dewey (1916); and Goodlad, Soder, and Sirotnik (1990) for discussions about the meaning and purposes of education, and the commission of teaching. See Elias (1997) for a request for school reform to provide greater attention to social and emotional learning, or to find the "missing piece" in the education system.

[4] One recent study on the opinion of teachers on non-cognitive skills was conducted by Bridgeland, Bruce, and Hariharan (2013).

[5] Examples extracted from Rothstein, Jacobsen, and Wilder (2008).

[6] See Ravitch (2011); Rothstein, Jacobsen, and Wilder (2008); and Tough (2012).

[7] In contrast to cognitive outcomes, there is currently no consensus on what represents a high "level of [non-cognitive skills] performance." See the policy implications section of this paper for a discussion of the scaling of these traits, and a call upon research to contribute to ascertaining these relationships.

[8] Most of the existing work classifying non-cognitive skills relies on the contributions of psychologists, who have developed different conceptual frameworks and constructs, in different attempts to narrow the concepts they represent and attach quantifiable indicators. The history of the development of a conceptual approach to personality assessment is summarized by Digman (1990) and Goldberg (1993), and more recently, by Borghans et al. (2008), and by Almlund et al. (2011). Another recent attempt to develop constructs and measures representing non-cognitive skills is Kyllonen et al. (2009). While there are several traits taxonomies, the most famous classification of personality traits is probably the "Big Five" construct of personality, which organizes all personality traits along five uncorrelated dimensions: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. See Almlund et al. (2011, 74, Figure 4) for some of these and other traits' taxonomies.

[9] We acknowledge the (increasing) work that countries, national and international committees or advisory teams are doing in these regards, mostly related to the identification of skills and competencies needed in the 21st century. In the United States, one example is the publication by the National Research Council (2012).

[10] Another important issue to note here is that this list and any possible list are tied with the need to specify a "for what and for whom" the included items would matter (Duckworth & Yeager, 2015). In addition, skills and corresponding measures "must be culturally, educationally, age, and gender appropriate, and be sensitive enough to measure changes among program participants across regions and sectors of the world." (Lippman et al., 2015, p. 46).

[11] It is not clear that all of these belong in the non-cognitive camp; some might be skills that fall between cognitive and non-cognitive extremes. Also, some skills may be more static or fixed, while some may be more adaptable and learnable, depending on each individual. Additionally, some degree of overlap can be detected among some of the skills included in the list.For work building on existing classifications that aims at providing a representative framework of skills and competencies (including noncongitive skills), see Fadel, 2015.

[12] Promoting non-cognitive skills as defined and listed is a mission for education policy. Promoting the full development of children and ensuring acquisition of a broader list of skills for democratic as well as education reasons is a mission for public policy in general, for society, and more importantly, for families and communities. This paper refers exclusively to educationally relevant non-cognitive skills.

[13] Very recent literature reviews such as Lippman et al. (2015) and the book edited by Durlak et al. (2015) are important additions to the work done from an academic perspective.The review below exclusively focuses on studies examining the relationships between non-cognitive skills and education and earnings, and does not include studies that examine the association between these skills and other individual and societal outcomes.

[14] One recent literature review of the contribution of non-cognitive skills to academic performance is provided by Farrington et al. (2012). This review assumes that academic performance, as measured by grades or test scores, reflects not only knowledge of academic contents but also other important student attributes or non-cognitive factors, such as a "range of academic behaviors, attitudes, and strategies that are critical for success in school and in later life." Farrington and colleagues' list includes study skills, attendance, work habits, time management, help-seeking behaviors, metacognitive strategies, and social and academic problem-solving (some of which, as noted above, may be considered in part cognitive). In the authors' conceptual framework, non-cognitive skills operate in a three-level environment, determined by student background, school and classroom context, and socio-cultural context, which may, in turn, shape their specific impact on achievement. Other literature reviews on the same topic include Rosen et al. (2010) and Gutman and Schoon (2013). Rosen et al. (2010) focus on the relationships between academic performance and seven non-cognitive skills, such as motivation, effort, self-regulated learning, self-efficacy, self-concept, social behavior, and coping and resilience, among students in grades kindergarten to 12. Gutman and Schoon (2013) review studies that discuss how non-cognitive skills can be defined and measured and explore interventions that aim to improve non-cognitive skills in children. Additional references are found in the works by Brunello and Schlotter (2011) and García (2013, chapter 2).

[15] See table 2 on page 414.

[16] We briefly summarize some evaluations and correlational studies that look at how improving non-cognitive skills could boost cognitive performance. We will examine whether these interventions worked through improving non-cognitive skills as well in later sections.

[17] Interesting work in the self-regulation field, particularly concerning self-regulation's importance at earlier stages in children's development, has been conducted by Bierman, Domitrovich, and colleagues. See, for example, Bierman et al. (2008); Bierman et al. (2009).

[18] For example, see Carter (2013) for a discussion; Fergus, Noguera, and Martin (2014) for some evidence associated with single-sex schools' efforts to improve both cognitive and non-cognitive skills of their minority male students; and OECD (2010, 2013). An example using the OECD's Programme for International Student Assessment (PISA) data is the work developed by Weiss and coauthors looking at the relationship between students' engagement with the school and the teacher (i.e., measuring the degree to which the student feels connected with his/her school), and academic performance or competencies. Results for the United States suggest that, net of standard individual and education controls, higher values of engagement with teachers are associated with higher reading scores, and higher values of engagement with school were predictive of performance (Weiss & García, 2015; Weiss, García, & Torrats, 2014). Other countries examined are Canada, Japan, South Korea, and Mexico. Among others, the comparisons highlight the cross-cultural variation among the associations in the different countries.

[19] See Table 5, page 21. This specific survey/ranking does not ask which specific cognitive skills new entrants may use at work. From a cumulative learning perspective, it is reasonable to assume that some of the cognitive skills used in the workplace build on basic concepts learned in school. This argument should not be interpreted to mean that cognitive skills do not matter, but rather that non-cognitive skills *do* matter.

[20] In other words, these rankings may be comparing job-specific cognitive skills with general, non-job-specific non-cognitive skills. Evidence of the importance of job- and sector-specific non-cognitive skills is found in Mourshed, Farrell, and Barton (2012). From the point of view of labor economists or business leaders, the subset of non-cognitive skills may differ from the list of skills relevant for educational purposes. For example, see Murnane and Levy's (1996) new basic skills, or materials from the 21st Century Skills Partnership.

[21] Other references of interest in this regard are Heineck and Anger (2010) and Lindqvist and Vestman (2011).

[22] As we review the literature, keep in mind that while some studies explore specific skills and impacts on them, much of the research discusses non-cognitive skills writ large. As such, we may not yet be able to understand the degree to which given child-rearing and/or school practices influence the development of various non-cognitive skills, or their impact at different ages.

[23] For instance, Rothstein (2004) reviews the importance of different factors in explaining cognitive gaps. See Brooks-Gunn and Duncan (1997) for a detailed study on how poverty in childhood can affect a multitude of outcomes, including emotional and behavioral domains.

[24] Olson (2012, 11) points to new evidence on genetics that "indicates that behavior influences genes […] and that experiences are able to change genetic activity that once was assumed to be hard-wired" and how "neuronal structure and function change in response to experiences." Nisbett (2009) provides a comprehensive study of the importance of the environment for the development of intelligence (in all its various forms).

[25] Publications that report such findings include Bloom (1964), Lee and Burkam (2002), Barnett and Belfield (2006), and Rothstein (2004). For a more recent compendia analyzing the multiple ways in which socioeconomic status or social class influence children's development, see Duncan and Murnane (2011).

[26] See Gall et al. (2000); Hall (2001); and Strolin-Goltzman (2010) for other references.

[27] This should probably not be surprising, given the explicit goals of many out-of-school-time programs of compensating for lack of attention to these factors during the school day/in the classroom. See, for example, Carter (2013); and Heckman and Sanger (2013).

[28] Some of these and other interventions aiming at altering the learning climate, or other school aspects, in order to boost students' non-cognitive skills are listed in Durlak et al.'s (2011) meta-analysis. Note

that these interventions are implemented during the school time and year. Rothstein (2004) reviews some empirical research that highlights the importance of after-school activities and summer programs for "laying the foundations for academic success" as well as for building "social skills, like leadership, conflict resolution, and teamwork" (101). Zins et al. (2004) also provide a review of studies that show the relationship between socio-emotional learning and academic performance.

[29] In addition to its positive impact on a number of non-cognitive skills, the intervention also improved standardized test scores (that is, a type of intervention leading to associations and outcomes such as those explained in the section *Why cognitive skills matter*).

[30] Comer School Development Program, Child Study Center, Yale School of Medicine, http://schooldevelopmentprogram.org/about/index.aspx.

[31] Earlier work on this topic by Clark (1990) showed that after-school activities mattered largely for minority and disadvantaged children and were predictive of high achievement among them.

[32] The best-known examples of studies examining the determinants of academic performance are those developed by Hanushek (for instance, Hanushek, 1979, 1989), and with their roots in the well-known Coleman Report (Coleman et al., 1966).

[33] Their identification builds on having the same students take different academic subjects in classes with different sizes, which allows contemporaneous within-student and within-teacher comparisons across two academic subjects, and first differences.

[34] See chapter six. The non-cognitive skills index is constructed using the standardized variables by grade level for students' scores in externalizing behavioral problems, internalizing behavioral problems, and self-control, as reported by teachers.

[35] See chapter seven. Other examples of this identification are found in the literature in the 1970s and 1980s. In addition to Levin (1970), see Boardman, Davis, and Sanday (1977); and Schneider (1985). The cognitive skills index is constructed using information on achievement in reading, mathematics, and science/general knowledge. The non-cognitive skills index is constructed using the scores in students' and teachers' reported externalizing behavioral problems and internalizing behavioral problems, teachers' reported self-control, and students' reported locus of control and self-concept. Both indices are constructed using the standardized variables by grade level.

[36] According to the empirical estimates (with controls for individual- and school-level covariates), an increase of one standard deviation in cognitive skills would increase non-cognitive performance by 0.084 standard deviations in kindergarten, by over 0.223 standard deviations in third grade, and 0.185 standard deviations in eighth grade. An increase of one standard deviation in non-cognitive skills is associated with an increase in a student's academic performance of 0.053 standard deviations in kindergarten. The coefficients are 0.093 standard deviations in first grade, 0.082 standard deviations in third grade, 0.095 standard deviations in fifth grade—and a substantial rise to 0.169 standard deviations in eighth grade.

[37] See García (2013) for more detailed explanations and sensitivity checks, and for a discussion of the stability of the patterns over time based on different personality traits.

[38] See Nisbett (2009) or Kusche and Greenberg (1994), on the PATHS Curriculum. For example, project-based learning allows students to learn about specific academic issues while also providing an opportunity to use and develop a number of organizational, communication, and teamwork skills.

[39] For example, the work of Jackson (2013) can be used to illustrate new attempts to measure teachers' contribution to non-cognitive development.

[40] These practices and policies vary widely from state to state and, within states, across districts. As such, the first step is to examine current policies and to determine how changes to state and district laws factor in. For example, only 3 percent of the disciplinary actions for students in middle and high schools in Texas were for conduct for which state law mandates suspensions and expulsions, and the remainder of disciplinary actions were made at the discretion of school officials (primarily in response to violations of local schools' conduct codes) (Fabelo, 2011).

[41] For an assessment of the evolution of quality instruments in early education in the last decade, see La Paro, Pianta, and Stuhlman (2004); La Paro et al. (2012); Pianta, La Paro, and Hamre (2008).

[42] This short section includes initiatives and strategies in the U.S. only. For information of initiatives targeting or promoting non-cognitive skills in other countries, see, for example, Durlak et al. (2015), chapter 37.

[43] As is true of other examples in this section, the few that we highlight are intended to provide illustrations of what we discuss. There are many more that merit attention, and these are not necessarily representative of them.

[44] For a one page summary of this intervention, see Broader, Bolder Approach (2010a). For more detailed information, see City Connects (2014).

[45] For a one-page summary of this intervention, see Broader, Bolder Approach (2010b). For more detailed information, see Black Oak Mine Unified School District (2014).

[46] The other districts taking part in the Collaborating Districts Initiative, which vary greatly in terms of strengths and challenges, include Anchorage, Chicago, Cleveland, Nashville, Oakland, Sacramento, and Washoe County, Nevada. Several of these districts also highlight the frequent conflicts between districts' desire to focus on non-cognitive skills and state and federal mandates and requirements that may impede or even drown out those efforts.

[47] See http://www.casel.org/collaborating-districts/austin-independent-school-district.

[48] More information about these programs and their effectiveness is provided at http://www.devstu.org.

[49] See New York State Board of Regents (2011). The State of New York, like the State of Illinois before it, was advised by CASEL and conducted a survey to learn about practices pertaining to a comprehensive approach to implementing school-wide social and emotional development and learning. See Tanyu et al. (2005). Other institutions, such as the UCLA Center for Mental Health, are working with other states to advance similar statewide strategies to embed non-cognitive skills in education policy.

[50] Just as it is beyond the scope of this paper to provide a detailed analysis of how accountability policies could be improved, there is no way to list all of the foundations that might fall into this category. We include in this category foundations that have focused on this issue for at least several years and/or supported multiple initiatives.

[51] In other words, not only would we need to define what, for example, collaborative problem solving is, but also to find a way to measure it through a computer.

[52] The list we put forth earlier in the paper is likely to be adapted as more evidence becomes available.

[53] Although this is beyond the researchers' control, a potential institutionalization of non-cognitive skills (from their definition, measurement and evaluation through standards, to the design of a learning curriculum, or teachers' training on the new curriculum, etc.) could drive the development of stereotypes or pressure, and, thus, be at odds of living up to their unique potential.

[54] The preparation of aspiring teachers should include a more comprehensive preparation program incorporating support regarding knowledge and practice of teaching strategies to nurture non-cognitive skills (in the same way that teachers currently learn not only math, reading, and writing content, but strategies to teach subtraction, decoding, and persuasive writing, for example).

[55] Concerns exist about the fact that misuse and poor design of cognitive assessments, and inappropriate accountability in recent years, have caused substantial harm. Traditional testing tended to exclude many of the school outcomes we truly value and to inherently narrow the schools' focus regarding what teachers should teach and students should learn. Numerous voices advise that the *utilization* of standardized achievement test data as the main element of education accountability, with punishing purposes, is ineffective, poor policy, and immoral (Baker et al., 2010; Gordon, 2013; Ravitch, 2013, among multiple other voices). See also American Educational Research Association (2014).

[56] For example, issues such as peer effects and teaching practices, among many others, are areas that could be reassessed in light of non-cognitive skills affecting the channels through which they can work and the outcomes that they can produce (García & Gottfried, 2013).

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4. NON-COGNITIVE VARIABLES AND ACADEMIC ACHIEVEMENT

The Role of General and Academic Self-Efficacy and Trait Emotional Intelligence

INTRODUCTION

Mapping the individual differences that predict academic success in higher education is key within educational and vocational settings because academic performance (AP) is an indicator of prospective success and accomplishments and opens the door for job opportunities (Strenze, 2007). In educational settings, acknowledging and assessing these differences and the roles they play on academic success can be useful (e.g., when developing personalized interventions to increase academic achievement).

Early research on the predictors of AP found that intelligence (as measured by IQ and aptitude tests), as well as previous achievement (as measured by GPA), were the strongest predictors of AP (Sinha, 1966; Touron, 1987; Rohde & Thompson, 2007; Kuncell & Hezlett, 2010). However, several lines of inquiry have suggested that, in order to attain accuracy in predicting academic achievement, a heuristic approach needs to be adopted. Empirical evidence shows that non-intellective variables such as personality traits, emotion, and motivation, may directly or indirectly predict university AP (e.g., Robbins, Lauver, Le, Davis, Langley, & Carlstrom, 2004). Some of those non-cognitive factors seem to predict AP over and above intelligence (e.g., Sanchez-Ruiz, Mavroveli, & Poullis, 2013).

The present chapter focuses on some of the non-cognitive factors mentioned above that have shown to influence in academic achievement. After reviewing the empirical evidence on the role of traditional personality traits and academic motivation, we turn our focus on self-efficacy constructs, in particular academic and emotional self-efficacy, as they relate to academic achievement.

PERSONALITY TRAITS AND AP

One of the leading psychological factors that influence AP is personality (e.g., Richardson et al., 2012). Some studies have reported that personality traits show incremental validity over other variables such as cognitive ability and gender in

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the prediction of AP (e.g., Furnham, Chamorro-Premuzic, & McDougall, 2002; Richardson et al., 2012). Researchers have primarily focused on traditional personality hierarchies, namely the Five Factor Model (FFM; McCrae & Costa, 1997).

Among the five personality dimensions, conscientiousness has been the one most consistently related to AP (see Poropat, 2009, for a review) across samples and measures (Noftle & Robins, 2007). Findings from studies (e.g., Furnham et al., 2002) and meta-analyses (Richardson et al., 2012; Trapmann, Hell, Hirn, & Schuler, 2007) indicate that university AP correlates positively with conscientiousness. Furthermore, a study among undergraduates suggests that conscientiousness is the one personality trait that predicts AP consistently across the three academic years of the university degree (Sanchez-Ruiz, Pérez-González, Fayad, Filella, & Soldevila, in progress).

An explanation for these findings lies in the association between conscientiousness and effortful strategies that are beneficial to learning in educational settings, which in turn promote AP (e.g., Corker, Oswald, & Donnellan, 2012). This is in line with research indicating that being motivated to succeed, organized and disciplined, has a beneficial impact on study habits and increases academic commitment (Komarraju et al., 2011; Poropat, 2009). In addition, the abovementioned findings can be accounted for by the relationship between conscientiousness and higher-order thinking skills, such as executive function, working memory capacity, and other neurobiological underpinnings of the prefrontal cortex (e.g., DeYoung et al., 2010). In addition, a recent study found that trait conscientiousness acts as a catalyst by enhancing the relation between intelligence and AP (Di Domenico & Fournier, 2015).

Openness to experience has also been linked to AP (e.g., Komarraju et al., 2011; Propat, 2009) and has shown to be a strong predictor of SAT verbal scores (Noftle & Robins, 2007). This trait, also referred to as "intellect", affords intellectual curiosity, which is a drive for learning and can have a positive impact on academic success. In this regard, Chamorro-Premuzic and Furnham (2008) reported that students scoring high on openness have a rich vocabulary repertoire, are open to novel ideas, and think in an abstract way, all of which support the positive relation between openness and AP. Conversely, other studies have found that openness and AP are negatively correlated, possibly due to the difficulty in following rules and meeting deadlines among high-openness scorers (Chamorro-Premuzic & Furnham, 2004; Kappe & van der Flier, 2010).

Individuals high in neuroticism (low on emotional stability) tend to be more anxious, tense, vulnerable, and focus mainly on their emotional state (Costa & McCrae, 1992). Students high on neuroticism are susceptible to higher level of stress under academic demands, such as exam performance, and distraction from their academic work, both of which can lead to poorer performance. This explanation finds support in longitudinal studies reporting a negative correlation between neuroticism, exam performance, and final-project grades (Chamorro-Premuzic &

Furnham, 2003). These findings are in line with those of other studies (e.g., Furnham & Monsen, 2009; Lounsbury, Sundstrom, Loveland, & Gibson, 2003) and meta-analyses (e.g., Trapmann et al., 2007).

There are mixed findings regarding the role of extraversion in AP. Several studies have reported a positive relation between the two constructs (e.g., Chamorro-Premuzic & Furnham, 2003; Komarraju et al., 2011). A tentative explanation for this is that extraverts might have ample energy to help them endure more academic mundane tasks than their introverted counterparts. Also, extraverts might be benefitting from social support, teamwork and networking in their academic endeavors to a greater extent than introverts might.

The relationship between AP and extraversion could be moderated by the type of assessment used. For example, Furnham et al. (2004) reported extraversion to be positively correlated with final-project but not with exam grades, suggesting that the social skills used in the interaction with the supervisor could play a role. Other studies have found a negative relationship between extraversion and AP (e.g., Furnham, Nuygards, & Chamorro-Premuzic, 2013), which might be due to extraverts diverging from academic tasks and orienting more towards socializing, thus allocating little time and energy for studying.

The personality trait resulting in the most mixed results when explored in relation with AP is agreeableness. Some findings indicate a positive relationship between agreeableness and classroom behavior (Furnham, Chamorro-Premuzic, & McDougall, 2002), but not necessarily with AP. However, meta-analyses indicate a small correlation between agreeableness and AP (e.g., Poropat, 2009).

However, extraversion, openness to experience, and agreeableness have been non-significant predictors of AP in a few studies (e.g., Poropat, 2009), which contradicts previous findings. Also, in Komarajju et al. (2011), there was no significant relation between extraversion and AP and there was a positive relation between neuroticism an AP. A possible reason for the discrepancies regarding the relation between some personality traits and AP could be the potential extraneous effect of the academic major. There are numerous studies demonstrating that personality and emotion-related traits of university students vary across academic majors (e.g., Sanchez-Ruiz, Pérez-González, & Petrides, 2010), but fewer studies focus on the differential relationship between personality traits and AP by major. One such study by Vedel, Thomsen, and Larsen (2015) found that conscientiousness, followed by openness, positively predicted AP. Extraversion negatively predicted AP among psychology students only, and openness positively predicted AP among political science students only. These findings suggest that certain traits might be important for the academic success in certain disciplines and future studies would benefit from incorporating academic major into their designs.

It is worth noting that all of the above reviewed studies used self-rated personality measures (e.g., NEO-Personality Inventory Revised, Costa, & McCrae, 1992), and so scores can be influenced by social desirability. However, a recent meta-analysis

explored the relationship between personality traits rated by close individuals such as friends or family members (referred to as other-rated as opposed to self-rated traits), and AP, with results indicating that this association has a similar direction, yet stronger, than that between self-rated personality traits and AP (Poropat, 2014). Not surprisingly, in the same meta-analysis, conscientiousness was the strongest correlate of AP followed by openness (moderate correlation). The rest of the personality traits showed weak correlations with AP. Furthermore, other-rated personality traits collectively had an incremental predictive validity on AP over and above intelligence. However, while controlling for intelligence, openness had the strongest correlation (Poropat, 2014).

In sum, conscientiousness and openness to experience have been commonly associated with AP, followed by extraversion and neuroticism (e.g., Chamorro-Premuzic & Arteche, 2008). While conscientiousness has been a consistent correlate of AP throughout a wealth of studies, there are mixed findings regarding the other four traits.

ACADEMIC MOTIVATION

Old and new findings suggest that academic motivation is a prominent non-cognitive contributor to AP (Amrai, Motlagh, Zalani, & Parhon, 2011; Daoust, Vallerand, & Blais, 1988; Vecchione, Alessandri, & Marsicano, 2014), even beyond cognitive ability (Spinath, Spinath, Harlaar, & Plomin, 2006). The construct of academic motivation is grounded in the self-determination theory (SDT: Deci, Vallerand, Pelletier, & Ryan, 1991), which distinguishes the various drives toward task engagement, and suggests that individuals have an innate tendency to express their interests, activate and develop their potentials, and overcome challenges.

According to the SDT, motivation is a continuous quality rather than a static trait. This continuum ranges from intrinsic motivation, at one end, to amotivation, at the other end. In between these two poles lies extrinsic motivation, which is also considered a continuum ranging from integrated regulation (closer to intrinsic motivation), identified regulation, introjected regulation, and external regulation (closer to amotivation). Self-determination can mainly be achieved through exercising intrinsic motivation, which is engaging in an activity driven by the genuine interest in it rather than by external forces or rewards (e.g., extrinsic motivation), is the stepping stone to reaching high self-determination.

The self-determination theory identifies three basic psychological needs: (1) *Competence,* which refers to the need to gain positive feedback on performance and for perceived capability to master a task; (2) *Autonomy*, which refers to the need of one's course of action to be driven by one's own initiative and interest, and a need to be self-regulated; (3) *Relatedness,* which refers to the need for close relations and interaction with other people. There is evidence that the fulfillment of these basic needs in students promotes self-regulation for learning, AP, and ultimately, well-being (Niemiec & Ryan, 2009).

This approach has numerous applications in educational settings. Intrinsic motivation is seen as conducive to learning and performance. It is sustained by the satisfaction of two of the basic needs mentioned above (Competence and Autonomy; Niemiec & Ryan, 2009). For example, students may feel competent when they have a sense of ability to meet the challenges of academic work; and autonomous when they study willingly and not out of obligation, which might contribute to better performance. Thus, self-determination is a result of interest in and valuing of education, which are, in turn, predictive of AP (Deci et al., 1991).

On the one hand, some types of extrinsic motivation can hinder AP. External regulation (which is closest to amotivation) favors behaviors that are aiming solely at obtaining a reward (e.g., grades, or praise) or to avoid a punishment (e.g., failing, being ridiculed). Once these conditions are removed, the motivation diminishes, which might actually hinder AP. In introjected regulation, behaviors are performed in order to fulfill internal contingencies, such as self-aggrandizement. For example, a student with this kind of motivation might study to feel pride or to avoid guilt-feeling.

On the other hand, some types of extrinsic motivation can facilitate AP. Identified regulation and integrated regulation are at the most autonomous end of the spectrum, closest to intrinsic motivation. Identified regulation refers to motivation to perform behaviors because of their significance and value. In this case, students may study a subject because it is important for their future career. In integrated regulation, identified regulations are combined with other aspects of the self. For example, students may be motivated to study psychology as doing so will enable them to help others in need, which might be in accord to their personal values, interests, and traits, such as empathy. However, these influences of different types of extrinsic motivation on AP will need to be further explored in future studies as they remain under-researched.

The self-determination approach is well-supported by research, and in particular, the impact of intrinsic motivation. For example, a recent 40-year meta-analysis indicates that intrinsic motivation is a moderate-strong predictor of performance in educational and work domains (Cerasoli, Nicklin, & Ford, 2014). Additionally, intrinsic motivation positively influences the learning process and the quality of learning, while lack of motivation has been related to poor psychosocial adjustment to university life (Baker, 2004), which can, in turn, hinder AP.

SELF-EFFICACY

Another aspect of personality that is widely studied in educational psychology is perceived self-efficacy, derived from the social-cognitive theory (Bandura, 1977). Self-efficacy is closely linked to the competence domain of the SDT theory, and has been conceptualized as a compilation of self-perceptions of capabilities, skills, and competencies which function in different domains, and exert control over one's own environment and level of functioning (Bandura, 1977). The construct has been

applied in different domains of functioning including academic, emotional, and social, and is commonly measured by self-report scales. According to the theoretical framework of self-efficacy, expectancies of personal efficacy determine coping behavior, optimism or pessimism, extent of efforts exerted, and perseverance in the face of obstacles and adversities (Bandura, 1995). Self-efficacy has empirically demonstrated to influence a person's level of motivation, perseverance, adaptation, subjective well-being, and vulnerability to depression and stress (Bandura, 1997; Strobel, Tumasjan, & Spörrle, 2011).

Academic Self-Efficacy

For decades, research on perceived self-efficacy has been widely applied in educational settings. It is evidenced from early research that students who score high on self-efficacy work harder, participate and persevere more, and have less negative responses to stressors than their low self-efficacy counterparts (Bandura, 1997; Zimmerman, 2000). One of the most commonly used self-efficacy construct in educational settings is academic self-efficacy, which is defined as self-perceptions of capabilities to manage academic work and achieve, and there is solid evidence that it predicts academic outcomes (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996). Studies and meta-analyses indicate a well-established positive relationship between academic self-efficacy and AP, over and above other predictors, such as cognitive ability and high school AP (Komarraju & Nadler, 2013; Lee, Lee, & Bong, 2014; Multon, Brown, & Lent, 1991; Richardson et al., 2012). Additionally, Khan (2013) studied the association between academic self-efficacy, coping strategies and AP. In particular, academic self-efficacy positively correlated with positive reinterpretation, growth, acceptance, and planning, all of which upsurge AP, and negatively with maladaptive strategies to cope with stress (e.g., substance abuse). In addition, Chemers, Hu, and Garcia (2001) longitudinally explored the relationship between academic self-efficacy and AP, commitment to remain in university, academic expectations, and perceived coping abilities in university students. Results indicate that academic self-efficacy has both direct and indirect effects on AP.

The Academic Self-efficacy Scale (ASE: Mcllroy et al., 2000) is one of the most commonly used measures of self-efficacy in educational settings. The ASE has been used in several studies exploring the relation between academic self-efficacy and AP, while showing a strong reliability score of 0.83 (Lawler, 2012).

Emotional Self-Efficacy (Trait Emotional Intelligence)

Emotion-related personality traits, such as psychological well-being, have been found to contribute to AP (e.g., Vaez & Laflamme, 2008), through the willingness to exert effort towards accomplishing academic tasks and the positive affect component (Ayyash-Abdo & Sanchez-Ruiz, 2012). However few research has systematically

studied the role of emotion-related traits, not covered by existing personality trait taxonomies, in AP. One exception is trait emotional intelligence (*trait EI* or *emotional self-efficacy*; Petrides, 2011), which is conceptualized as a constellation of emotion-related self-perceptions located at the lower level of hierarchical personality structures, and assessed through typical-performance instruments (Petrides, 2011). Trait EI can also be understood as a collection of affective dispositions linked to well-being that are useful in social interactions and thus considered adaptive (Pérez-González & Sánchez-Ruiz, 2014).

Trait EI is to be distinguished from ability EI. One of the most important distinctions between the two constructs is that trait EI provides a more comprehensive operationalization of the affect-related aspects of personality than traditional personality models (Pérez-González & Sanchez-Ruiz, 2014) and lies wholly outside the taxonomy of human cognitive ability (Carroll, 1993). In contrast, ability EI seeks to measure emotionality through maximum performance tests (Petrides, Furnham, & Mavroveli, 2007), which has shown to be problematic because of the subjective nature of emotion (Brody, 2004).

The construct of trait EI originated and developed within the field of individual differences in emotionality (e.g., Matthews, Deary, & Whiteman, 2009), while ability EI belongs to the cognitive dimension. Thus, the two constructs represent two different lines of research and distinct operationalizations (evidence of this can be found in the low correlations reported between the two—Petrides, Furnham, & Mavroveli, 2007). For more information on the ability vs. trait conceptualizations of trait EI, please see Petrides, 2011.

Trait EI plays a role in various variables in educational contexts, especially AP. The advantageous effect of trait EI has been shown in a recent meta-analysis (Perera & DiGiacomo, 2013), suggesting that the construct's influences AP moderately, and its effect depends on sample characteristics (see Mavroveli & Sanchez-Ruiz, 2011 for a comprehensive review). However, several studies have explored the relation between trait EI and AP among university students, reporting a significant association (Parker et al., 2004). In addition, trait EI has shown incremental validity over and above cognitive abilities and the Big Five personality traits in higher education (e.g., Sanchez-Ruiz et al., 2013).

Some research, however, has found weak or null correlations between trait EI and academic success (e.g., Newsome & Day, 2000). Some inconsistent findings regarding the relationship between trait EI and AP might be due to such relationship being different across academic domains. In fact, trait EI differs across domains (Sanchez-Ruiz, Perez-Gonzalez, & Petrides, 2010) and appears to be more important for academic achievement in social sciences than in other disciplines (Sanchez-Ruiz et al., 2013). Thus, more research looking into different domains needs to be conducted to further elucidate the mechanisms by which trait EI operates in particular academic contexts, such as medical education (Austin et al., 2005; Chatila et al., in progress; Fallahzadeh, 2011), whereby trait EI might have an impact in the

patient-doctor relationship. Another tentative explanation for the low correlations found is that often, indirect effects seem to be more important than direct ones in a number of studies (Perera & DiGiacomo, 2015; see following section).

Trait EI has been linked to academic variables other than AP. High trait EI university students also score higher on certain measures of creative skills (Sanchez-Ruiz, Hernández-Torrano, Pérez-González, Batey, & Petrides, 2011), which are crucial for academic and work success. Regarding primary and secondary education, absenteeism, for example, has been less reported among high trait EI students than their low trait EI counterparts, and the same is true for the number of expulsions from school due to misconduct (Mavroveli, Petrides, Shove, & Whitehead, 2008). Trait EI can have a positive impact on children's peer relations at school and decrease the likelihood of disruptive and violent behavior (Santesso, Reker, Schmidt, & Segalowitz, 2006) as well as bullying (Mavroveli & Sanchez-Ruiz, 2011).

There have been some criticisms regarding certain trait EI assessment tools (see Pérez-González, Petrides, & Furnham, 2005 for a review), due to lack of robustness of their psychometric properties or because they claim to measure ability EI when they are really assessing trait EI through self-report. One of the most reliable, valid, and widely used tools to measure trait EI is the TEIQue which has shown excellent psychometric properties across samples (e.g., Freudenthaler, Neubauer, Gabler, Scherl, & Rindermann, 2008; Mikolajczak, Luminet et al., 2007; Petrides, Pérez-González et al., 2007). This questionnaire is the result of a systematic analysis of previous models of EI and covers 15 facets encompassed in four factors, namely Well-being, Self-control, Emotionality and Sociability. There are a wide variety of versions of the test (e.g., Short form, Child form, Adolescent form, etc.) and it has been translated into more than 15 languages.

INDIRECT EFFECTS

Due to the complexity and interconnected network of the effects of various cognitive and non-cognitive determinants of AP, oftentimes the relationships between the aforementioned constructs and AP is not a direct one. To delineate the mechanisms operating in such network, indirect effects need to be considered. As such, research has tried to test models of direct and indirect effects, normally through structural equational modeling (SEM) or path analysis in order to understand how specific factors mediate the relation between another non-cognitive factor and AP.

Indirect Effects of Personality and Academic Motivation on AP

Conscientiousness has shown to have an indirect effect on AP via learning approaches, such as learning strategies (Diseth, 2013). The mediation of students' learning approaches between conscientiousness and AP is not surprising since students who engage in a strategic learning approach effectively require the organization of their work in accordance with their academic demands. In addition, openness

to experience indirectly promotes AP through other learning strategies, such as deep elaborative processing and synthesis analysis (Komarraju et al., 2011). An explanation for this relationship is that students who are open to new concepts and experiences, intellectually curious, and actively process the information provided and relate it to their personal experiences, which enhances AP.

In addition, Hazrati-Viari, Rad, and Torabi (2012) found that academic motivation mediates the effect between conscientiousness and AP, and between openness to experience and AP. This further supports the idea that personality traits promote AP through predisposing students towards academic behaviors that are conducive to performance through other constructs, such as motivation and learning approaches.

Having a clear insight about academic preferences and being confident in one's skills within a particular domain can boost motivation and promote efforts when dealing with academic demands. In fact, students high on academic self-concept (i.e., beliefs, attitudes, and perception towards their skills and performance) are more intrinsically motivated, which can enhance AP (Khalaila, 2015).

General and Academic Self-Efficacy

Yusuf (2011) reported that self-efficacy has a direct effect on the students' academic motivation and tendency to engage in self-learning, which indirectly increases their AP at university. Similarly, self-efficacy had the strongest indirect effect on AP through promoting effective studying strategies, namely deep processing, and other non-cognitive variables, such as achievement goals. Such a strong indirect contribution indicates that students' belief in their academic skills might help direct their cognition towards trying to understand complex ideas using prior knowledge and making interconnections among them (Fenollar, Roman, & Cuestas, 2007).

Students with high self-efficacy tend to be also more academic motivated (Gota, 2012), which, as discussed earlier, has a positive impact on AP. Furthermore, students who believe that they are capable of achieving are better in regulating the effort exerted for academic achievement. Also, these students tend to believe that intelligence is changeable and depends on the effort placed, contrary to students with low self-efficacy, who tend to believe that intelligence is innate and resilient to change. As such, high self-efficacy students are better at controlling natural impulses, such as being distracted or giving up, across various academic demands ranging from dull to very demanding tasks. Moreover, self-efficacy is associated with efficient goal setting, which includes engaging in challenging tasks, gaining new information, and performing better at univeristy (Komarraju & Nadler, 2013).

Putwain, Sander, and Larkin (2013) found a positive indirect effect of academic self-efficacy on AP via pleasant emotion-related constructs, such as hope, enjoyment and pride. These findings imply that academic self-efficacy may impact the student's overall well-being, and that could be a drive for them to reach academic outcomes. Academic self-efficacy was directly related to parenting styles, whereby students who perceived their parents as authoritative had higher academic self-efficacy than

those who perceived their parents as non-authoritative, which, in turn, resulted in a higher AP of the former (Gota, 2012).

Trait EI and Emotion-Related Constructs

Previous studies have shown that emotional self-efficacy has an impact on academic self-efficacy, and indirectly enhances AP (Adeyemo, 2007; Hen & Goroshit, 2014), which suggests the importance of the affective component of personality in educational contexts. A study conducted by Sanchez-Ruiz (in progress) found that trait EI indirectly predicted AP in undergraduates through procrastination (negative relationship) and major satisfaction (positive relationship).

In a study conducted by Austin et al. (2005) trait EI mediated the association between gender and exam performance among medical students. Additionally, females scored higher on trait EI, which could be a potential partial explanation of previous findings (e.g. Ferguson et al. 2002) where females performed better in medical school than males. The mediation effect of trait EI between gender and AP could act as a protective factor against academic stress. More recently, Perera and DiGiacomo (2015) reported two novel two-step pathways by which trait EI indirectly contributed to AP. In the first pathway, trait EI impacts AP through the perceived social support, which subsequently increases students' positive affect, in turn, increasing AP. In the second pathway, trait EI influences AP through adaptive academic strategies, namely active coping, positive reinterpretation, and planning, which also increased the students' academic engagement. Similar research is being carried out investigating the indirect effects of trait EI on medical AP via parental support, coping skills and academic stress (e.g., Chatila. et al., in progress).

LIMITATIONS OF THE EXISTING LITERATURE

Overemphasis on Cognitive and Traditional Personality Traits

As we have mentioned, while cognitive factors play a major role in predicting AP, there are other factors, specifically non-cognitive, which are equally or more important predictors. It may be then problematic to rely extensively on cognitive factors in predicting AP in higher education settings. This is especially the case because universities criteria for student admissions have become increasingly demanding, and thus, the selected students have high scores on intelligence and aptitude tests and a restriction of range in intelligence (Johnson, 2003). The role of intelligence in AP (as measured by IQ tests), might be more prominent for particular academic majors, such as those that require logical reasoning (Sanchez-Ruiz, Mavroveli, & Poullis, 2013).

Studies on the incremental validity of non-cognitive over cognitive factors in the prediction of AP is key, but so far it has been mainly focused on traditional personality traits. It would be advisable for future research to study how specific

constructs such as general, academic and emotional self-efficacy, perfectionism and fear of failure, can predict AP over and above cognitive variables.

In sum, future research could consider the restriction of range in cognitive abilities in higher education, the potential domain-specificity of the relationship between AP and cognitive and non-cognitive factors, and the incremental validity of specific traits.

Lack of Cross-Cultural Research

Despite the existence of some studies examining predictors of AP across different ethnic groups (e.g., Duong, Badaly, Liu, Schwartz, & McCarty, 2015; Woolf, Potts, & McManus, 2011), these studies have been mainly conducted in Western cultures. Lack of cross-cultural research limits researchers' ability to understand how AP is conceptualized and assessed across different cultures and academic systems, thus inhibiting the ability to draw generalisable conclusions about the predictors of AP.

In the first systematic cross-cultural meta-analysis of its kind, Dekker and Fischer (2008) highlighted the role of culture on academic achievement goals, which have clear repercussions on AP, and the reason behind those goals across cultures. Their findings suggest that social context has a moderately significant effect on adopting academic achievement goals. For instance, individuals in cultures that value embeddedness (i.e., social cohesion) exhibited a desire for gaining social approval through demonstrating their competence and skills. Distinctively, in egalitarian cultures, individuals demonstrate high achievement motivation due to a desire to master challenging tasks (Dekker & Fischer, 2008).

Excessive Focus on GPA

The present chapter has reviewed research studies using mainly GPA scores as indicators of AP. While GPA has been widely used as a proxy for AP, it is not free from limitations. First, there is the potential problem of grade inflation, which can also occur differentially by instructor and subject (e.g., Johnson, 2003; Young, 2003), and can result in scores not truly representing academic achievement. Also, the diversity in grading systems across various institutions (e.g., percentage grading system vs. GPA) further complicates the interpretation of results (Didier, Kreiter, Buri, & Solow, 2006).

At the individual level, using university grades as the only indicator of AP has multiple disadvantages. One disadvantage lies in the high stakes status of GPA and entry exams for the academic and work opportunities of students where pressures to pass can negatively impact their performance on these exams (Karatas, Alci, & Aydin, 2013). In addition to the stress and pressure students might feel as they are determining their future, there are environmental and internal factors that can affect performance on exams that may exist occasionally or at one point in time only, such

as, time of the exam (Burns, 2004), mood (Febrilia & Warokka, 2011), and sleep quality (Gilbert & Weaver, 2010).

In tertiary and pre-tertiary education, there is very often a major interest in preparing students for particular assessments that determine promotion (e.g., SAT exams in the US, UMAT exam for medical education in Australia and New Zealand). The focus on teaching to test, therefore, greatly limits the quality of learning experiences because the primary educational focus is almost exclusively on covering the material for the specific test (Atkinson & Geiser, 2009).

Some researchers argue that standards-based assessment, which measure skills (or competences) using particular outcomes is more informative than the GPA scores, which might simply evaluate students' recollection of what is covered in a given course or curriculum (Nicholson, 2014; Stiggins, 2005). Also, outcomes of standards-based assessments, which are framed within normative standards, are more comparable across different courses and departments than GPA scores (Tam, 2014). Additionally, it is contended that standards-based assessment promotes a sense of justice among students (Tognolini & Stanley, 2007; Wilkinson, Wells, & Bushnell, 2007); given that standards are grounded in task mastery as opposed to social norms, every student who attains these competences receives good evaluations, which is not necessarily the case for university GPA.

Still, many of the abovementioned criticisms of GPA can be applied to this type of assessment, such as the influence of students' anxiety due to pressures on exam performance, and the tendency to direct great educational efforts to help students perform well on such tests. Both GPA and standard-based tests are summative assessments. Much less effort has been put into the investigation of cognitive and non-cognitive factors involved in students' individual performance on formative assessment.

Overlooking Key Components of Learning

One way we can classify the assessment of academic performance is into summative assessment (primarily focused on "summing" up what a student has learned over the course of the curriculum) and formative assessment (primarily focused on understanding and informing the process of learning; Berry & Adamson, 2011).

Overemphasis on university GPA, entry scores and standard-based assessment can promote surface approaches to learning, or learning to mainly pass exams. When the bulk of the assessment is summative, students tend to work towards obtaining good grades, so they tend to utilize surface approaches to learning (e.g., memorization and other strategies for recitation or reproduction of knowledge) and are likely to be driven by extrinsic motivation (Marton & Säljö, 1976). In this context, grades become a very limited measure of learning that focuses on the final outcome of a complex process. Thus, the non-cognitive factors influencing grades might not be the same as those influencing different aspects of the learning process.

When the assessment is formative, namely when it aims at monitoring the learning process to be able to modify the teaching and learning experiences to promote academic success, the non-cognitive factors contributing to performance can be very different, and can be used to better understand learners' approaches to learning effectively.

Watkins, Carnell, and Lodge (2007) identified four dimensions of effective learning. The first dimension is *active learning,* which refers to a cycle of Do-Review-Learn-Apply developed by Dennison and Kirk (1990). Learners first produce work that is then reviewed with feedback on how to improve it, then they are given the opportunity to incorporate this feedback as part of their work. The second dimension is *collaborative learning* where learners produce individual or group work that can only be done with the continuous input of peers. In the third dimension, learners make choices about their learning, this is otherwise referred to as *autonomous learning*. They have a say in what they learn, how they learn it and how they think would best assess their learning. Cconsequently, motivation to learn transforms from extrinsic (i.e. grades) to intrinsic (i.e. curiosity, will to improve and discover). The fourth dimension, *meta-learning*, requires that learners monitor and review how they learn. They first reflect on what helped them learn best and the barriers that made learning difficult. Second, they think of things they can do to address the barriers and, then, take action.

However, to our knowledge, the literature relating non-cognitive factors as predictors of effective learning is scarce. Some studies have identified a link between active learning strategies and AP. For instance, Fayombo (2013) found that active learning strategies (e.g., class discussion, video clips, role-playing, five-minute reflective papers, and clarification pauses) explained 22% of the variance in AP. Other studies have illustrated the role that collaborative learning plays in academic engagement and motivation through processes such as peer support and acceptance (e.g., Wentzel & Watkins, 2002). Still, approaches to effective learning and their relationships to various non-cognitive variables (e.g., personality traits, academic motivation, and self-efficacy) remain largely unexplored. Findings on how personality and emotion-related traits influence approaches to using feedback, collaborating with other and learning about one's learning could inform teachers' approaches in supporting learners to better regulate particular traits that could be hindering their learning. The following section presents some potential future directions to be undertaken by researchers.

Future directions. Future studies could focus on the impact of extraversion and the social components of trait EI on collaborative learning. In addition, the ability of making choices while learning (i.e., autonomous learning) could be related to openness to experience and intrinsic motivation. Approaches to meta-learning might be influenced by degrees of conscientiousness. In addition, the effective learning components themselves could have an impact on some non-cognitive factors. For

example, receiving continuous feedback as part of active learning could promote self-efficacy among students.

Educational Implications

In academic settings, the assessment and understanding of individual differences in noncognitive variables is essential for the planning and implementation of emotional education initiatives (Vandervoort, 2006). Education professionals and academic and career counseling practitioners, and most importantly, students, could use the findings on personality and emotion-related factors of AP to cater for students' needs and assist them with decisions and planning, as well as dealing with problems of academic engagement and satisfaction.

As for *personality*, this chapter has reviewed some literature indicating that, for example, extraverts are more likely to underperform because of the time spent socializing. In addition, neuroticism can be associated with test anxiety, which might hinder the AP. Moreover, a possible explanation to the findings on openness is that students who score high on this trait might be more intellectually curious and seek to learn new information. Furthermore, as mentioned above, those personality traits might relate to AP differently across academic disciplines. These findings can be informative for teachers when deciding on the teaching and learning strategies that are more efficient for particular students and how to enhance their motivation in the classroom.

In the case of *academic motivation*, as reviewed earlier, according to the SDT theory, intrinsic motivation can be achieved by the satisfaction of basic needs for autonomy and competence. Education professionals have an important role in promoting self-determination by using autonomy-supportive approaches when introducing learning tasks and by fostering pleasure and satisfaction at university. However, much often, educators may minimize the role of intrinsic motivation by introducing external conditions (e.g., grades, and reinforcement) to achievement and learning, which may in turn outweigh the role of extrinsic motivation, and decrease enthusiasm and genuine interest in the process of learning.

Several intervention programs have aimed to increase students motivation through various methodologies. In fact, a meta-analysis on academic motivation enhancement interventions showed the effectiveness of such interventions (Wagner & Szamoskozi, 2012). One of the successful interventions on teachers adopted a multidisciplinary approach to enhance student's motivation and interest (Bartimote-Aufflick, Walker, Smith, Sharma, Collier, & George, 2009). Another program, *Possible Selves Program*, focused on the improvement of personal and academic motivation from elementary school through post-secondary education. By focusing on ideas on what one might become in the future, this program was effective in increasing athlete university students' motivation, performance, and retention (Hock, Deshler, & Schumaker, 2006).

As opposed to the trait approach to personality, which views personality as relatively stable and fixed across the life-span, the social-cognitive theory suggests that self-efficacy is subject to enhancement and personal development through various strategies, including repeated experiences of success, receiving encouragement from others, seeing efficacious behaviour from others, and having a healthy physical state (Bandura, 1997). In fact, an experimental study investigating the effectiveness of an individual cognitive-behavioral intervention (Bresó, Schaufeli, & Salanova, 2011) found that academic self-efficacy, as well as AP and engagement increased after the intervention. This suggests that self-efficacy can be modified to benefit educational outcomes both directly, or through its effect on other variables.

While it is widely accepted that academic motivation and self-efficacy can be enhanced among students through educational programs and interventions, the training of *trait EI* for educational purposes is somehow more controversial due to the enduring and stable nature of personality traits. However, great progress has been made regarding emotional education in general (Vandervoort, 2006), and the development of particular trait EI aspects through treatment. An intervention study reported an increase in trait EI and certain EI-related constructs, namely emotion identification and emotion management compared to a control group, who did not receive the training (e.g., Nelis, Quoidbach, Mikolajczak, & Hansenne, 2009). A similar intervention program focused on emotional competence not only showed significant increase in emotion-related aspects (e.g., identifying, understanding, expressing and managing emotions), but also showed a subsequent increase in life satisfaction, well-being, physical and mental health, global social function, and employability, as well as a decrease on neuroticism level among individuals who received the training.

It is noteworthy that extremely high trait EI can also contribute to maladaptive behaviors (see Petrides et al., under review), which should be taken into consideration by educators, who can use the trait EI approach to develop high quality relationships with students, and using previous knowledge to be able to distinctions genuine students' emotions for non-genuine ones that can also contribute to the student-teacher dynamics; thus, increasing students' performance (Roy, 2015).

In sum, educators can benefit from the growing understanding of the dynamic relationships, direct and indirect, between non-cognitive factors and AP, by developing interventions and designing curricula that empowers students as learners and enhances their intrinsic motivation, academic and emotional self-efficacy in a myriad of domains and ensure their optimal academic success. In addition, educational and career counsellors may find it useful to assess and account for the role of noncognitive factors such as academic and emotional self-efficacy when advising students on academic matters. It is important not to misuse findings on non-academic predictors of AP. The aim should not be to encourage learners to avoid certain approaches that they might find difficult or conflicting with their personal characteristics and overfocus on those that they find congruent with their traits.

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5. CONSIDERING NON-COGNITIVE FACTORS IN THE PREPARATION AND SELECTION OF EDUCATORS

INTRODUCTION

The effect of non-cognitive factors on the educational process is bi-directional. Its value redounds to both the student and the teacher. One must respect the effectiveness of a teacher who, no matter the obstacle(s) or how long it takes to overcome it, exercises the skill and conviction to successfully instruct the assigned students. Ideally, we seek to develop students who demonstrate the same positive, non-cognitive traits in their work habits in school and in their daily lives.

In the past two decades, a number of researchers (Bandura, 1997; Bobek, 2002; Woolfolk Hoy & Burke Spero, 2005) have turned their attention to the overarching concept of self-efficacy. In its exercise, self-efficacy is both a basis for self-confidence and, a source to enable the individual to simultaneously draw increased self-efficacy for subsequent experience. In other words, self-efficacy has a tonic effect. In our judgment one cannot seriously address non-cognitive factors without recognizing the pervasive influence of self-efficacy. Therefore, we will include intermittent treatment of self-efficacy, unapologetically.

This chapter addresses the value of non-cognitive variables in the instruction of students and, as a contributor to the development of the skills repertoire of teachers. We have also provided a rationale for considering non-cognitive factors and their cognitive counterparts in the process of selecting and hiring teacher candidates. Using the examples of three research-based, measurable, non-cognitive skills we have illustrated the role of non-cognitive factors in the teaching-learning process. Finally, we have discussed the values that we perceived from blending the cognitive with the non-cognitive in education, generally, and, in particular, as they impact upon teacher preparation and selection. We have also offered several recommendations for implementing the conclusions that we have reached in the chapter.

In the process of conducting this review, we have been struck by the many instances of interrelationships among the non-cognitive factors we have encountered. We have determined that self-efficacy or self-confidence is an overarching factor of personal belief in one's instructional capability. It seems to represent the highest

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level of assuredness that a teacher possesses the skill level to ensure students will learn with proper tutelage. We see a high degree of overlap in practice among the non-cognitive factors of grit, resilience, and persistence. Grit is distinguished by its focus on long term goals through hard work no matter what the obstacles. Its companion, resilience, enables the individual to adjust during particularly adverse conditions (Bobek, 2002). Persistence, often referred to as perseverance, is that characteristic by which one sustains effort, when others would be likely to terminate it. As Estephanie Cayetano, a high school student with a high level of grit, is quoted in Pappano (2013), persistence is "continuing in the face of adversity" (p. 8). Therefore, we must caution that there is a need for a greater degree of parsimony in the conceptualization of non-cognitive factors. This would seem to be an important objective for empirical study of these factors. With that caveat in mind we present our current review.

Rationale for Non-Cognitive Traits

The remarkable influence teachers have on both the lives and learning of children is widely recognized. While other factors may also contribute to student performance, research has established the importance of the relationship between a child's teacher and academic achievement (Hanushek, Kain, & Rivkin, 1998). In an age of increased accountability for all, the concept of teacher effectiveness has become even more significant and, the need to maximize factors that enhance teacher and student success is critical.

Today's novice teachers confront more challenges in the early years of their careers than ever before. These challenges have had an appreciable impact on the attrition of teachers. During the 2008–2009 school year, an analysis of public school teacher attrition rates completed by the National Center of Education Statistics found that 77.3 percent of new teachers remained in their base-year school, 13.7 percent relocated to another school, and 9.1 percent left the field (Cox, Parmer, Tourkin, Warner, & Lyter, 2007). Similarly, Ingersoll (2003) found that "new teachers are most at risk of leaving the teaching profession" as "14 percent of new teachers leave by the end of their first year; 33 percent leave within three years; and almost 50 percent leave in five years" (Ingersoll, 2003). A recent article in the Washington Post (4/30/2015) belies Ingersoll's estimated figures and demonstrates that they may have been flawed. Using data from the National Center for Education Statistics (NCES) reporting on public school teachers who were new in 2007–2008, the Washington Post article reported that only 17% were not teaching five years later. This figure was reported to be "a far lower level of attrition than previously estimated" (p. 1). It must be noted, however, that Ingersoll was reporting on public and private school teachers while NCES was calculating based upon public school teachers alone. Ingersoll also counted the full five years from 2007–2008 through 2011–2012, but NCES counted only four of those years. Nevertheless, even Ingersoll admits that his estimates appear to be inconsistent with the actual count (Brown, 2015).

Why do novice teachers leave the field? There are, of course, many reasons and no one single answer is valid for every teacher. Some consider teaching as a transition to other jobs in the field or a different career (Recruitment and Retention Project, 2002). Teachers develop in phases similar to the way that learners develop in stages. In general, when new teachers enter the field many undergo *classroom or reality shock.* To best understand a new teacher's novice experiences, it is essential to grasp what has been called the *roller coaster effect*, a metaphor for a range of experiences filled with emotional highs and lows that typify the early years (McIntosh, Steele, & Wolfe, 2006). Moir (1990) defined six specific stages that most new teachers pass through during their novice years: anticipation, survival, disillusionment, rejuvenation, reflection, and then back to anticipation. Teachers experience different challenges and emotions during each phase, which contracts or expands the duration of each stage.

Teacher attrition proceeds in a U-shaped pattern whereby new teachers and older teachers exit teaching at the highest rates (Guarino et al., 2006). It appears that, at least some of their departure or retention, especially in the case of novice and pre-service teachers, may be related to their interpretation of the balance between cognitive and non-cognitive factors in teaching. It may also be the case that this imbalanced interpretation survives to become a factor in the high attrition rate among veteran teachers. In order to direct our examination of non-cognitive factors we have compiled a focused review of the available literature guided by the following questions:

1. What is the nature of cognitive vs. non-cognitive factors in teaching and learning?[1]
2. What examples of non-cognitive factors (grit, persistence, and resilience) as evident in schools, should be elaborated?
3. What effect(s) should the research findings on non-cognitive factors have on teacher preparation and professional development?
4. How should non-cognitive factors be incorporated into the selection and retention of teachers?

COGNITIVE AND NON-COGNITIVE FACTORS

Typically, teacher preparation programs are focused on developing an understanding of the functions of educators on a cognitive level. Indeed, there are school districts where applicants are screened out on the basis of Grade Point Average (GPA). In the State of New Jersey, for example, candidates who do not maintain a B average as undergraduates must exit the teacher preparation program. While there has been some recent recognition of the importance of teachers' personality or character traits (French, Immekus, & Oakes, 2005; Pappano, 2013), "…there has been limited progress linking teacher effectiveness and retention with objectively measurable traits at time of hire" (Robertson-Kraft & Duckworth, 2014, p. 22). That is to say, we have produced little research connecting student learning or teachers' retention with non-cognitive traits.

Duckworth, Quinn and Seligman (2009) urge that schools in the process of selecting teachers weigh traits such as grit, life satisfaction, and optimism to the same degree as traditional indicators of performance (e.g., certification or GPA). According to the research of Duckworth and Seligman (2005), "grit—the ability to set goals and persist in working toward them—is a better predictor of academic success than I.Q." (p. 62). It would certainly be useful to gain "a better understanding of the factors that have enabled the majority of teachers to sustain their motivation, commitment and, therefore, effectiveness in the profession" (Day, 2008, p. 256). In the process, we seek to learn which non-cognitive traits positively enhance teachers' effect on student learning and exert a positive influence on teacher and/or student retention. To that end, we begin our exploration of the first question: *What is the nature of cognitive vs. non-cognitive factors in teaching and learning?* Initially, we will distinguish the nature of cognitive and non-cognitive factors:

> Non-cognitive skills have been broadly defined as those "patterns of thought, feelings and behavior" (Borghans et al., 2008) of individuals that may continue to develop throughout their lives (Bloom, 1964). These skills encompass traits not directly represented by cognitive skills or by formal conceptual understanding. Instead they are socio-emotional or behavioral characteristics that are not fixed traits of the personality, and that are linked to the educational process, (Garcia, 2014 – Introduction and executive summary ▪ 1).

Hopefully, we will provide the reader with "a better understanding of the factors that have enabled the majority of teachers to sustain their motivation, commitment and, therefore, effectiveness in the profession" (Day, 2008, p. 256). We will refer to character traits, personality features, and other measurable non-cognitive influences on cognitive attainment.

It is important to realize the interrelated reality between cognitive and non-cognitive factors. According to Garcia (2014), "… non-cognitive skills support cognitive development; non-cognitive and cognitive skills are interdependent and cannot be isolated from one another" (Introduction and executive summary ▪ 3). As we separate the two sets of factors for purposes of discussion, we must also appreciate the practical interdependency that defines them. It is critical that we develop an improved understanding of the interconnections between cognitive and non-cognitive skills. This is a much neglected area of research. Garcia (2014) goes on to say, "we may fail to boost cognitive skills unless we pay closer attention to non-cognitive skills" (Introduction and executive summary ▪ 5). Research provides the following evidence in support of these relationships:

> According to the empirical estimates (with controls for individual- and school-level covariates), an increase of one standard deviation in cognitive skills would increase non-cognitive performance by 0.084 standard deviations in kindergarten, by over 0.223 standard deviations in third grade, and 0.185 standard deviations in eighth grade. (Garcia, 2014, The importance of simultaneous effects. Para.1, footnote 33).

The above evidence conflicts with the current overemphasis on cognitive skills, which has not only displaced schools' support of non-cognitive development, but may also prove counterproductive for improving cognitive skills. Disciplinary measures, for example, would be best focused on developing non-cognitive skills in lieu of sanctioning undesirable behavior. Teaching students to exercise more grit in their pursuit of significant long-term goals is preferable to punishing their inattention. All motivation is goal-oriented. Goals motivate people to act in a manner which reduces the difference between desired behavior and current behavior (Hoy & Hoy, 2009). The greater an individual's determination to reach a goal(s) (grit), despite the hardship in doing so, the more successful they tend to be in mustering the required cognitive skill (Duckworth, Quinn, & Seligman, 2009).

It is just as important to know that a student or teacher candidate is resourceful, as it is to realize that he/she has the necessary degree of content knowledge or intellectual ability. The likelihood of failure in many of life's endeavors is definitive. Some (Tough, 2010; Hoerr, 2013) would suggest that failure is an integral and useful component of the learning spectrum. Or, as Winston Churchill put it, "Success is going from failure to failure with enthusiasm" (Hoerr, 2013). Therefore, it is highly desirable that an individual possess the resources to rebound from those certain discouraging experiences and turn them into increments of success. It is critical that anyone who engages in the learning process *persist* in spite of the likely setbacks one will most assuredly encounter; demonstrate the *resilience* to recover from periodic failure; and, realize that we possess the *grit* to maintain our goal-centered focus in spite of unavoidable obstacles.

NON-COGNITIVE SKILLS

What do we mean by non-cognitive skills? We refer, for example, to traits like *self-discipline* which by several measures outdoes IQ as a predictor of the academic performance of adolescents. Harms (2004) refers to the observations of Heckman who advises, "Numerous instances can be cited of people with high I.Q.s who failed to achieve success in life because they lacked self-discipline, and of people with low I.Q.s who succeeded by virtue of persistence, reliability and self-discipline" (p. 1). Researchers at the London School of Economics have discovered that measures of self-discipline taken in the fall of an academic year account for twice the variance of IQ in explaining final grades (Carneiro, Crawford, & Goodman, 2007). Binet and Simon (1916) noted that performance in school "admits other things than intelligence; to succeed in his or her studies, one must have qualities which depend on attention, will and character" (p. 254). Research conducted by Robertson-Kraft and Duckworth (2014) demonstrated that SATs and college GPA failed to predict either retention or effectiveness among teachers. Additionally Heckman (in Harms, 2004) advises that by focusing on cognitive skills …, they (educators) exclude the critical importance of social skills, self-discipline and a variety of non-cognitive skills that are known to determine success in life (p. 3).

In this chapter we have assigned careful analysis to three particular non-cognitive factors: grit, persistence, and resilience, in order to determine their relationship to teacher effectiveness. We have chosen to explore these particular non-cognitive influences because of the accumulated evidence (Perkins-Gough, 2013; Henderson, 2013; Pinquart, 2009) regarding their bearing on effective teaching and learning. Special consideration was given to the part that these traits might play in the selection and hiring of educators at various levels of responsibility. Other studies have indicated that non-cognitive factors such as resilience (Henderson, 2013), persistence (Duckworth & Seligman, 2005), and grit (Robertson-Kraft & Duckworth, 2014) exerted a positive influence on retention and effectiveness.

We shall elaborate on the non-cognitive factors most apparent in the literature. Guided by our second question we provide a thorough review of this group of three non-cognitive entities. We asked: *What examples of non-cognitive factors (grit, persistence, and resilience) as evident in schools should be elaborated?*

NON-COGNITIVE FACTORS

Grit – Overview and Definition

Angela Duckworth set the bar on grit research and established the concept of grit as it has come to be accepted today in the fields of psychology and education (Duckworth et al., 2007; Duckworth et al., 2009; Robertson-Kraft & Duckworth, 2014). According to Duckworth et al. (2007):

> Grit entails working strenuously toward challenges, maintaining effort and interest over years despite failure, adversity, and plateaus in progress. The gritty individual approaches achievement as a marathon; his or her advantage is stamina. Whereas disappointment or boredom signals to others that it is time to change trajectory and cut losses, the gritty individual stays the course (pp. 1087–1088).

Gritty individuals stick with what they start for the long term, even when difficulties abound. They are able to work towards goals that are not immediately evident. Duckworth and her colleagues have studied grit across a variety of settings from a variety of perspectives, examining the grit of students, teachers, and West Point Cadets. In the process they have developed instruments for evaluating grit (Duckworth et al., 2007; Duckworth et al., 2009; Robertson-Kraft & Duckworth, 2014).

Grit and West Point Cadets

Duckworth et al. (2007) used their 12 item adult and adolescent grit scale in a series of studies. The fourth study examined the grit of 1,218 new cadets at West Point Military Academy in 2004. The cadets completed both a grit scale and a self-control

scale on a volunteer basis a few days after arriving for training. Grit was found to be related to self-control and to be the best predictor of cadets completing the first summer at West Point. In fact, those cadets whose grit score was one standard deviation or higher than average were 60% more likely to finish the grueling summer training.

These findings support Galton's (1892) contention that there is a qualitative difference between minor and major accomplishments. Earning good grades during the academic year at West Point requires regulating effort from moment to moment, primarily by resisting "hourly temptations" to procrastinate, daydream, or indulge in unproductive diversions. Self-control may be constantly taxed, but the workload is manageable and there is little temptation to give up altogether. Staying at West Point through the first summer training (sometimes referred to as Beast Barracks), in contrast, calls upon a different sort of fortitude (Duckworth et al., 2007, p. 1096).

The *fortitude* needed to survive the "Beast Barracks" is similar to the type of perseverance required of new teachers during the grueling first year in the field as they cycle through the phases of novice teaching (Moir, 1990).

Grit and teacher effectiveness. Duckworth et al. (2009) explored the relationship between three identified positive traits, grit, life satisfaction, and optimism, and the performance of first and second year teachers in the Teach for America (TFA) program. Duckworth et al. (2009) believed the design of the program made it an ideal environment for evaluating the impact of positive-traits on teaching because the assignment approach lessens the possibility that higher quality teachers choose and are chosen by better performing schools.

Data regarding teacher effectiveness rankings, demographics, and type of teaching assignment (elementary, secondary, or special education) were obtained from TFA a year later. A rubric was utilized to more systematically compare teachers and approximate the grade level growth of students (Duckworth et al., 2009). Duckworth et al. (2009) found that second year teachers were not as satisfied with their lives as first year teachers, which they believed supported the idea that teaching in poorer school communities is more challenging. They also found that elementary and special education teachers had a "greater impact on their students than did secondary school teachers" and second year teachers performed better than first year teachers (p. 543). Grit, life satisfaction, and optimism all positively impacted the performance of teachers:

- Teachers one standard deviation higher in grit were 31% more likely to outperform their less gritty peers.
- Teachers who were one standard deviation higher in life satisfaction were 43% more likely to outperform their peers.
- Finally, teachers one standard deviation higher in optimistic explanatory style were 20% more likely to outperform their peers (p. 543).

When the impact of each trait was separately assessed, only grit and life satisfaction were found to be strong predictors of teacher performance. Optimism was insignificant (Duckworth et al., 2009).

Grit and hiring teachers. The results of Duckworth et al. (2009) support the value of considering the grit of new teachers when making hiring decisions. Why? The novice teachers with more grit were more effective teachers compared to their fellow less gritty first and second year peers. Ultimately the purpose of hiring is to locate the most effective educators. The impact of grit was compared to more traditional factors, such as college GPA and SAT scores. In contrast to many of Duckworth's prior studies in which self-reporting grit scales were employed, Robertson-Kraft and Duckworth (2014) chose to use biographical data obtained from teachers' résumés to determine grit. "Because biodata is limited to verifiable objective events, it is less easily faked than self-report personality questionnaires" (Mael, 1991 as cited in Robertson-Kraft & Duckworth 2014, p. 11).

Robertson-Kraft and Duckworth (2014) found a strong relationship between SAT scores and college GPA, but neither was highly correlated to grit. They also could not connect grit to demographics or school assignment, but a moderate connection between grit and leadership was found. Teachers who taught for the entire school year had higher grit scores than those teachers who left midyear. These two groups of teachers did not differ substantially in any other way, such as demographic characteristics, school assignment, SAT score, college GPA, or leadership ratings. Specifically they found:

- When controlling for leadership, teachers who were one standard deviation higher in grit were more than twice as likely to be retained over the course of the year as their less gritty peers…Leadership ratings in this model were not predictive of retention.
- When controlling for leadership, teachers who were one standard deviation higher in grit were 60% more likely to outperform their less gritty peers…Leadership ratings in this model were not predictive of effectiveness (p. 17).

In their second study, Robertson-Kraft and Duckworth (2014) repeated the same design with a different sample of teachers selected byTFA. "…the teachers randomly sampled for Study 2 were, as a group, much more successful" (pp. 19–20), as 99% of the teachers finished out the school year in study two compared with 82% of the teachers in study one. Since most teachers completed the school year in the second study, Robertson-Kraft and Duckworth (2014) focused their attention on teacher effectiveness and found that effective teachers had more grit and no other predictor analyzed in the study was a better indicator of teacher effectiveness.

Controlling for leadership and assignment to a middle school, teachers who were one standard deviation higher in grit were 64% more likely to outperform their less gritty peers, OR = 1.64, $p < .01$. Neither leadership nor assignment to a middle school predicted teacher effectiveness in this model (p. 21).

RESILIENCE

A popular term to describe the cumulative decrease in commitment to the responsibilities of the profession is "burnout" (Gu & Day, 2007; Beltman, Mansfield, & Price, 2011). It is used to characterize teachers whose dedication has been eroded by the stresses of the education process. Gu and Day (2007) suggest that when teacher role models do not project a resilient persona, it is unlikely that their students will derive a set of resilient qualities. They define resilience as "the capacity to continue to 'bounce back', to recover strength or spirit quickly and efficiently in the face of adversity" (p. 1302). Fives et al. (2007) explored the relationship between prospective teachers' burnout and efficacy beliefs. They found that "as the self-efficacy beliefs of prospective teachers increased, their burnout decreased" (Shaukut & Iqbal, 2013, p. 38).

Grotberg (1997) defines resilience as the ability "to face, overcome, and even be strengthened by experiences of adversity" (in Tait, 2008, p. 58). Tait (2008) advances the hypothesis that "Novice teacher resilience, bolstered by personal efficacy and emotional competence, may be key to helping beginning teachers become more capable, more confident, and more committed to teaching over the long term" (p. 58). Thus, it becomes relevant to assess and develop resilience among preservice and in-service teachers.

As indicated at the outset of this section an overarching component of resilience is self-efficacy, which was considered by Rutter (1990) to be one of the "most robust predictors of resilience". Gibson and Dembo (1984) are also cited in Gu and Day (2007) as believing that "teachers' efficacy beliefs influence their persistence and resilience when things do not progress smoothly" (p. 1311). Self-efficacy consists in the subjects' belief that they possess the capacity to overcome any obstacle that may intervene between them and goal attainment. Bandura sees self-efficacy as a powerful trait and observes of its implementation: "Those who doubt their capabilities *slacken* their efforts … Those who have a strong belief in their capabilities *redouble* their effort to master the challenges" (Bandura, 2000, p. 120). Furthermore, he makes note that "resiliency of self-belief" is what really counts (Bandura, 1989, p. 1176). One is best served by a redundancy of confidence that manifests itself within teacher and student by the effort to overcome each intervening instance of adversity as one learns.

Grit and Resilience

The concepts of grit and resilience overlap. Gu and Day (2007) describe resilience as a "multi-dimensional, socially constructed concept" that from the psychological perspective "helps clarify the internal factors and personal characteristics of trait-resilient people" (p. 1305). Everyone has the capacity to be resilient, but certain personal or life circumstances have influence on resiliency. Resiliency is a constantly changing construct, which relates to how individuals react to their

environments. It is this reaction and adaptation to one's environment that connects resiliency and grit. According to Angela Duckworth in an interview with *Resilience and Learning*:

> Grit is related to resilience because part of what it means to be gritty is to be resilient in the face of failure or adversity. But that's not the only trait you need to be gritty… So grit is not just having resilience in the face of failure, but also having deep commitments that you remain loyal to over many years (Perkins-Gough, 2013, pp. 14–16).

Thus, part of the questions on the scales used to assess grit, developed by Duckworth and her colleagues, is related to resiliency in that they address difficult scenarios of failure or diligence. The purpose of the other half of the questions is to assess the focus of the individuals on long term goals and interests, ideas that zero in much more on grit than resiliency (Perkins-Gough, 2013).

There are other scales developed specifically to measure resilience within people of various ages. The most recent and short version of a widely used Resilience scale is Wagnild and Young's (2009) 14 item scale (Hoy, 2012). It is a 7 point Likert Scale rated from strongly agree to strongly disagree. Some sample items include: "I usually manage one way or another", "I usually take things in stride", and, "I am determined". The Resilience Scale has been deemed reliable by empirical research (Abiola & Owoidoho, 2011).

In her seminal book, Mindset, Carol Dweck (2006) cites four attributes shared by resilient people: social competence, autonomy, problem-solving, and sense of purpose and future. These attributes have their basis in the personal and socio-cultural areas. The individual who demonstrates a high level of skill in these four areas possesses the resilience to "bounce back" from adverse circumstances.

PERSISTENCE

To persist in an effort to learn is to remain on task despite social, psychological or physical distractions. Everyone encounters their own set of demons that would tempt or directly assault them by providing an attractive alternative(s) to the task at hand. One needs to find an antidote to persist against time, difficulty of the task, boredom, or discomfort (Grant, 2006). Persistence is often enhanced by the individual's degree of self-efficacy. The teacher who feels as though she lacks the efficaciousness necessary for the position will be unlikely to persist when the going gets tough (Tschannen-Moran, Hoy, & Hoy, 1998). These teachers have a strong belief in themselves. They also believe strongly in their students. If they did not have this dual sense of confidence, they would not be able to exercise a high level of energy on behalf of their students.

Observers of gifted and talented students will confide that these subjects exhibit high levels of persistence with a topic or project. In the process they often endure

failure incidents in numbers that would try the patience of many of us. In fact, studies of gifted children have found perseverance to be a stronger predictor than intelligence (Terman, 1947; Winner, 1997). In describing the research of Heckman, distinguished service professor of economics at the University of Chicago, Harms (2004) reports: "Numerous incidents can be cited of people with high IQs who failed to achieve success in life because they lacked self-discipline, and of people with low IQs who succeeded by virtue of persistence, reliability, and self-discipline" (p. 1). Again, we find a key to success being derived from the harmonious blending of the cognitive with the non-cognitive aspects of human nature.

Sources of Persistence

How is it that these traits supersede high levels of cognitive ability as key factors in achievement among the most capable students? Snyder (1991) found that hope, for example, was a better predictor of the first semester grades of college students than their SAT grades, which were designed to predict freshman success. Hope was defined in this study as "believing you have both the will and the way to accomplish your goals" (p. 579). Hopeful people are able to remain optimistic when they experience failure. They see the possibilities of changing their approach rather than feeling that the present performance level is the best they can expect.

Carol Dweck (2006) conceives of two mindsets—a "fixed" and a "growth" mindset. The "fixed" mindset persons hold to the belief that one has a certain level of ability. They interpret failure as a sign that they have reached the limit of their capability. The "growth" mindset individual believes that mental ability can change if personal adjustments are pursued, circumstances change, or helpful assistance is gained.

Where do some teachers find the source of strength necessary to draw the persistence to inspire and instruct their students? Bandura (1997) identifies four sources of efficacy: mastery experiences, physiological and emotional states, vicarious experiences, and social persuasion. Mastery experiences, the most powerful source of efficacy, are derived from personal experiences of success, whereas failure experiences tend to reduce efficacy. These outcomes become a source of diminution or gain of future efficacy. The degree of enthusiasm or anxiety related to a task affects either the teacher's level of mastery or feelings of ineptness.

Having a mentor that one believes is competent to model effective teaching is the source of vicarious experiences. A high-performing mentor guides the teacher to self-efficacy. When the model fails, the "efficacy expectations" of the teacher are lessened. Finally, social persuasion derives from the positive feedback of trusted individuals, and knowledgeable stakeholders in the educational environment (Bandura, 1997; Milner & Hoy, 2002; Milner, 2002).

Thus social persuasion in terms of verbal feedback and specific help, encouragement, praise, and norms of persistence and achievement can help create a

supportive social environment, whereas lack of feedback, non-responsiveness from colleagues and students, criticism, and norms of neglect can create an unsupportive environment (p. 265).

According to Leslie W. Grant (2006), persistence is synonymous with perseverance, determination, commitment, and stick withitness (p. 50). Based on our review of literature, we view persistence as the most pervasive of the non-cognitive traits. While it is especially connected to self-efficacy, it also taps in to aspects of grit and resilience.

Persistence and self-efficacy are undeniably connected (French, Immekus, & Oakes 2005). The self-efficacy beliefs of teachers impact teacher persistence when difficulty arises. In fact, "teachers with a high sense of efficacy work harder and persist longer even when students are difficult to teach, in part because these teachers believe in themselves and their students" (Woolfolk, 2001, p. 389 in Milner, 2002). Milner (2002) conducted a qualitative study on the self-efficacy and persistence of Mrs. Albright (pseudonym), a veteran English teacher at a Midwestern suburban high school who encountered a *crisis experience*. A *crisis experience* is a significant event that has the potential to cause a teacher to question professional capabilities or persuade an individual to leave the field (Milner, 2002).

In part, it is the co-existence of sources of positive feedback that support self-efficacy within the context of crisis situations that allows teachers to persevere. In the words of Mrs. Albright:

> Some teachers get taken for granted, and even in my later years in the profession, confidence lifters are nice. We all need them, even our students. We have to build each other up sometimes. But we also need to hear the bad, you know? How else will we get better? And so both the good feedback and the bad are helpful, and it's [positive feedback] nice to hear…Both are very important to be a good teacher…So you see things are not always rosy. There are low points, but there are also very high ones. Teachers have to know this. (Milner, 2002, p. 32)

In summary, "Efficacy beliefs influence teachers' persistence when things do not go smoothly and their resilience in the face of setbacks" (Milner & Hoy, 2003, p. 264).

TEACHER PREPARATION AND PROFESSIONAL DEVELOPMENT

Teacher preparation in the United States has often been criticized for its lack of academic rigor (a.k.a. cognitive content). It has been alleged that this lack of challenge has been the source of a poorly prepared and ineffective teacher corps, which in turn produces an underachieving student population (Levine, 2006). These assumptions have resulted in the ratcheting up of academic requirements, which take shape as more rigorous standards for teachers and, higher norms for teacher education. Teacher education institutions have been accused for quite some time of

grade inflation and inconsistent curriculum content. National and State standards have been provided as remedies for that situation. Professional examinations have been instituted for content area and general education teacher certification requirements as measures of the standards and gateways to certification.

Grade Point Averages (GPAs) are gradually increasing to the point where the previous 3.0 GPA of graduate education has now become the expected norm for graduation from undergraduate teacher training. To ensure compliance many undergraduate institutions have made the 3.0 a requirement for program entry. Others have required the purported exit exam passing score a condition for entry into the teacher education program. Each of these initiatives is currently in place for school administrators also. Researchers need to more thoroughly examine the effects of these increased standards, if any, on student attainment and teacher effectiveness.

Based on their study of resilience strategies for new teachers in high needs areas, Castro et al. (2010) identified several optional strategies for pre-service training that might be employed by teacher educators. They include providing experiences in problem-solving techniques, consideration and interactions examining the school as workplace, and creating pre-service peer support groups for beginning teachers. The key ingredient to enabling these practices to be effective is "teacher educators and school leaders must provide an atmosphere that allows novice teachers to feel safe when they seek advice, guidance, and support" (p. 629). These strategies were derived from extensive interviews which the subjects (new teachers in high needs communities) found to be useful in building support and resources for their teaching (Castro et al., 2010). In this aspect of the review we focus our attention on the means of attaining these strategies, and others, as we respond to the third question: *What effect(s) should the research findings on non-cognitive factors have on teacher preparation and professional development?*

There is a paucity of guidance for instructing pre-service or in-service teachers in the delivery of instruction based in non-cognitive factors. However, there are isolated examples of development that hold promise for the future. Among these initiatives are several that we feel have the potential to prepare pre-service and in-service teachers to deliver instruction that is balanced between the cognitive and non-cognitive realms.

USOE Program Reviews

First, the U.S. Office of Education (2013) reviewed about 50 programs as potential models to promote grit, tenacity, and perseverance. From their analysis they identified five clusters of promising programs on the basis of target age level, learning environment, and which facets of the model are addressed (USOE, 2013). The programs and models include these types:

- School readiness programs that address executive functions
- Interventions that address mindsets, learning strategies, and resilience
- Alternative school models and school-level reform approaches

- Informal learning programs
- Digital learning environments, online resources, and tools for teachers

The USOE findings make them believe that non-cognitive strategies may be taught or transferred.

Penn Resiliency Program (PRP)

Second, a vigorous case was made on behalf of Seligman's (2015) Positive Education as reported in the University of Pennsylvania newsletter on Resilience Training for Educators. Herein, he decries the widespread incidence of depression as he calls for an increase in life satisfaction. He claims that depression has increased tenfold in the past fifty years and, its first onset has dropped from thirty years of age to fifteen. In that same fifty years Americans demonstrate no increase in life satisfaction (Seligman, 2015, p. 1).

In order to counteract this phenomenon, Seligman has established the Penn Resiliency Program (PRP) based on the premise that "skills that increase resilience, positive emotion, engagement and meaning can be taught to schoolchildren" (Seligman et al., 2009, n.p.). In fact, the PRP has been tested and found to effectively accomplish the following:

- Reduce and prevent symptoms of depression
- Reduce hopelessness significantly
- Reduce and prevents anxiety (Seligman, 2015, p. 2).

Students who can be relieved of anxiety and depression are much more capable of unimpeded learning and more creative thinking (Seligman, 2015).

Learning Strategies Models

Third, as an example of a model designed for non-cognitive learning, we present Exhibit 1 below. This model provides four broad areas of planning that will encourage the student to maintain attention to the specified task and related challenges.

Exhibit 1. A general model of learning strategies to support persistence in the face of challenge

Phase Name	*Examples of types of strategies and tactics*
1. Definition of Task	Construct full definition of the task.
	Consider what is known and unknown about it.
	Consider how difficult it will be and potential challenges.
2. Goals and Plans Set specific goal(s)	Set specific criteria for knowing when goal(s) are achieved.

	Formulate specific actionable plans to achieve goal(s).
	Formulate tactics for dealing with challenges.
3. Enactment and Monitoring	Structure the environment so that it is favorable for executing plans.
	Execute plans.
	Manage time.
	Seek new information.
	Organize information and resources.
	Seek assistance from other people.
	Monitor progress relative to criteria for meeting goal(s).
	Adjust course of actions as necessary.
4 Deliberation and Adaptation	Deliberate on effectiveness of plans and strategies.
	Reformulate task, goals, conditions, strategies, plans.

Source: Adapted from Winne, P. H., & Hadwin, A. F. (1998). Studying as self-regulated learning. In D. J. Hacker, J. Dunlosky & A. C. Graesser (Eds.), Metacognition in educational theory and practice (pp. 277–304). Mahwah, NJ: Lawrence Erlbaum Associates, Inc

Any given goal may call for a particular subset of these phases and strategies. For example, in solving a difficult math problem, the task and goals may be well defined already, but monitoring of progress and adjusting courses of action may be essential (Winne & Hadwin, 1998).

Public Profit Foundation Strategies

Fourth, another publication featuring learning strategies developed by a group in Silicon Valley, California provides a compendium of 16 options for preparation in non-cognitive strategies for youth. The publication presents skill-based strategies based on non-cognitive research. Each strategy is assessed on eight key characteristics: cost, evidence, population, training, duration, frequency, depth, and assessments (Public Profit Foundation, p. 1). A sample of one of the strategies (G.R.I.T. Initiative) is provided in Exhibit 2 below. Each strategy is accompanied by a set of related engaging activities.

Exhibit 2 – G.R.I.T Initiative

College Track strategy developed the Guts, Resilience, Integrity and Tenacity (G.R.I.T) Initiative to help articulate the youth outcomes that align with the mission of their program but were left out of academic assessments. The foundation of the G.R.I.T. Initiative is a rubric that details specific academic and leadership behaviors for each characteristic

at three different levels: (1) approaching expectations (2) meets expectations and; (3) exceeds expectations. For example, the Guts section of the rubric describes the academic and leadership behaviors for each level of expectation. College Track gave their sites flexibility in the way that the rubric is used to promote G.R.I.T. in youth.

College Track also developed a 4-week curriculum that is designed to give youth clear examples of the four focal characteristics. The curriculum provides youth an opportunity to discuss what the characteristic means, people in their lives who possess the characteristic, assess whether they have the characteristic, and how that characteristic can be helpful in their lives.

The G.R.I.T. curriculum can be used at minimal costs. Programs should plan to provide instructors for the curriculum, access to an Internet connection, a projector or computer to screen videos, and basic office supplies. College Track recommends programs dedicate a few hours to developing an implementation plan.

(Public Profit Foundation (2014). Strategies to promote non-cognitive skills: A guide for youth developers and educators. Silicon Valley, CA)

To become efficacious and maintain resilience, new teachers also need assertiveness training so they can advocate for themselves in their new positions, work effectively with administration, colleagues, and parents, and ask for the support and assistance they will need on the job (Tait, 2008, p. 71).

Non-Cognitive Factors and Teacher Education

Duckworth, Quinn, and Seligman (2009) found that grit and the life satisfaction of teachers were predictive of teacher's performance. However all three variables (grit, life satisfaction, and optimistic explanatory style) predicted students' academic performance. Higher satisfaction with their life situation enables teachers to be more engaging with pupils and the teachers' "zest and enthusiasm may spread to students" (p. 545). In tandem with GPA, SAT scores, and Praxis exams, variables such as grit, persistence, resilience and self-efficacy ought to be considered as criteria for admission to teacher education. Once enrolled, candidates should experience programs and pedagogy that prepare them to engage their future students in non-cognitive experiences.

Non-cognitive research suggests that teacher preparation is incomplete if the resources derived from these factors are not included. In fact, research conducted with male teachers indicates, "An increase in teachers' cognitive abilities tends to increase the achievement gap between high and low aptitude students, while an increase in non-cognitive ability tends to reduce it" (Gröngvist & Vlachos, 2010, p. 4). Clearly, there is a need to infuse non-cognitive factors in teacher preparation and professional development. The challenge is to determine how that shall be accomplished. There should be a respect for the interrelation of the cognitive with the non-cognitive as the nature of teacher education is re-examined.

According to Knight et al. (2015), "Teachers not only must have a deep knowledge of content and students' cognitive and non-cognitive learning but be able to recognize and mediate the two" (p. 2). Furthermore, Knight et al call for an increased "focus on tying classroom practice to student learning" in both pre-service and in-service professional development. The need to recognize and build instruction upon this relationship must also be viewed in the context of a new conception of learning in recent decades, as active construction drawn from prior learning and experiences (Knight et al., 2015). Consistent with that goal there should be an ongoing dialogue that connects the student intern experiences with the pre-service college classroom and increases awareness of cognitive and non-cognitive factors in teaching (Knight et al., p. 3).

In an article entitled: Can perseverance be taught?, Duckworth (August 5, 2013) avers that perseverance, grit, and resilience are the product of our DNA and our life experiences. If we are convinced that we will be well-served by sticking with a particular course of action, we will be inclined to do so. However, if we assure ourselves that this course of action is not worth the time and energy, we will decide against continuing. The social context in which we exercise these options with its assets and its liabilities has a significant influence on our decision-making process. Finally, Duckworth concludes, "our past experiences shape our predictions of the future, and these predictions drive present-day choices" (p. 2).

TEACHER SELECTION AND RETENTION

According to the American Institutes for Research (2015), we need to become "smarter" about selecting the approximately 1.5 million teachers who will be hired in the next decade. That will require careful consideration of the personal characteristics of the candidates as well as their academic abilities. While teacher candidates' academic background should be carefully assessed for their cognitive accomplishments, cognition alone would yield an insufficient set of selection criteria. Intellectual understanding, absent consideration of the character traits that complement cognition, ignores those research findings that make use of "the tools of science to peel back the mysteries of character" (Tough, 2012, book sleeve). We now turn our attention to the question of how non-cognitive factors should become part of the teacher selection process. Are there certain unmistakable characteristics that school leaders should seek in the selection of teaching candidates to ensure their effectiveness and retention?

An emerging body of research now suggests that it is perhaps the grittiest teachers who best survive and flourish during these important first years in the field (Duckworth et al., 2007; Duckworth, Quinn, & Seligman, 2009; Robertson-Kraft & Duckworth, 2014).The results of Duckworth et al. (2009) supports the value of considering the grit of new teachers when making hiring decisions. In their study, the novice teachers with more grit were more effective teachers compared to their fellow less gritty first and second year peers. Buoyed by these findings, we raised

our fourth and final question: *How should non-cognitive factors be incorporated into the selection and retention of teachers?*

Ultimately the purpose of hiring is to locate the most effective educators. If the research suggests that grittier teachers are more effective, how do we identify them during the hiring process? In contrast to many of Duckworth's prior studies in which self-reporting grit scales were employed, Robertson-Kraft and Duckworth (2014) chose to use biographical data obtained from teachers' résumés scored with their Biographical Data Grit Rubric to determine grit.

Vecchione (2015) responded to Robertson-Kraft and Duckworth's (2014) recommendation that a structured form be developed as a more streamlined way of collecting biographical data when measuring grit. In contrast to Robertson-Kraft and Duckworth's (2014) Biographical Data Grit Rubric, on the Short Response Grit Form adapted by Vecchione (2015) for her action research thesis, participants selected the six activities or work experiences that best reflected their résumé and achievements. The difference was that the participants lifted the data from their own résumés and simplified the process for the coders. The most significant finding was that résumés and structured forms, such as The Short Response Grit Form adapted by Vecchione (2015), when coded for biographical data using Robertson-Kraft and Duckworth's (2014) Biographical Data Grit Rubric, similarly measured grit.

Structured forms, like the Short Response Grit Form, have the potential to impact hiring practices in schools by providing administrators with practical tools to examine the extent of the grit of job applicant candidates. The protocol for determining grit by examining the biographical data in candidates' résumés is time consuming for administrators actively engaged in the hiring process. In contrast, the Short Response Grit Form requires the job applicant to provide the biographical data and record it within the fields of the form. This is quite different from the examination of grit in résumés, using just the Biographical Data Grit Rubric. Here the coder, the administrator looking to interview a potential candidate, must examine the résumé and lift the experiences prior to scoring. By streamlining the process of recording and coding biographical data by using structured forms, administrators involved in hiring can more easily employ this tool in an effort to broaden the array of information available about new teacher candidates and make more informed decisions. Structured forms lend themselves to be easily imbedded into today's 21st century teacher job applications. Online applicant software programs would be an ideal venue for this type of data collection. In addition, once coded, those involved in screening job applications would have another lens through which to sort applicants, which would be even simpler when coupled with these types of software programs.

Novice Teachers and Non-cognitive Factors

Our investigation revealed the importance of non-cognitive factors across the teaching continuum. As Bobek (2002) advised, "Preservice teachers must recognize

and develop the resources that will sustain them and increase their resilience as they enter the initial career stages of the profession" (p. 202). The resilient individual must be "capable of assessing adverse situations, recognizing options for coping, and arriving at appropriate resolutions" (Bobek, 2002, p. 202). Specifically, the necessary resources to develop the resilient teacher are: trusted mentoring relationships, subject matter competence, personal responsibility, goals and expectations, confidence, and a sense of humor (Bobek, 2002). This set of resources is a marriage of the cognitive and non-cognitive factors.

The concepts of mentorship and collaboration in the field of education are in no way a new invention (Milner, 2002). This research uncovered the value of the internal supports and feedback through the non-cognitive lens. The aforementioned veteran teacher Mrs. Albright surmounted her crisis situation in part because of the positive support and feedback she received from her colleagues, parents, and students (Milner, 2002). "As resources, the relationships that new teachers cultivate…provide networks of support that can ease the transition into teaching and help sustain teaching over time" (Bobek, 2002, p. 203).

What should these collaborative relationships look like? New teachers and administrators should establish a partnership and, a sense of support should be evident to the novice (Bobek, 2002). It is important for principals to create job embedded scenarios in which teachers "receive positive, constructive feedback from their colleagues" (Milner, 2002, p. 34).

Quite often, teachers' work is evaluated to make them stronger without pointing out their strengths. Teachers may feel inept without the same form of positive reinforcement. Only hearing weak areas could result in a crisis point that causes a teacher to leave (Milner, 2002, p. 34).

This positive reinforcement from peers could take several forms. Novice teachers benefit from observing veteran teachers practicing their craft and navigating new instructional approaches or managing challenging student behaviors (Grant, 2006).

In addition, teacher self-efficacy and resilience are enhanced when educators are confident in their craft (Bobek, 2002; Grant, 2006). Teachers are most resilient when they teach subjects and grade levels for which they are most competent (Bobek, 2002). We posit that when hiring novice teachers, special consideration should be paid to areas of curriculum strength and student teaching experiences. Attention should also be afforded to determination of the candidate's awareness of the basis and implementation of non-cognitive factors in learning. Strategies for instruction in these factors such as those included in this chapter would also be desirable. There is great value in a complete teacher who will attend to non-cognitive and cognitive skills for learning.

Developing a competency of any kind strengthens the sense of self-efficacy, making a person more willing to take risks and seek out more demanding challenges. And surmounting those challenges in turn increases the sense of self-efficacy. This attitude makes people more likely to make the best use of whatever skills they may-or do what it takes to develop them (Goleman, 1995, pp. 89–90).

By building upon strengths first, teachers are willing to take risks. Addressing areas of need will only further enhance resilience (Bobek, 2002). Such findings present crystalline support for sustained professional development and lifelong learning for all educators.

CONCLUSION

When these findings are synthesized, we surmise that the difference between ordinary and exceptional education lies within the competencies and the personality of the teacher. Whether we are referring to grit, resilience, or persistence, the significance of the benefit for the student will depend upon the teacher's commitment to finding the means to facilitate the students' learning. Is there a way to enable the student to recognize the value of the learning proposed and, despite the obstacles, summon the grit to sustain effort over the long term? Will he/she find the necessary resilience to ward off the adversity that threatens to distract from the endeavor? Can the student and the teacher obtain the needed support, ability, self-efficacy, confidence, and sense of responsibility to yield that level of resilience? Will the student and the teacher persist or persevere encouraged by recognition of a worthy goal(s), in order to realize their ambition for themselves and their students, respectively? These questions and many others must undergo the scrutiny of thorough research to fully inform the profession of the effects of non-cognitive or cognitive factors on student attainment.

Garcia (2014) surmises, "In the current context of debates about how to shape education reforms, a renewed focus on non-cognitive skills could provide an opportune chance to enact a more effective education strategy overall" (Conclusion, para. 5). Further understanding of the interrelationships between cognitive and non-cognitive skills can greatly benefit our ability to moderate their effect on instruction. Teacher education candidates will be stronger pre-service and in-service practitioners when armed with thorough knowledge of these skills.

This research sought to consider the effects of the personalities of new teachers through the lens of three non-cognitive factors: *grit, persistence, and resilience*.

In light of the challenges that new teachers face in their induction year of teaching and the growing population of novice teachers entering the field of education, school leaders must determine which teachers have the best potential to thrive, and should be hired. An emerging body of research now suggests that it is perhaps the grittiest teachers who best survive and flourish during this important first year in the field (Duckworth et al., 2007; Duckworth, Quinn, & Seligman, 2009; Robertson-Kraft & Duckworth, 2014).

NOTE

[1] In our judgment, labeling a set of factors as non-cognitive when a number of the researchers we have cited in this chapter have reported them as interrelated with cognition constitutes a misconception. Since

these factors have such strong ties to cognition, they should not be labeled non-cognitive, suggesting they are absent cognition. We suggest that we refer to these factors as personal characteristics, which they are.

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6. UNDERSTANDING ATTITUDES IN EDUCATION

New Directions for Assessment

UNDERSTANDING ATTITUDES IN EDUCATION: NEW DIRECTIONS FOR ASSESSMENT

For decades researchers have been trying to identify and classify characteristics that contribute to students' academic success. The plethora of meaningful predictors is covered in the current volume by scores of distinguished contributors, and the reader will discover that all of the suggested lists and models are in no way complete or definitive. Let us mention a few examples. The Partnership for 21st Century Skills, for example, listed critical thinking, communication, collaboration, and creativity as four key factors of skills necessary for scholastic achievement. The Collaborative for Academic, Social, and Emotional Learning (CASEL) presented five "competency clusters" that include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. Roberts, Martin, and Olaru (2015) suggest that the Big 5 personality theory be used as the organizing framework for all noncognitive predictors of academic success (see also Lipnevich, Preckel, & Roberts, in press). Finally, Lipnevich, MacCann, and Roberts (2013) provided a taxonomy of some of the most commonly researched noncognitive constructs, grouped into four domains: (a) attitudes and beliefs, (b) social and emotional qualities, (c) habits and processes, and (d) personality traits. Attitudes and beliefs, however, may be considered more proximal to the behavior in question than other noncognitive constructs (Ajzen & Fishbein, 2005). Thus, the current chapter we will focus on the first group of noncognitive factors and will review existing theories, research, and discuss the role these skills play in academic achievement.

DEFINITION OF ATTITUDES

Attitudes can be broadly defined as a person's evaluation of an entity (Ajzen & Fishbein, 1977). The entity can be, for example, a person or a group, an object, a political party, an activity, or a school subject. Individuals may hold several evaluative beliefs about an entity ranging on dimensions such as good-bad, likable-dislikable, joyful-sad (Ajzen, 2001). The sum of beliefs about an entity form the attitude towards that entity.

M. S. Khine & S. Areepattamannil (Eds.), Non-cognitive Skills and Factors in Educational Attainment, 111–127.

The importance of studying, assessing, and, potentially, changing attitudes derives from the underlying premise that attitudes predict volitional behavior. That is, when a person holds a positive attitude towards something, he or she will also perform positive behaviors related to it (e.g., engage in activities to protect the environment). Although research conceded that the strength of the attitude-behavior link may vary depending on the accessibility, stability, certainty, consistency, and the amount of direct experience with the attitude object (Kraus, 1995, see also Cooke & Sheeran, 2004; Glasman & Albarracin, 2006), the general notion is that people will direct their behavior to be consistent with their attitudes (Ajzen & Fishbein, 1977).

Two theories have evolved to model the attitude-behavior link: the Theory of Reasoned Action (Fishbein & Ajzen, 1975) and its successor, the Theory of Planned Behavior (Ajzen, 1991). Both theories posit that the behavioral intentions people form on the basis of their attitudes mediate the link between attitudes and behavior. Furthermore, both theories assume that attitudes alone are not sufficient to predict intentions and behavior. Rather, they posit that people form intentions on the basis of their attitudes and their perception of social pressure (which is assumed by both theories) and the perception of control they have to exert the targeted behavior (which is assumed by the Theory of Planned Behavior). So, the Theory of Planned Behavior is an extension of the Theory of Reasoned Action and is next described in more detail.

The Theory of Planned Behavior

The TPB posits that a core predictor of volitional behavior is a person's intention to engage in that behavior (Ajzen, 1991, 2006). A person's intention, in turn, is mutually determined through attitudes, subjective norms, and perceived behavioral control. While we have defined attitudes above as the overall positive or negative evaluation of the target behavior, we can further distinguish experiential and instrumental aspects of attitudes. Experiential attitudes target the affective aspect of an attitude (e.g., to like or to dislike an entity or a behavior). Instrumental attitudes are formed through evaluative beliefs about the usefulness of an entity or a behavior (e.g., is it important or not). Subjective norms capture an individual's perception of the social pressures to engage (or not to engage) in an activity. Finally, an individual's perception of the behavioral control he or she has over exerting a certain behavior also contributes to forming intentions.

These three components of the TPB (attitudes, subjective norms, and perceived behavioral control) consist of a set of underlying beliefs as the cognitive foundation of the respective component. E.g., a student may think that math is fun, enjoyable, and interesting and thus form an overall positive attitude towards math. Another student may think that one should work hard to master math because her or his friends, parents, and teachers say so and thus exert social pressure (high subjective norms). Finally, a student may think that math homeworks, assignments, and in class activities are actually quite easy to do and thus view behavioral control over math

activities as high. Together, the three components predict behavioral intentions and subsequent, attitude-related behavior. Thus, intentions act as a mediator between those three components and behavior. Furthermore, TPB posits that perceived behavioral control also has a direct, that is, an unmediated effect on behavior (see Figure 1). Or, as Armitage and Conner (2001, p. 472) stated, perceived behavioral control "provides information about the potential constraints on action as perceived by the actor, and is held to explain why intentions do not always predict behavior".

In addition to the aforementioned components, the TPB acknowledges that other personal qualities (personality, knowledge, skills) may be relevant in predicting target behavior. However, these qualities are – according to the TPB – seen as background variables that may contribute to the targeted behavior via attitudes, subjective norms, and perceived behavioral control (Ajzen & Fishbein, 2005). For instance, having the knowledge of how to learn math (i.e., knowing adequate learning strategies) may contribute to the intention to learn and subsequently to learning activities through perceived behavioral control. However, empirical evidence about background variables and the mediating role of TPB components is currently sparse (cf. Ajzen & Fishbein, 2005).

The core assumptions of the TPB have been empirically confirmed in many studies, for many different attitude entities, and across a variety of samples (e.g., Sheeran, 2002). For example, Notani (1998) provided meta-analytical evidence across 63 studies supporting the assumed structure of the TPB. In another meta-analysis, Armitage and Conner (2001) were able to confirm that TPB variables accounted for a substantive amount of variance in intention and (self-reported and observed) behavior. These authors also reported evidence for the role of perceived behavioral control as a direct determinant of behavior. Generally, the TPB has been used to predict intentions and behavior in several domains, such as physical exercise, smoking, safe driving, and nutrition (Godin & Kok, 1996; Godin, Valois, & Lepage, 1993; Parker, Manstead, Stradling, Reason, & Baxter, 1992).

Although attitudes specifically and the components of the TPB in general have been found to predict intentions and behavior, we would like to emphasize that their predictive validity varies depending on several factors. Glasman and Albarracin (2006), for example, identified attitude accessibility and stability as moderators of the attitude-behavior link. Cooke and Sheeran's (2004) review additionally outlined attitude certainty, ambivalence, direct experience, and affective-cognitive consistency as moderators of the attitude-behavior relation. Overall, authors agree that more research is needed to further elucidate the link between attitudes and behavior (e.g., Armitage & Christian, 2003). Next, we will focus on the relevance of attitudes in educational contexts, and, specifically, in predicting math performance.

Attitudes and Educational Outcomes

Understanding factors that promote academic success has important implications for all learners in educational settings. Student attitudes and behavior have been

linked to previous achievement, level of engagement, and perceived academic competence (Akey, 2006). More specifically, student beliefs about academic competence (an antecedent for attitudes towards a content area), were demonstrated to improve academic achievement in subjects such as reading and mathematics. Research has indicated that even among young children (ages 4–7), attitudes towards school predicted academic performance (Geddes, Murrell, & Bauguss, 2010; Ak & Sayil, 2006; Marjoribanks, 1992; Petscher, 2010). Overall, the relationship between attitudes and school performance outcomes, has been shown to be significant and positive (Reynolds & Weigand, 2010; Guzmán, Santiago-Rivera, & Hasse, 2005; Juter, 2005).

A large meta-analysis of correlations between reading achievement and attitudes towards reading indicated that there was a strong relationship between the two variables for students in elementary school and a moderate relationship for students in middle school (Petcher, 2010). A key implication of this finding is that attitudes influence academic achievement even among the youngest learners. Attitudes towards specific subject areas, such as reading, are formed in the early years and are consistently shown to influence levels of achievement. Recent research has indicated that positive attitudes do not only relate to achievement in school subjects, but also contribute to orientations towards career choices. For example, Uitto (2014) found that positive attitudes towards biology in school was related to the likelihood to pursue biology-related careers. In the remainder of this section, we will discuss specific attitudes as applied to a single academic domain – mathematics. Additionally, a meta-analysis on study habits, attitudes, and study skills, indicated that habit and attitude inventories were the single most significant predictors of academic performance (Credé & Kuncel, 2008).

Math Attitudes

Attitudes toward mathematics in the TPB can be described as the overall positive or negative evaluation of mathematics-related behavior (“Studying math makes me nervous”). Subjective norm reflects social pressures on the individual to perform mathematics-related behavior (“Most of my friends think that math is an important subject”). Perceived behavioral control describes the extent to which an individual perceives his/her ability to control the outcome of a behavior (“If I invest enough effort, I can succeed in math”). These three components determine individuals’ intention to exert a certain behavior (“I will try to work hard to make sure I learn math”). Before we turn to math-related outcomes predicted by math attitudes, let us first discuss attempt to differentiate math attitudes from mathematics anxiety – the construct that has been erroneously used as a synonym of mathematics attitudes.

Mathematics as a school subject is generally known to elicit anxiety in some students (e.g. Ashcraft, 2002; Frenzel, Pekrun, & Goetz, 2007). Mathematics anxiety can be defined as “an unpleasant emotional response to math or the prospect of doing math” (Beilock, Gunderson, Ramirez, & Levine, 2010, p. 1860). Mathematics

anxiety has been frequently and successfully applied to predict mathematics achievement (see Hembree, 1990; Ma, 1999). Conceptually, mathematics anxiety—especially its emotionality component (see Sarason, 1984)—is very closely related to the attitudes component of the TPB, which according to Ajzen (2006) is reflected by adjectives such as *pleasant* or *enjoyable*. However, the math attitudes comprise more math-related beliefs than those pertaining to anxiety, such as whether math is interesting or important.

Math Attitudes and Educational Outcomes

Math performance. Achievement in mathematics is seen as a gateway to higher-education, lucrative career opportunities, and an indicator of the ability to compete with the demands of a global economy (Jerald, 2008). Especially in the area of mathematics, researchers, practitioners, and educational policy decision-makers seek to pinpoint and understand specific factors that contribute to achievement in mathematics. Comparative education research has repeatedly shown that the U.S. does not measure up to other developing countries in mathematics achievement (Lee, Grigg, & Dion, 2007). Hence, investigating meaningful predictors of performance that can be enhanced through interventions is of utmost importance to the field.

Mathematics is conceptualized as a subject that builds upon its foundational concepts and serves as a cognitive multiplier or as a subject that builds upon elementary concepts (Sweller, 1994). This is an important distinction between mathematics and other school subjects. The nature of mathematics forces educational psychologists to investigate how achievement in the subject develops, which factors influence the development of relevant skills, and to what degree are these factors stable across time. Furthermore, the importance of early competencies and later academic achievement is most evident in mathematics. Early mathematics achievement has been shown to be a significant predictor of later overall academic success, even when accounting for general cognitive skills (e.g., attention) and reading ability (Duncan et al., 2007). The overall positive attitudinal profile of a student in relation to the may facilitate learning and mastery in the domain of mathematics (Lipnevich, Preckel, & Krumm, 2016).

Gender differences are often discussed in relation to math performance and other math-related characteristics. Studies have revealed that male students tended to have higher perceptions of their math ability, higher performance expectations, stronger intentions to keep taking math courses, and lower math anxiety compared to female students (Brownlow, Jacobi, & Rogers, 2000; Meece, Wigfield, & Eccles, 1990; Trankina, 1993). Given the attitudinal pathways to math achievement, these findings suggest that female students are at risk for intentionally avoiding advanced math classes. Trends in postsecondary education major selections between 1995 and 2001, indicate that only 14% of females enter science, technology, engineering, and mathematics (STEM), when compared to 33% of men (Chen, 2009). Of note,

women represent 40% of the American workforce, but only 23% of the STEM fields (Beede, Julian, Langdon, McKittrick, Khan, & Doms, 2011; Phillips, Barrow, & Chandrasekhar, 2002; Stake & Mares, 2005).

So, it is pivotal to understand how math skills are acquired and how mathematics achievement can be sustained throughout the formal academic years. The relationship between attitudes towards mathematics and achievement in mathematics can provide a framework for developing such academic competencies that lead to success in secondary school and in future careers.

The link between attitudes towards mathematics and mathematical ability in predicting mathematics achievement is complex and is explained by multiple factors (Furinghetti & Morselli, 2009). There are mixed research findings about the cause-effect precedence between attitudes and attainment. So, whether it is low performance in mathematics that leads to negative attitudes and affects responses towards the subject or whether the relationship is reversed remains unclear. Another important question concerns specific factors that interact with prior achievement, affect, and attitudes, and contribute to later mathematics achievement. Despite existing gaps in our understanding of these complex relationships, there are strong research findings showing that significant positive relationships between attitudes towards mathematics and mathematics achievement exist (Ai, 2002; Ma & Kishor, 1997). Longitudinal studies have revealed that prior mathematics achievement and attitudes towards mathematics related strongly to later mathematics achievement (Hemmings, Grootenboer, & Kay, 2010). In a meta-analysis, the causal relationship between attitudes towards mathematics as a predictor variable and achievement in mathematics as an outcome variable, was shown to be statistically significant (results were not significant for the causal relationship of the alternative direction) (Ma & Kishor, 1997). These findings are in line with results reported for the domain of statistics, which generally yield significant positive relationships between attitudes towards statistics and statistics outcomes (Dempster & McCorry, 2009; Emmioglu & Capa-Aydin, 2012; Sizemore & Lewandowski, 2009).

To our knowledge, only few studies have examined mathematics attitudes making use of the TPB framework (Lipnevich, McCann, Krumm, Burrus, & Roberts, 2011; Lipnevich et al., 2016). Lipnevich and colleagues successfully applied a TPB based questionnaire on mathematics attitudes (MAQ) to predict mathematics achievement. The authors were able to explain up to 32% of variance in mathematics grades in Belarusian and US samples. Moreover, Lipnevich et al. (2016) examined the incremental validity of mathematics attitudes above and beyond cognitive ability and Big 5 personality traits and revealed that math attitudes explained up to 25% of incremental variance. So, albeit these findings are obtained from cross-sectional studies and evidence from longitudinal or experimental studies is still lacking, shaping math attitude components as suggested by TPB may be particularly beneficial in increasing math performances.

Another key outcome of education, as it relates to the domain of math, is career choices. Meece et al. (1990), for example, showed that higher mathematics anxiety levels were related to less mathematics courses students choose to take. These authors argue that the avoidance of mathematics courses inevitably results in a deficit of students entering scientific and mathematical professions. Studies also show that stable negative emotional profile toward the domain of mathematics (i.e., trait emotions, or experiential attitudes (Ajzen, 2002)) relates to individuals' intention to take challenging courses and pursue additional tasks in the domain of mathematics (Goetz, Cronjaeger, Frenzel, Lüdtke, & Hall, 2010). Thus, substantial correlations between mathematics attitudes and career interests in a field which require a higher mastery of mathematics is evident. More specifically, career interests of students are also determined by norms established by their peers (as reflected in the subjective norms component of the TPB). Studies consistently demonstrate that peers can exert significant influence over individuals' career choices (Smith, 1992). For example, in his classical study Johnson (1987) found links between experiences within early adolescent groups and later vocational identity. Similarly, Sax and Bryant (2006) showed that aspects of environment, including the peer culture, contributed to shifts in individuals' career choices. Hence, as the reviewed research demonstrates, mathematics attitudes matter for academic achievement in math, as indexed through student grades and test scores, and greatly relate to student choice of vocation. Assessing students' attitudes with the goal of developing potential interventions to enhance this characteristic is of utmost importance to the field of education.

ASSESSMENT OF ATTITUDES

Although attitudes is an important construct accepted globally among researchers, educators, and social scientists, the currently available assessment approaches vary in their quality. While in many studies attitudes towards school are conceptualized as a "non-cognitive" construct (among math self-efficacy, elaboration, and motivation) (Morony, Kleitman, Lee, & Stankov, 2013), in other studies attitudes are indexed as self-beliefs (see Straus, 2014), attributions (see Kozina & Mlekuž, 2014), self-confidence (see Kadijević, 2008) or achievement-related emotions (see Daniels et al., 2008). In some large-scale assessments, attitudinal factors are derived from student self-report questionnaires that may or may not have been developed with the intention to measure attitudes towards academics. For example, in Kadijević (2008), attitudes towards mathematics was measured by using student survey data on answers to questions such as "I enjoy mathematics" and "I need mathematics to learn other school subjects." Other approaches towards assessing attitudes towards specific subject-areas include administering assessments that have been developed specifically for measuring attitudes. For example, the Survey of Attitudes Toward

Statistics (SATS; Schau, Stevens, Dauphinee, & Del Vecchio, 1995) has been used to understand the attitude-achievement relationship in statistics. Another approach for assessing attitudes is through student interviews based on prompts of relevant situations (see Hannula, 2002).

TPB-Based Approaches

The TPB outlined in a previous section, provides a framework of assessing, understanding, and predicting mathematics achievement. While previous mathematics achievement and mathematics ability test scores are important predictors of later mathematics achievement, the components of the TPB, have been shown to explain an additional significant variation of grades in mathematics (Lipnevich et al., 2011).

Consequently, the Organisation for Economic Co-operation and Development (OECD) began incorporating Ajzen's theory of planned behavior model into the background student questionnaire in 2012. This approach was accounted for in Straus's (2014) analysis of math-related attitudes, socio-economic background, and their effect of academic achievement. The framework of the TPB was used to understand the likelihood of student behavior through subjective norms. More specifically, subjective norms revealed a significant relationship with mathematics achievement among the U.S., Canadian, and German students. Kozina and Mlekuž (2014) also took the TPB measurement approach to understanding mathematics achievement through subjective norms and perceived control. Control beliefs were used to assess attributions for success in mathematics and predict mathematics achievement. Results indicated that there were significant effect sizes noted of perceived control and its impact on math achievement in several of the countries studied (including Slovenia, Estonia, and Netherlands).

A questionnaire specifically developed to assess the four components of the theory of planned behavior (i.e., Attitudes, Subjective Norms, Perceived Behavioral Control, and Intentions) is the Mathematics Attitudes Questionnaire (MAQ; Lipnevich et al., 2011). In this questionnaire students are asked to rate each item on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The authors initially developed an item pool of 40 items (10 for each component of the TPB) and reduced this pool on the basis of results obtained from exploratory factor analysis to 22 items. Six items address attitudes (e.g., "I enjoy studying math"), five items address subjective norms (e.g., "My friends think that math is an important subject"), five items represented perceived behavioral control (e.g., "If I invest enough effort, I can succeed in math"), and six items address intentions (e.g., "I will try to work hard to make sure I learn math"). The total scores are build by summing students' responses for each of the four components. Lipnevich et al. (2011) demostrated that this questionnaire yielded satisfactory to good internal consistency reliabilities across two samples from different cultures. Moreover, the factorial structure of the TPB was replicated with the MAQ across different

cultures. Importantly, the MAQ predicted a substantial proportion of variance in math performance (Lipnevich et al., 2011; Lipnevich et al., 2016).

Large-Scale Assessments of Attitudes

Large-scale national and international assessment of attitudes provide us with valuable information about student achievement across many grade levels, contexts, and outcomes of interest. The Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA) are internationally recognized efforts of evaluating achievement and performance standards in specific subject areas. The TIMSS and PISA are administered every few years to students in participating countries to assess competencies in science and mathematics (as well as reading and literacy for PISA). In addition to domain-specific assessments, the data collected includes student background characteristics and surveys to measure factors that may influence achievement (e.g., approach towards subject area, attitudes, utility for subject area, positive or negative affect towards subject, academic self-beliefs).

In predicting mathematics achievement, attitudes (seen as learner-related variables) towards mathematics, have been an important component of understanding achievement in cross-cultural analyses (Papanastasiou, 2000). Using data from the PISA, positive correlations were found for the relationship between attitudes towards school and several academic outcomes including scores in reading, mathematics, and science (OECD, 2003). More generally, positive relationships between domain-specific (e.g., mathematics, science) attitudes and achievement have been trending in studies using secondary data-analyses procedures from large-scale assessments. However, across several analyses using the TIMSS 1995 data, the relationship between attitudes and mathematics was significant in few of the of the countries examined (Martin, Mullis, Gregory, Hoyle, & Shen, 2000). Several factors could be explaining the inconsistency of results across countries; (1) that there are meaningful cultural differences when examining the attitude-achievement relationship, (2) that measurement of "attitudes towards mathematics" was not culturally sensitive (see Kadijević, 2003), and (3) that "attitudes" is a multidimensional construct that is represented differently between samples (see Lipnevich et al., 2011).

Within the last decade, dimensions of attitudes towards mathematics and mathematics achievement have been refined in research studies using data from large-scale assessments. By utilizing survey responses from the TIMSS 2003 data, self-confidence in learning mathematics and favoring mathematics were conceptualized as dimensions of attitudes towards mathematics. These constructs were shown to be significant predictors of mathematics achievement in almost all countries that were studied, which included the United States, Sweden, Japan, and England (Kadijević, 2008). While controlling for family background characteristics such as socioeconomic status, mathematics-related attitudes showed a significant effect size on mathematics achievement test scores measured in the PISA assessment

(Straus, 2014). Measures of mathematics-related attitudes included student responses on subjective norms in mathematics (i.e., the perceived utility of mathematics in future encounters and the enjoyment of mathematics).

INTERVENTIONS

Once attitudes are formed, they can be rather stable (Glasman & Albarracin, 2006). However, the formation of attitudes takes place through an individual's socialization and can thus be influenced by various factors throughout the socialization process. Learning processes are among the factors discussed in the literature on attitude formation (Hogg & Vaughan, 2009). One way of learning is to have direct (positive) experience with the attitude object. In its simplest form, attitudes can be changed by mere exposure with the attitude object (Zajonc, 1968, 2001). Learning may also occur through classical and instrumental conditioning. Building on the principles of classical and instrumental conditioning, parents, teachers, and others can reinforce attitude-related behavior or the (positive) consequences resulting from such behavior. This is, for example, evidenced by Olson and Fazio (2001) who showed that attitudes towards objects that were paired with unrelated positive items were significantly more positive than attitudes towards items that were paired with unrelated negative items. Furthermore, significant others (e.g., parents, friends, teachers) can serve as role models and thus shape attitudes.

Another pathway to attitude formation can be through individuals' behavior. Bem (1972) introduced the self-perception theory, which argues that people form self-concepts on the basis of what they do. For example, a person may frequently attend a psychology lecture and, as a result, infer that he or she must like psychology (cf. Olson & Zanna, 1993). Other research suggests that it may particularly effective to change attitudes by combining cognitive and behavioral interventions. Krahé and Altwasser (2006) were able to show that attitudes towards physically disabled individuals changed significantly (in comparison to a control group) when participants were given information about disabilities and engaged in paralympic activities. Notably, these effects remained stable in a three month follow up. Several other factors relevant in attitude formation are currently discussed (for an overview see, for example, Greenwald, Brock, & Ostrom, 2013), but may not serve the purpose of delineating approaches to attitude change (e.g., genetic influences on attitude formation).

In addition to targeting learning processes, the TPB may be used as a point of departure for developing specific interventions. Specifically, interventions can be designed to change the underlying beliefs of the three components of the TPB (behavioral beliefs as determinants of attitude toward the behavior, normative beliefs as determinants of subjective norms, and control beliefs as determinants of perceived behavioral control). A very illustrative example for interventions targeting those beliefs in the domain of risky driving was presented by Parker, Stradling, and Manstead (1996). These authors designed video scenes specifically

targeting behavioral, normative, and control beliefs. For instance, the video on normative beliefs shows an actor (Tom) "pulling up to a curb on three separate occasions. On each occasion, he is accompanied by a passenger. In the first scene, the passenger is his partner (i.e., husband, wife, boyfriend, girlfriend); in the second scene it is a same-gender close friend; and in the third, it is his (male) child. As Tom leaves the car to go into a shop, each of these passengers speaks to the camera, complaining about Tom's driving, and in particular about the fact that he drives too fast on narrow residential roads. The main message from each of Tom's passengers is that they are not impressed by his speeding and would much prefer it if he kept to the 30-mph (48-kph) speed limit. This video, then, features the wishes of others who are important to Tom. It is designed to convey to the audience the message that people do not like being driven by someone who exceeds the 30-mph (48-kph) speed limit in residential zones" (Parker et al., 1996, p. 5). Other videos were similar but specifically designed to address a distinct belief. Their results, however, showed that only half of their videos (particularly those addressing normative beliefs) had an effect on attitude change. The authors acknowledge that the videos were produced with a relatively low budget. So, future interventions along these lines may provide more insights into the malleability of TPB-related beliefs through videos.

Obviously, changing TPB-related beliefs is not restricted to video interventions. For example, persuasion through written or spoken messages may also target specific beliefs (e.g., Brubaker & Fowler, 1990). A meta-analysis conducted by Webb and Sheeran (2006) revealed that TPB-based interventions had a medium effect on intentions (d = .58) and on actual behavior (d = .40). Thus, TPB-based interventions can overall be considered effective in changing attitudes and, subsequently, in changing intentions and behavior. In the future, such interventions may not only help creating more favorable attitudes towards certain attitude objects but can also be used in controlled experiments to examine the causal link between attitudes and behavior.

FUTURE DIRECTIONS

Novel Approaches Toward Assessment

The strengths of using large-scale assessments to assess the effect of attitudes on academic achievement, also present limitations. Although cross-cohort and cross-cultural analyses are ways of understanding factors that contribute to academic achievement, the large-scale data proposes strains on measuring psychological factors that are important to predicting student achievement. There have been several efforts to incorporate more refined measures of student attitudes, behaviors, and attributions. For example, in PISA 2012, Ajzen's (1991) model of the theory of planned behavior was used as a framework to measure value and expectancy components of behavior through self-report methods in the Student Questionnaire (OECD, 2012). As mentioned earlier in the chapter, measuring attitudes proposes

a challenge because of a perceived notion that attitudes are easily changeable. If attitudes are easily recalled and situational, they are better measured. Using the advantages of self-report questionnaires (usability, ease of administration) and creating more effective items that measure attitudes in relevance to education, we become better equipped to understand these psychological constructs and their impact on academic achievement. Especially in the topic of measuring non-cognitive constructs (i.e., attitudes), several challenges have immersed (see Duckworth & Yeager, 2015) after considering the research-base that non-cognitive factors are as important as cognitive factors in predicting achievement (Duckworth & Seligman, 2005).

An assessment approach that has re-gained awareness in the scientific literature are situational judgment tests (SJTs). SJTs typically consist of written scenarios followed by a set of multiple-choice response options (Motowidlo, Dunnette, & Carter, 1990). Test takers are asked what they would or should do in each one of the situations. SJTs are frequently used in personnel assessment and selection (Whetzel & McDaniel, 2009), but have not yet been applied to the domain of attitudes. Considering that attitudes always refer to a specific object (e.g., math), SJTs may be apposite to capturing attitudes as they present typical situations in which the attitude object occurs or an attitude towards that object becomes relevant. Such SJTs may, for example, present typical situations related to the attitude object and assess test takers' attitude-related beliefs. The situations used in such SJTs may also be geared towards emphasizing a specific attitude component (as included in the TPB) and capture test takers' response to such situations. However, whether SJTs indeed provide added value beyond self-reports in the domain of attitudes is an open research question.

Causal Evidence

Currently, very few studies provided evidence for the causal role of attitudes on educational outcomes. This is surprising for several reasons. First, ample correlational studies have been conducted that linked attitudes to educational outcomes. Hence, the initial groundwork justifying more sophisticated and expensive follow-up studies. Second, the dependent variable is of major interest, both from an individual as well as from a societal perspective. For example, achievement in mathematics is viewed as pivotal for higher-education and lucrative career opportunities (Jerald, 2008). Third, teachers and researchers in education have a genuine interest in developing interventions to improve school-related attitudes. The TPB provides specific recommendation on how to create such interventions (Ajzen, 2002; Armitage & Conner, 2001). Such interventions can be used in controlled experiments to establish causal links between attitudes and outcomes. Fourth, technology as well as easy to apply methodology are available to derive causal evidence from non-experimental studies (e.g., through cross-lagged panel analysis). Research along these lines might also benefit from a more in-depth assessment of behavior

(e.g., through ambulatory assessments). In fact, multi-time assessments may also shed light on reciprocal relationships between behavior and attitudes as well as on dynamics of potential upward or downward spirals.

Inclusion of Background Variables and Multiple Outcomes

The TPB acknowledges several background variables (e.g., personality, knowledge), some of which are also included in taxonomies of 21 century skills (see Intro of this chapter). However, evidence on the interplay of attitudes and several other important personal qualities is sparse. Indeed, the components of the TPB may not simply act as mediators between background variables and intentions (cf. Ajzen & Fishbein, 2005). Rather, their interaction may be more complex (for instance, attitudes towards math may be less predictive when students' show high levels of conscientiousness). Moreover, students' attitudes may be more or less open to interventions depending on other student characteristics. So far, research has not been devoted so much to disentangling the interplay between attitudes, other noncognitive and cognitive characteristics.

An important avenue for future research may also lie in the inclusion of further outcome variables. While the natural focus of researchers so far was on behavior and performance in several educational domains, fruitful insights may also be gained from including outcomes such as extracurricular activities, interests, satisfaction, commitment, stress, etc. A narrow focus on domain-related behavior and performance may in fact ignore important side effects of shaping students' attitudes.

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7. RELATION BETWEEN NON-COGNITIVE FACTORS OF LEARNING AND THE STUDENTS' ACADEMIC PERFORMANCE

INTRODUCTION

The question of learning and of its determining factors is widely tackled in the literature in the field, many researchers attempting to comprehend the act of human learning in general and school learning in particular. Thus, learning is analysed from the perspectives of neurologists, psychologists, educationalists and sociologists, each with an interest in the aspects that determine the process of learning. The neurologists explain learning from the perspective of some biochemical, bioelectrical and anatomical mechanisms. 'The sensorial and motor systems, perception, memory, cognition, thinking, emotion and personality are represented by certain patterns, nervous impulses and structures pertaining to the central nervous system' (Dănăilă & Golu, 2000, p. 60). The psychologists are interested in analysing the psychic processes involved in learning, as well as the effects of learning on individual behaviour; whilst the sociologists analyse the social dimension of learning. Likewise, the educationalists focus on the efficacy of school learning, analysed from the points of view of the process, product and factors of influence. From these perspectives results not only the importance of the problem under the lens but especially the complexity of this multiple-determined process.

Regardless of the research field, it is certain that learning places the individuals in the position to valorise their skills of adapting to the environment's requirements and of optimising their accommodation and assimilation processes along their entire lives. In our opinion, *learning* represents a permanent, evolving and dynamic process, socio-culturally determined and individually assumed, which highlights both the bio-psychic progresses and the formative experiences of the educational and social environment, and which determines relatively stable quantitative and qualitative changes in the individual's psychic-behavioural development. At the individual level, learning is not attained all of a sudden, but as a dynamic process which entails making reference to the level of intellectual development, as well as the harmonisation of a series of aspects pertaining to each individual's ability to adapt to their own needs for knowledge. Also, when referring to psychic progress we have in mind both the quality of the cognitive mechanisms and the non-cognitive factors involved in learning.

M. S. Khine & S. Areepattamannil (Eds.), Non-cognitive Skills and Factors in Educational Attainment, 129–150.

Starting from these aspects, this chapter aims at underlining the influence of non-cognitive factors on the learning process and students' outcomes, as reflected by the research in the field, and also by the experience of the Romanian education in what the understanding of the learning process is concerned.

From the perspective of the process, learning entails a chain of operations of restructuring, alignment of one's personality with the experiences provided by the school, as well as adaptation of the school's requirements to the individual's learning needs. A particularly important aspect is the promoted/ required learning pattern, in accordance with the way in which an educational system understands and defines learning. For example, as the debates on learning and quality of education are relatively recent at the level of Romanian education, and as the educational strategies are in full process of aligning to the European exigencies, the definition of learning has not been made definitive yet.

Generally speaking, learning means change, transformation, and for that is necessary that all people involved in designing and carrying out the learning process to avoid improvising. Thus, we can underline the fact that school learning equally engages the human resources of the school and the school as a whole. It does not exclusively target the formal educational demarche, but also the informal learning, which claims its prevalence more and more.

Like any other process, school learning entails the drafting of a rigorous planning of all aspects and components in relation to it. In this respect, a diagnosis analysis is necessary in order to identify the actual learning needs and requirements of the students, especially in the case of a society which goes through a process of transformation. Such an analysis might provide support for establishing some realistic educational objectives, capable to valorise the students' needs and aspirations, and to anticipate the expected outcomes of the process. The students' engagement in the learning process also depends on what is expected from them, but also on the way in which the teacher is able to channel their energies and potential. The students must be taught how to learn, thus preparing them for auto-education. To this effect, they must be psychologically prepared for auto-education (the development of volition skills, of the intrinsic interest and motivation), as well methodologically trained for it (the formation and development of skills and independent, intellectual work styles). The relation between the teacher's action and the students' aspiration is optimised by feedback mechanisms, which regulate the learning activity of the latter, preventing learning failure. Also, the learning contents must provide support for attaining the objectives but also for supplying the students' learning necessities. To this end, they have to be interdisciplinary designed, providing the student with a bird-eye view on the matter in focus, as well as with the possibility to actually understand what they are taught. The contents should be further doubled by access to action and experimentation. Along these lines, it is compulsory to promote active didactic strategies which give students the chance to experiment and discover knowledge, thus motivating them to learn. The outcomes of the school learning process should then be externalised as competences, as the students' superior ability

to creatively valorise the acquired knowledge in view of their adequate response to the requisitions of the labour market and of the society in general.

The analysis of all components of the school learning process gives us the chance to reflect on the students' learning necessity and motivation (*why? to what end does the student learn?*), on the factors which determine and support learning (*who* or *what determines learning?*), on the teaching strategies which facilitate the learning process (*how is it taught? how is it learnt?)*, and most importantly, on the expected outcomes of school learning (*what are the competences acquired though learning?*). All these questions make us aware of the fact that explaining learning only by means of the cognitive mechanisms is a reducible approach which exaggerates the role of cognition and eludes the importance of all the other variables which undoubtedly support learning.

NON-COGNITIVE FACTORS OF LEARNING AND ACADEMIC PERFORMANCE: A BRIEF LITERATURE REVIEW

The first impulse in the attempt to explain the learning process and its influencing factors is to refer to the student's skills and intellectual abilities, to his or her competences, to his or her intelligence quotient. A possible explanation may be, in our opinion, the fact that in both teaching and assessing of performance, emphasis is primarily laid on what the student is actually able to demonstrate, on what may be detailed in clearly defined performance indices, in their objective behavior. Most of the time, the major reproof is that school learning is exclusively based on what is comprised in the curriculum, whereas evaluation only measures concrete outcomes, disregarding the effort put in acquiring them. In truth, academic performance, success, generally speaking, is determined by multiple factors.

"The affective factors – such as attitudes, values and more comprising aspects of personality – are considered only inasmuch as they enter in relation with the cognitive field. Thus, for example, we are interested in the general anxiety level of a student only in relation to its well-known or postulated connexion with the problem-solving ability, and not as a phenomenon with repercussions on the interest (a dependant variable)" (Ausubel & Robinson, 1981, p. 49).

It is true that the cognitive structure seriously affects the learning process, but its role is not exclusive whatsoever. The affective-attitudinal aspects, the general traits of the personality of the student are equally relevant. In our opinion the tendency to elude the importance of the non-academic factors may be determined by the fact that the cognitive variables are objective and have an obvious influence, whereas the non-cognitive variables are implicit, less obvious and more difficult to make operational.

An objective overview of the literature reveals the interest of all researchers in the educational field in identifying the factors that may influence the learning activity and the student's performance level. Among the most cited factors one finds: motivation, the valorisation of the learning tasks, the will to succeed, the effort, the

sentiment of self-efficiency, learning strategies, self-trust, learning types, the class factor, the personality factors, the demographic factors.

A brief overview of the studies which focus on this problem matter is helpful in understanding both its importance, and the fact that regarding learning and performance one speaks of permanent epistemological rearrangements. Thus, Amrai et al. (2011) have conducted a study on the possible relation between the academic performance of the students of Tehran University and their *academic motivation*. Their results underline the statistically significant positive correlation between motivation and academic performance. It is not just motivation what produces satisfactory academic achievement. Their investigation has proved that other variables, such as praise, engagement, effort, competition, and social context also have positive effects on the students' performance level. Generally, the students show appreciation to those learning tasks which they perceive as valuable and significant for their intellectual development. Also, the positive valorisation of learning triggers positive effects on self-discipline and auto-efficiency.

Academic achievement or performance is influenced by the motivational level, but Linnenbrink and Pintrich (2002) maintain that other factors also hold great importance. Among such factors, they list cognitive variables (metacognitive strategies, acquired knowledge, individual ability of ordering the learning activity), but also social aspects, students 'expectations, values or previous achievements. It is well-known that success breeds success, whist failure may foreshadow another possible failure. It depends on the way in which the student activates his or her energies and skills.

Also, *the attitude towards learning* is a non-cognitive variable which may determine the level of students' engagement in solving academic tasks. Tsuda (2003) has investigated the students' attitude towards learning the English language. The analysis of the results underlines the fact that although they are aware of the importance of learning English, as well as of the fact that they need this language for computer use or even travel, most of the subjects display a negative attitude towards the acquisition of this language. Their reasoning is grounded in the fact that their previous learning experiences proved unsuccessful. Nonetheless, we consider that these results should be met with due reservation, as one cannot equate learning a foreign language with learning in general. Moreover, the easiness of learning a foreign language is determined by other cultural factors. However, the results of this study come to reinforce the idea that learning engagement depends on the way in which the students appreciate the tasks they are given.

Also, Tuckman (1999) proposes a model of reaching motivation in reference to the requirements of education. His model emphasises three generic factors which are said to influence academic performance:

a. the individuals' attitude towards themselves and their skills;
b. their will to attain that goal, and
c. the strategies they employ.

Tuckman considers that the effort put in solving tasks, the entire cognitive arrangement is not a source but an effect of motivation. In other words, inasmuch as the student has the necessary motivation, he or she will make substantial efforts to solve the learning tasks given to him/her. Nonetheless, performance requires stimulation. In general, researchers underline the fact that people engage in solving tasks when the estimated outcomes are important for them, when anticipated performance matches their wishes (Tuckman, 1999; Anghelache, 2013). To put it otherwise, the performance stimulus has the role of mediating the relation between the individual and the effort required from him/her. The individual engages either to achieve success or to avoid failure.

Tuckman's research is in complete agreement with Pintrich and Schrauben's investigations (1992, as cited in Tuckman, 1999) which also underline the importance of *the learning strategies*. The two consider that self-reference may be a possible strategy for measuring the cognitive engagement. In what the relation between performance and applied strategies is concerned, Tuckman's study emphasises the fact that they also function as a factor of activity self-ordering. His research on the learning strategies self-ordering is confirmed by the study conducted by Lavasani et al. (2011), on a sample of 5th grade schoolgirls. Their results reveal a statistically significant and positive relation between the subjects' motivation level and learning strategies. The ability of learning activity ordering and efficientisation was greater, in the sense that the subjects were capable of constantly measuring their progress. This aspect also led to positive effects at the motivational level. The conclusion of this research is a simple one: the subjects managed to clearly define their aims, and then they selected the appropriate learning strategies, efficiently associated old and new knowledge, and made school performance efficient. Also, as Pintrich (1990) maintains, if we discuss learning from the perspective of activity self-ordering, it results that the student is capable of setting clear goals and monitor learning behaviour and the motivation level. In this case, learning becomes active and the student is involved directly.

Although most studies have emphasised the role of motivation in achieving satisfactory academic performance, there are also some studies which, while not arguing, do not fully support this theory either. A good case in point is the research conducted by Francis et al. (2004) at University of Maryland. The authors consider the relation between motivation and academic performance unclear, students' monitoring being compulsory. However, they have recorded subjects that improved their performance as a consequence of motivation, but the improvement was not significant, in their opinion. Nonetheless, they admit that their results are not fully relevant for their aims.

An interesting perspective is provided by the study elaborated by Willms (2003). The scholar analysed the outcomes of students in different countries in PISA international evaluations, attempting to interpret them from the perspective of *learning engagement.* Engagement or commitment to learning is defined by Willms as an affective-behavioural component of the sentiment of belonging, inasmuch

as the students identify with and valorise their school. Willms considers that the obtained data provide information about students' values and attitudes, and also about their self-confidence. In his opinion, the main predictors of the outcomes students obtain in these tests are *the sentiment of belonging* and *participation in cognitive and non-cognitive activities*, to which family background may add. The former has been measured by attempting to identify the students' feelings of acceptance and integration into group. Willms maintains that this feeling of belonging is influenced by family and community experiences. In what engagement is concerned, it has been measured by way of students' absence or presence during activities. Willms admits that this measurement form is relative, as participation has different cultural significance in many countries. The mere presence in school cannot be directly related to full engagement in solving school tasks.

The results of this research underline the fact that students' engagement does not necessarily entail positive performance, exemplifying with some cases of students who achieved performance while being discontent with their school.

Other studies, such as the ones conducted by Covington (2000) or Dalgety (2003), illustrate the fact that motivation, the will for knowledge, but also the quality of the teaching process are predictors of learning engagement (as cited in Anders & Berg, 2005). Also, our previous research has led to a similar conclusion: students who engage, set objectives and clearly define their personal achievements show positive attitude towards learning and, implicitly, achieve superior performance. Moreover, students who acquire performance valorise learning, opting for strategic and thorough learning and even engage in additional tasks (Anghelache, 2013).

A non-cognitive variable that may be related to academic performance is *type of learning*. In this respect, Chou and Chen (2008) conducted an investigation based on six empirical studies (three in the United States of America and three in Asia) in view of identifying the extent to which self-ordered learning generates academic performance in the case of web-assisted learning. The results differed from one another in the six case studies. In only one situation, a strong correlation has been observed between self-ordered learning and academic performance. Among the possible causes that have determined such results, some may be in relation to the subjects, and others to the research methods employed. In brief, the two researchers lists the following frequent causes: confidence in academic performance, students' learning style, quality of the materials used in e-learning, educational background, prior knowledge of the subject matter, the way in which self-ordered learning was carried out, the sample dimension.

A similar research was conducted by Riaz et al. (2011), on a sample of 120 students enrolled in an online study programme. The investigation aimed at identifying what determines students' acceptance of and engagement in learning, and to what extent these factors influence academic performance. The results obtained underline the fact that technological resources and some traits of students may be considered key factors in explaining the indices of acceptance of and engagement in learning. The students had a positive perception of e-learning, which they regarded

as being a comfortable, unintimidating form of learning. In turn, the teacher was positively turned to advantage from the perspective of the quality of materials used, which motivated the students more and made them engage in the learning activity. We believe that this research has certain limitations related to the efficiency of online learning on long term and to the access of students in various countries to such learning resources.

The feeling of self-efficiency is also related to the level of academic performance. Missoum (2003, pp. 27–31) defines efficiency in terms of achievements and identifies three interacting factors which determine it:

a. the psychological potential (actualised in the individual's skills of processing information, of managing his or her emotions and of having best interpersonal opinions, behavioural dynamism and self-confidence);
b. mental training (the totality of means and methods by which an individual develops and enhances his or her psychic resources);
c. mental strategies (by which the individual sets up his or her success).

Thus, Missoumi confirms Bandura's research (1982) which posits that there is a strong correlation between learning, academic performance and the self-efficiency sentiment. The last empowers the student, who perseveres in attaining the proposed objectives. In his opinion, efficiency translates in the individual's self-confidence, in his or her ability to solve tasks. Along the same lines, the research conducted by Decker (1989, as cited in Zlate, 2004, p. 178) emphasises the fact that self-efficiency depends on engaged psychic resources. Decker stresses the importance of the following: the will to reach formulated objectives, confidence in succeeding and also in one's own skills, the decision to reach these objectives, which empowers personal skills and resources.

It is common knowledge that most of the learning tasks are given in class. In this context, it is natural to posit the question as whether the class represents or not a determining factor for learning and success. A possible answer is provided by Fabunmi et al. (2007). In a study conducted on a sample of secondary school students in Nigeria, they prove that there may be a significant correlation between students' performance and their participation in class activities. When speaking of class, Fabunmi refers to group dimension, relationships between students, and their participation in class activities. Performance is influenced only inasmuch as the three aspects of the class factor are analysed as a whole. Separately assessed, they do not significantly determine performance. One may infer that performance also has a social dimension. It is not only achieved at the individual level but also through cooperation and engagement of the entire group in solving learning tasks.

Also, Farrington et al. (2012) analyse the extent to which the non-cognitive factors influence the long-term success, as well as the importance of these factors for students or for teacher. Farrington selects five non-cognitive factors: academic spirit, perseverance, school behaviour, socializing skills, and learning strategies, each being separately conceptualized. Thus, perseverance translates through purposefulness,

self-discipline and self-control. Academic spirit reflects in the students' sense of belonging to the class, in the way in which the class puts forward the activity of each student. Learning strategies comprise students' learning abilities, learning self-ordering skills, goal-setting, whereas academic behaviour is analysed by way of the following aspects: presence in school, doing home assignments, engagement in school activities, and learning. The research undertaken by the professors of Chicago University has led to the following conclusions: students' academic performance depends on the concomitant action of the five non-cognitive factors of learning. Academic spirit, as a result of the socio-cultural context of the class, determines a certain level of perseverance which, in turn, is reflected in academic behaviour, which also depends on students' socialising skills (interpersonal skills, empathy, assertiveness, cooperation, responsibility). In turn, learning strategies influence students' class spirit, perseverance, behaviour, and academic performance.

An interesting approach may be found in the research conducted by Roy et al. (2013), which lays emphasis on the fact that academic performance should not be measured exclusively by way of grades. To this effect, the aim of the research was that of identifying the possible relation between teenagers' academic performance and their *emotional intelligence* (EQ). This study was based on a real, universally valid case: despite a high IQ and previous positive performance, some students are unable to reach their maximum potential. However, many mediocre students succeed in graduating from university. The results indicate a positive correlation between low EQ and the level of motivation for academic performance. In other words, low EQ determines low academic performance. Admitting that any student's aim is to achieve high academic performance, it is important for students to acquire both learning strategies and strategies of emotion self-control. What is more, they need skills to recognise their own emotions and to correctly assess some circumstances. One infers that students with high EQ are more self-confident, and approach school and life challenges more efficiently.

The literature in the field lays emphasis on the fact that learning performance is also influenced by demographic variables, such as: age, gender, marital status. For example, the studies of Kasworm (1990) and Richardson (1995) have pinpointed the relation between the age factor, attitude towards learning, and performance. Paradoxically, although aging affects the cognitive development, the results prove that adults achieve as good performance as the youth. They approach learning more thoroughly, and are more scrupulous in solving the tasks they receive. In our opinion, these results may also be explained by the fact that adult age is generally associated with a higher level of responsibility, which determines a greater engagement in learning activities. A similar study undertaken by us in 2013 reveals the fact that attitude towards learning significantly correlates with age. Our results have indicated that the subjects older than 40 years of age are more motivated than their younger peers, set goals and wish to accomplish them (Anghelache, 2014).

Another interesting study was carried out by Garkaz et al. (2011) on a sample made up of 450 subjects, students of an Iranian university, with the following

variables: gender, field of study, marital status, employment status, interest in learning, and family patterns (either encouraging or discouraging). The study aimed at establishing the extent in which these factors influence academic performance. The results they obtained prove that performance is strongly influenced by gender and interest in the field but that there is no obvious correlation between social status, marital status, and family pattern on the one hand, and performance on the other hand, although family plays a certain role in students' academic orientation. In what gender is concerned, the results seem to prove that women have higher level of performance than men, which comes to support previous studies, such as Koh and Koh (1999), Gracia and Jenkins (2003) or Vickers et al. (2003). The *field of study* also influences academic performance (for example, students in Mathematics scored significantly higher than students in any other fields).

The impact of the study field has also been demonstrated by Shah and Mahmood (2011), whose investigations have revealed that the number of students who opt for Sciences is lower and lower, due to the fact that many consider the curricula in this field as boring or inappropriately taught which triggers their negative attitude towards learning. This conclusion is also supported by Norwich's and Duncan's observations (1990), who maintain that the level of motivation determines the attitude towards science. Thus, motivated students manifest a positive attitude towards science and engage in solving the learning tasks provisioned by the curriculum.

It is certain that each educational curriculum has its own requisitions and learning experiences. We have obtained similar results from an investigation undertaken in 2014 on a sample made up of 180 subjects, which attempted to identify a possible relation between the field of study and the attitude towards learning. Our results have indicated such a connection, but we have observed that the students in Philology, Medicine, Economics and Law scored higher in attitude towards learning than the students in History, Philosophy and Theology. The different results obtained by correlating the two variables make us come to the conclusion that the specificity of the socio-cultural context also plays a particularly important role. Thus, the way in which society valorises a certain field of study is important for Romanian students (Anghelache, 2015).

Marital and employment status do not significantly influence academic performance. For example, students who are employed and are, implicitly, financially independent, record better results compared to those who do not work, but the differences are not significant.

Learning style and *personality factors* are also variables which may be correlated with academic performance. Eysenck's personality theory establishes three fundamental dimensions of personality: extraversion, neuroticism and psychosis, each of them affecting any activity of an individual, including learning, through neuronal inhibition or excitation. Thus, the extrovert tend to expedite learning tasks due to the fact that they are energetic, easily bored, communicative, sometimes authoritative, assertive and in constant search for new challenges. At the opposite pole, the introverts linger more on tasks due to a higher level of cortical alert. In turn,

neurotic people manifest anxiety, depression, self-consciousness, all associated with low or negative self-esteem.

Pintrich and DeGroot (1990) have also concluded that personality influences learning. Their research has proved that students of a certain personality type and ability of self-ordering activities are more focused on solving tasks, displaying learning skills.

Based on the personality theory, Sadeghi et al. (2012) undertook a study which aimed at identifying a possible correlation between performance acquired in reading and comprehension of a text in a foreign language, types of learning, and students' personality type. They walked in the footsteps of other researchers who had conducted similar studies (Blair, 1982; Brown, 2000; Carrel et al., 1996). Sadeghi insists that there is significant relation between students' personality traits, learning style, and academic performance in general, but these factors seem less relevant in the acquisition of a foreign language. In this respect, the studies undertaken by Brown (2000), Carrel et al. (1996), Ackerman et al. (1996) (as cited in Sadeghi, 2012) illustrate a fundamental idea: success in the acquisition of foreign languages is ensured by the interdependence of cognitive, affective-motivational and personality factors. Likewise, personality traits play a fundamental part in the development of knowledge, determining the engagement level and individuals' choices of intellectual activities. The importance of the personality factor is also stressed by Duff et al. (2004). Their research has aimed at establishing the way in which the personality type and the approach to learning (superficial versus strategic and profound) influence students' performance. The results confirm what one can already intuit: thorough approach to learning is associated with extroversion and openness towards experimentation, whereas strategic approach positively correlates with extroversion and negatively with neuroticism, both ensuing success. Superficial learning negatively affects performance and triggers failure. These results may be a useful signpost for teachers, in the sense of their developing some learning competences and intellectual work types for students, based on their own personality, but also in promoting differentiate teaching, with reference to the students' needs and to their personality traits. Along these lines, also worth mentioning is the research undertaken by De Raad et al. (1996). The results of their investigation underline the fact that the influence of some factors such as interest for school, the will to study or persistence in solving tasks, correlates to a lesser extent with school performance, and the latter is much more influenced by the individual's personality traits.

Our research on the personality-academic performance axis illustrates the existence of certain typological trends. Generally speaking, students with higher levels of performance tend to be more generous, engaged and vindictive (internal *locus of control*).

Furnham (1992) brings forth a novel element in the relation between performance and personality, i.e., intelligence. He considers that both the intelligence and the

personality traits of the student are essential predictors of the academic outcomes. Suffice it to consider the case of psychotic people who fail, which negatively affects their academic performance.

The relation between personality and performance is, however, controversial, in the sense that not all researchers correlate the two factors. A good case in point is a study undertaken by Bishop Clark et al. (2007). The subjects' personality was measured by Myers Briggs Type Indicator model, whilst performance sighted the outcomes of an e-learning course. Bishop maintains that personality traits are indeed relevant for students but, in what academic performance is concerned, other factors should also be traced. His conclusion is based on the fact that his results indicate that personality traits do not influence academic performance and that they actually represent two distinct factors.

The literature in the field is inexhaustible, and the results cited make us consider that the approach to learning exclusively from the perspective of cognitive variables is no longer justified, which is the reason why it is important for school to reconsider its teaching strategies, by valorising the students' needs and their personality.

To sum up, we can assert that the learning process is multi-determined, and that students' success or performance is not an outcome of the exclusive action of cognitive mechanisms. Aside some inherent controversies, most researchers emphasise the fact that school learning is strongly influenced by factors which depend on each student. We contend that non-cognitive factors make a difference between the student's potential and the actual academic success, as these factors activate the energetic resources critical for any learning process.

LEARNING MODELS AND PERSPECTIVES: THE EXPERIENCE OF ROMANIAN EDUCATION

The choice for the analysis and understanding of learning for the perspective of the non-cognitive variables goes beyond the sphere of a simple study in the field of education, for the simple reason that the learning process cannot be truly understood without laying emphasis on the affective-attitudinal and volitional factors. Probably, it is the single way of understanding what the school learning process actually entails, what are its generating and mechanisms, what are its implications or long-term advantages at the individual level. We must specify, however, that, regardless of the type of analysis employed, the actual learning process sets new objectives, different from those of traditional learning, associated with the requirements of a new type of society. The objective analysis of the literature in the field and the reference made to our previous studies allow us to accentuate a number of perspectives of understanding learning. Thus, in our opinion, the learning process may be analysed from at least five perspectives: axiological, psychological, pedagogical, social and managerial.

The Axiological Perspective

Aside from the requirements of the educational curriculum, learning relates the axiological referential of the teacher and student, their values and beliefs, both, against the background of the values and exigencies promoted at the level of the educational system, but also at the global, social level. From this point of view, academic performance depends on the way in which students appreciate the learning contents and experience provided to them. This way, learning becomes a matter of personal choice in agreement with what matters for students. The learning process should not be interpreted only in the sense of transmitting knowledge but also through students' expectations. Each student has his or her way of valorising school and learning, which is the reason why the teacher must motivate the student to learn, must make him or her interested in the act of learning. To this end, it is necessary that the designed requirements to target more than knowledge reception and reproduction, by not overbidding the cognitive aspect of learning.

The Psychological Perspective

The school learning process also has strong psychological implications. It weighs up two apparently contradictory aspects: the teacher's expectation regarding the students' learning activity and the latter's needs. The attempt to balance these aspects may determine conflicts, whose overcoming requires that both learning agents (teacher and student) show open-mindedness and ability of an objective analysis of the educational context. Learning should not be construed as compulsory but as an internal need of the individual. This is the reason why each student accesses only that knowledge he or she sees as relevant in his or her development process. Psychologically speaking, learning is defined as "the acquisition of new behaviours as a result of the repeated action of some stimuli over the organism and of the fixation of some reactions. It is basically an active assimilation of information and an acquisition of new operations and skills" (Neveanu, 1978, p. 393). Moreover, the quality and consistency of the learning process directly depend on the flexibility and mobility of the cognitive structures but also on the affective-motivational and conative particularities of the individual.

Therefore, from the cognitive point of view, students valorise their own mechanisms which help them process the information. Of course, we are referring here to students' intellectual capacity and skills, to the quality of their mnesic processes, but also to their individual representations of learning. Experience has shown that:

- Pupils and students place themselves differently in the learning process, engaging in accordance to what is important to them and to the way they see themselves in the future;

- The criteria for the valorisation of learning are, generally speaking, subjective. Sometimes, students may project their evolution unrealistically, based on their own beliefs, expectations, mentalities or attitudes, which become the main mediators between them and knowledge, helping them cope with the learning requirements.

At the affective level, the way in which school, in general, and the teacher in particular generate the learning process may trigger a certain type of affectivity, either positive or negative. If the learning promoted by the school is differentiated according to the students' needs and expectations, this may induce motivation, engagement, persistence in task-solving, pleasure to learn. On the contrary, a learning process which forces the students capitalise only their repetition skills, may trigger demotivation, a negative perception over the future development, irritability (induced by the tendency of considering learning useless); stress, exhaustion and aggressiveness; anxiety (determined by the students' fear that they would never be able to memorise the whole amount of information); the sentiment of inefficiency, negative self-image.

The self-image is particularly important, as it is in relation to the dimension of the real and future self. At the level of the real, cognitive self, it is important how the student structures the information about him/herself. In this case, a student with a negative self-image, who is unable to attain the goals he or she has set, tends to see himself/herself incapable of adequately responding to the school requirements. In the case of the affective self, the students with an affective balance are self-assured, confident in their success, and actually reach satisfactory outcomes. The others tend to perceive danger in solving the learning tasks they are given. The social self is interrelated with the affective self. The former is responsible with the individual's adaptive behaviour. Personal ideal and motivation may also influence the attitude towards learning. In what the future self is concerned, it refers to the way in which every individual perceives and assesses his/ her potential of personal development, the manner in which s/he projects him/herself into the future. The future self is made up of all goals, motivations and aspirations of an individual. The ones who are motivated enough and confident in their own possibilities manage to put both their cognitive and non-cognitive resources to work, regarding learning as an opportunity for personal development.

The Educational Perspective

In the case of school learning, this is one of the most important perspectives, all the more as understanding the specificities of school learning depends on the requirements of the entire educational system. From this perspective, learning is synonymous with *instruction*, more precisely with school instruction. Unlike the educational influences exercised by other factors (e.g. family, mass-media), school learning is the only systematic process, rigorously designed, organised and carried

out so that to generate the learning process. In the opinion of the researchers in the educational field, instruction represents "a planned construction of intellectual development by which students manage to assimilate and make operational the system of knowledge, abilities, skills and attitudes according to the goals of an educational system" (Neacşu, 1999, p. 62).

Generally speaking, educationalists are interested in finding the most plausible answer for questions such as: *what is and how is learning produced?* A definitive answer to this question can only be given by making reference to psychological investigations. Most of the time, there is a tendency to refer to students as containers to be filled up with knowledge, assessing them with standard performance grids. In this case, teaching and, implicitly, learning represent mere roads to failure. In truth, it is necessary to move away from the idea of the standard (ideal) student, who would be characterised by constant engagement in solving tasks, positive attitude towards school, special interest in knowledge, high motivation level, high academic performance. The psychologists' research, together with the teaching experience, prove that every student is unique: they relate to school requirements in different ways, they make efforts to various degrees, their learning motivation depends on their own mentality and learning necessities, which are perfectly illustrated by academic performance.

From the educational perspective, stress should also be laid on the teaching process, which must represent a source for the students' learning activities. From this point of view, Smith (as cited in Cerghit, 2008, p. 278) identifies three variables:

a. the independent variable which concerns the teacher's activity during class or extracurricular activities: communication and guidance activities, performative, and expressive activities;
b. the dependent variable which concerns the student's personality, behaviour and engagement (this variable orders the teacher's activity), and
c. the intermediate variable which concerns the totality of the psychic processes engaged in learning: motivation, memory, thinking, attitudes.

The entire teaching undertaking valorises these variables. The quality of learning depends, to a certain extent, on the way in which the teacher is aware of these variables, and on the way in which s/he designs the activity so that teaching would become an intelligent construction of some didactic activities meant to be useful to students. The student should not be regarded only as a product of the learning process but also as a factor involved in the process of building his or her own knowledge.

The Social Perspective

The student is the core element of the learning process but s/he should not be analysed alone but in the context of the relationships established in class, as the student is considered a product of these relations. The research conducted by

Willms (2003) and Fabunmi et al. (2007) confirms the importance of the class, of the sense of belonging and of the group activities in increasing academic performance. In this case, teaching also acquires a psycho-social dimension. Although learning represents an individual act, the behavioural and interactional perspective on learning and teaching underlines the positive effects of the group on the student's performance. Cooperation within the group and intercommunication become an endless source of energies which the students valorise in learning, solve socio-cognitive conflicts and structure thinking. From this point of view, each student engages his or her own beliefs, interests, expectations and attitudes in the learning activities of the group, which gives these activities a strong psychological component. In our opinion, the interactional character of learning illustrates the engagement of two interdependent components:

- *the normative component* – totality of principles and norms that regulate the student's learning behaviour within the group;
- *the affective-attitudinal component* – the type and constancy of behaviour, the contamination and influence degree at the level of the group.

In general, group learning is based on pedagogical and social arguments. The debates within the group and teamwork generate and stimulate learning productivity and efficiency. Students tend to be more creative; they identify solutions more easily, get engaged more and cooperate. At the same time, the group is a source of clarification but also of personal assessment; most of the time, individual performance is in relation to the performance of the others. In turn, group performance depends on individual performance. Group work requires tact and interactive strategies on the part of the teacher, but also to know his or her students well, to propose diversified tasks, and to appropriately allot the designed activities by reference to the independent learning activity. On the part of the students, group work requires exercise and openness.

The Managerial Perspective

Two essential aspects may be identified in this respect: the way in which each student monitors his or her learning activity, and the way in which the teacher handles teaching in order to generate the learning process at the level of students. In our opinion, in what the teacher's action is concerned, it is important that he or she is able to creatively refer to the curriculum, to rigorously design the didactic demarche based on clear objectives, to determine those learning experiences able to trigger changes in students, to adapt the learning contents to the student's real possibilities, to his or her learning style, to simulate the constant and active engagement of the students in solving academic tasks, to reflect on the possibilities to constantly amend the teaching undertaking. Although we apparently discuss technical acts, they in fact suit the exigencies of a didactic process which aims at adequately responding to the necessities of the student. The complexity of the teaching action entails making

decisions on giving effect to the designed objectives: *How should I select the learning contents? What teaching strategies should I use in teaching these contents? What activities should I organise?* Teaching activity must focus on students, on their necessities for development, and to that effect, a very rigorous management is necessary. The student must have freedom of choice to valorise his or her potential.

Beyond these perspectives in the understanding of the learning process, students' academic performance, as well as the level of engagement of the cognitive or non-cognitive variables may be in close connexion with the promoted learning type. The studies we have referred to implicitly illustrate this aspect. The interpretative patterns of the learning process are based on some principles of understanding the role of cognitive and non-cognitive mechanisms in learning, each of these models producing different experiences concerning the manner of valorising the students' potential and their level of engagement in solving the learning tasks they are given. For example, behaviourism promotes the idea that learning determines changes at the level of student's behaviour, but this change is triggered by certain conditioning related to the way in which the student responds to stimuli (learning experiences). It is not about a deliberately assumed, conscientious learning. The attempts and the error have also the role of consolidating students' behaviour. Thus, academic performance is conditioned by the way in which the student's learning activity is evaluated. An activity positively assessed by the teacher gives the student satisfaction and strengthen his or her learning behaviour, whilst negative evaluation breeds dissatisfaction and abandonment. In other words, learning is based on the student's extrinsic motivation. Linnenbrink and Pintrich (2002) point out that one of the predictive factors of academic performance is represented by the student's previous achievements. The behaviourist paradigm promotes the principle of the small learning steps, which reduces errors and determines behaviour which will be further enforced and strengthened.

Cognitivism is a qualitative leap in the approach to the learning process, laying emphasis on conscientious learning based on intrinsic motivation. Also, intelligence, memory, thinking or metacognition are mechanisms engaged in learning. Although they are interested in explaining the learning conditions, the cognitivists lay particular stress on the cognitive system, maintain that learning is the result of the correlation between old and new knowledge. The relation between students and knowledge is mediated by thinking, by processing of information. In this case too, the research undertaken by Linnenbrink and Pintrich is a useful point of reference, as they underline the importance of the cognitive variables in learning. Also, by analysing the variables of the cognitive structure, Ausubel and Robinson (1981, pp. 61–62) refer to:

- the quality of the previously acquired knowledge, which helps the student in the acquisition of new learning tasks for a specific subject;
- the intellectual capacity, reflected in the student's general attitude towards school and in the particularities of the cognitive skills.

According to the two authors, added to these are the quality and the quantity of the didactic material employed. In general, cognitivist thinking is based on expositive teaching strategies, in which the amount of information matters and the student must strive to process and correlate the extant information in his or her cognitive structure.

The constructivist pattern of learning is concerned with the manner in which knowledge is built. From this perspective, learning does not annul the importance of cognition, but doubles it with exercise, with students' motivation and experience, with the effective engagement for discovering knowledge. It is an active learning which promotes the non-cognitive factors: interests, intrinsic motivation, learning styles and level of engagement. Therefore, it is a conscious, assumed learning, based on explorative teaching strategies.

Similarly, the paradigm of social learning promotes the importance of socialising and of the social influence mechanisms in the construction of knowledge. In turn, humanism is nowadays the model that most clearly reflects the importance of the non-cognitive factors of learning. A didactic process which valorises the humanist education principles will analyse the student wholly, with his or her interests, motivations, aspirations and skills. The actual learning is an option of the student, based on his or her experience and on the way in which s/he appreciates knowledge.

A representative of humanism, C. Rogers (as cited in Negreţ-Dobridor & Pânişoară, 2005, p. 118) identifies two learning types: cognitive learning, which strictly emphasizes the memory and the reasoning, in which the individual passively conforms, and empirical learning, which also valorises the affective side of the individual. The latter type entails that the student gets engaged, initiates and self-orders his or her activity in compliance with his or her knowledge needs. It is a learning type which focuses on the student, intrinsically motivated, which encourages learning through discovery and practice. The studies undertaken by Pintrich (1990), Tuckman (1999), Willms (2003), Missoum (2003), Chou and Chen (2008), Lavasani (2011), Riaz (2011) confirm the postulates of humanist learning.

Laying emphasis on either cognitive or non-cognitive aspects of learning also depends on the teacher's perceptions on the learning process, on the depth of his or her analysis of the learning outcomes and of their determining factors. In general, the cognitive accentuates the idea of learning in tight connexion with transfer, whereas the non-cognitive rather favours full learning and the efficiency of instruction.

As stated earlier in this presentation, we believe that learning is a socio-culturally determined process. In asserting this, we have in mind the evolution of the learning systems in general, the changes of the learning paradigms, which particularly concern Romanian education. The last 25 years have represented an evolution in the manner of designing and carrying out the teaching process. If until 1989, Romanian learning strictly valorised the cognitive aspects of the learning process, the reforms in the field have made us aware of the importance of referring to the actual learning necessities of the students, all the more as the youth's interest in learning and

educational needs have radically changed. Within the European space, Romania's case is not singular (see also UK, France) but the context that has triggered change was completely different.

One may affirm that traditional Romanian education promoted the pattern of behaviourist learning or, at the most, that of classic Cognitivism. Learning used to be synonymous with memorising and faithfully reproducing information from textbooks. Knowledge only meant to know what others had written. Therefore, it was an intellectualist approach to learning, in which the student played a passive role. Academic success and performance depended on the student's ability to faithfully render a great amount of information, with minimal exercising and also with minimal effects at the level of the student's personality. Traditional-cognitive learning used to disregard the students' personality, and teaching was carried out through expositive teaching strategies. The oversize of cognitive learning was a consequence of the fact that teaching activity was exclusively construed from the teacher's actions perspective, which determined mechanical receptive-reproducing learning on the part of the students. In general, answers were sought for questions such as: *what or how much should I teach?* and only to a lesser extent for questions such as: *how does the student learn? How should I teach?*

All educational systems are structured on two major components: knowledge (the values of the knowledge fields) and experiences, the latter having the role of ensuring the development of students' skills through practical exercise. From this perspective, traditional Romanian education excessively promoted the accumulation of knowledge and laid too little emphasis on the formative aspects of education, which reflected in the students' attitude towards learning. It was considered that success was measured in the individual's assimilation skills, in his or her level of cognitive development.

During the last 25 years, Romanian educational system has changed its philosophy, and the reforms have imposed a new understanding of the learning process. This is now construed as an active and deliberate act of processing, restructuring and integration of knowledge, in compliance with the student's necessities, with what is important for him or her, and in view of changing the student at the cognitive, affective and action level. The formative dimension of learning has been thus granted significance. The new type of learning goes beyond the behaviourist approach and comes closer to the constructivist paradigm, activating the entire potential of the student.

In the context of placing the educational practices against the new philosophy of learning at the level of the education process, the efforts tend to focus more and more on the analysis of the present-day needs and interests of the students, inasmuch as on the reconsideration of the factors able to determine academic success or performance. The new reality of the education proves more and more that the students' engagement, their efforts and time allotted to solving the tasks they are given, as well as the level of performance reflect more clearly the attitude towards learning and the social experiences. The present-day school learning process

valorises various psychological, epistemological and pedagogical orientations. Romanian school becomes more and more aware of the fact that heterogeneity of interests, levels of development of the cognitive skills, motivation, and assessment criteria of learning make it rethink its teaching strategies and diversify its learning experiences. This revision must also concern school evaluation. It becomes more and more obvious that promoting formative evaluation is necessary, that is to say, aguiding evaluation capable of assessing not only the level of acquisition of the information taught but also the students' efforts in acquiring these outcomes, their recorded progress, their perseverance in solving tasks, their learning behaviour, and last but not least their motivation and attitude towards solving school tasks.

The assessment of the student from a cognitive point of view is extremely important but not also sufficient if the objective is that of increasing academic performance. This aspect is more and more obvious from the multiplication of extracurricular activities and from the importance acquired by informal learning.

Our plea for valorisation of the non-cognitive factors of learning is based on a few arguments:

a. At the level of any study field, knowledge is on the rise, and the volume of information a teacher should address is enormous. In this context, rigorous selection is necessary, as well as adopting a fresh perspective over the teaching strategies, so that school activities to address the knowledge necessities of all students;
b. Approaching the constructivist model of learning makes the teacher aware that each student must assume learning. To this end, it is necessary that school makes the student interpret and reorder knowledge in accordance with his or her interests;
c. Curriculum revisions from the perspective of full, active learning;
d. Flexibility of the learning options provided by the school;
e. Ensuring equal chances for personal development for all students, allowing everyone to activate his or her maximum potential;
f. Development of the students' learning attitudes and interests.

The objective and thorough analysis of the implications of the learning process leads to the conclusion that all variables making up the students' learning mechanism are complementary. The learning type promoted by the school is responsible with laying stress on one or another of these mechanisms. As far as we are concerned, we militate in favour of the reconsideration of the action dimension of learning by becoming aware of the importance of all internal resorts which mobilise the student during the learning process.

CONCLUSIONS

The large variety of the studies in the field and the educational experiences in different countries underline the complexity of the learning process. From this point on, two critical conclusions may be drawn:

- The functionality of the school learning process should be sought for in the in-depth analysis of all factors which determine and support the students' learning behaviour;
- School learning process places the student in the context of interactions between his or her cognitive structure (e.g. thinking, memory, imagination) and non-cognitive factors, equally responsible for his or her reaching of a certain academic performance level.

It is also worth mentioning that, from a psychological perspective, when non-cognitive factors engaged in learning are in focus, one speaks about affectivity, motivation, will, attentiveness, or personality traits. Nonetheless, more and more researchers bring into discussion factors that concern the class (Fabunmi, 2007), the quality of the teaching process (Covington, 2000; Dalgety, 2003), the promoted learning type (Chou & Chen, 2008), demographic factors (Richardson, 1995; Garkaz, 2011) or the field of study (Norwich & Duncan, 1990). At the first glance, accepting these variables as non-cognitive factors of learning may be considered a deflection from the strict rules of psychology. In truth, researchers actually draw on the fact that school learning process is sometimes determined by variable which we tend to ignore or which we consider as having mere contextual manifestation, without actually influencing students' performance.

The analysis of the non-cognitive factors engaged in learning is particularly important for teachers and decision-makers, as it entails an objective reflection on educational policies, academic success and performance, efficiency of the educational system, the degree of differentiation and individualisation of teaching or the quality of the learning experiences provided for students. Also, comparing the experience of the Romanian education and our studies with the outcomes of other researchers, we infer that the school learning process is also determined by cultural influences which promote a certain pattern of the teaching-learning process. We further contend that the increasingly great interest in the non-cognitive factors of learning is supported by a few arguments:

a. Psychological Arguments
   The act of learning should not be felt by students as something externally-imposed; on the contrary, learning should be perceived as an internal need of the individual. Furthermore, learning is not a mechanic act, independent from the student's will. It is only obvious that the student engages his or her values, aspirations, feelings and personality traits in learning, while constantly referring to the others and to his or her ideals. Under these circumstances, the design of the learning process should consider these variables so that it could generate complete learning.

b. Pedagogical Arguments
   It is getting more and more obvious that learning and teaching are two processes which must be differentiated and individualised for each student. Their approach

from the perspective of the 'standard student' leads to failure. Any teacher who is interested in making his or her activity more efficient must understand the learning mechanisms so that s/he is able to adequately respond to the student's needs. In this case, it is not sufficient to excessively dwell on the individual variables which influence the student's learning behaviour. More often than not, teaching strategies, the diversity of didactic tools and materials, the quality of the social relations at the level of the class influence, at least to the same extent, the outcome of a performance level.

To sum up, regardless any personal options and experiences related to learning, an objective reflection on the non-cognitive factors and their interaction with the cognitive mechanisms engaged in learning is necessary, as well as the consideration of the manner in which knowledge can be built for students.

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PART III

EVIDENCE FROM EMPIRICAL RESEARCH STUDIES

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8. NON-COGNITIVE INFLUENCES ON ACADEMIC ACHIEVEMENT

Evidence from PISA and TIMSS

INTRODUCTION

Recent large-scale international assessments of school achievement [e.g., the Programme of International Student Achievement (PISA) and the Trends in International Mathematics and Science Study (TIMSS)] contain background questionnaires that collect information about student characteristics, teaching practices, schools' administrative practices as well as demographics and system-level investments related to education. The primary reason for this exercise is to respond to a need to examine correlates of achievement – i.e., what enhances or hinders students' educational attainment. Although PISA and TIMSS routinely collect such data, the league tables of countries' cognitive achievements tend to be the main focus in international comparisons. Yet, non-cognitive attributes expressed in the background information questionnaires may be as relevant, perhaps even more pertinent, for governments in evaluating how their students are "really doing" and making long-term macro-level decisions that can affect the overall well-being of individuals and the system. For example, international student data shed light to a long-standing suspicion among researchers that students in Confucian countries have higher levels of anxiety and self-doubt although they can produce "right" answers to the tests and demonstrate high levels of proficiency in school subjects (Lee, 2009). In particular, Stankov (2010) argued that system-level factors in Confucian-type schooling may influence well-being and life satisfaction among students, and in the long run, can affect social interactions and health of the populations.

In the following sections we shall first outline a series of empirical studies that have led us to the conclusion that non-cognitive variables are significantly related to cognitive performance. We then elaborate on the predictability gradient that represents the ordering of non-cognitive measures in terms of the strength of their relationships to academic achievement, and point to the importance of non-cognitive measures of confidence. Recent work on confidence links educational assessment to decision making processes. In the last section we report on the link between social conservatism and academic achievement and emphasize the need to consider PISA and TIMSS cognitive and non-cognitive measures in relation to a broader set of

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cultural and social indicators, which are also available in reports of international bodies like the United Nations (UN) and the Organisation for Economic Co-operation and Development **(**OECD**)**.

BACKGROUND

Our own interest in non-cognitive influences on educational attainment was sparked by the outcomes of a review of the non-cognitive constructs that may be related to reading and mathematics achievement in K-12 (i.e., Kindergarten, primary and secondary) school settings (Lee & Shute, 2010). The review provided a comprehensive summary of constructs that have been identified as the most important in students' academic performance in the educational psychology literature over the past 60 years. At first, tens of thousands of published studies were located that argue for the importance of non-cognitive constructs on student achievement (cf. Lee & Shute, 2010, p. 186). The scope of the review was reduced to a body of literature that can claim moderate to strong effect sizes. Some of the key constructs included in the reviewed studies include: *adaptability, attitude, affect, anxiety, belief, basic skills, classroom behaviors, control strategies, cooperation, curiosity, discipline, effort, elaboration strategies, emotion, engagement, extracurricular activity, habit, help-seeking, homework, independence, interest, leadership, learning strategies, learning style, liking, memorization, metacognition, motivation, non-cognitive, note-taking, organizational skills, parenting, parental involvement, peer, peer-teaching, perseverance, principal leadership, resilience, school climate, school leadership, school organization, sense of belonging, self-confidence, self-concept, self-control, self-direction, self-discipline, self-efficacy, self-regulation, social competence, social context, social development, social relation, study habits, student-teacher relationship, teacher efficacy, teacher support, teacher relation, teamwork, test anxiety, test-taking strategies, thinking skills, time management, time spent on tasks,* and *value*. The authors concluded that these non-cognitive constructs can be grouped into the following four broad domains: (1) student engagement which includes motivation, self-concept, self-efficacy, enjoyment, and time management; (2) students' learning strategies as to how students control, manipulate, plan, and understand the learning process and outcomes; (3) school climate variables that include schools' emphasis on academic and extracurricular activities, teacher support, and school leadership; and (4) a set of factors which are primarily related to parents (i.e., how parents shape, their child's learning and attitudes) and peers (i.e., how students perceive norms, behaviors, attitudes, and support among their peers). These constructs may all be tied together under the umbrella term "non-cognitive" aspects of learning.

Recent studies of Hattie (2009) and Lee (2014) also highlighted the importance of non-cognitive factors in student learning. Hattie (2009) examined the effects of a wide range of student-, teacher- and school-level variables on student learning.

The overall relationship between students' attitudes and dispositions (i.e., non-cognitive variables) and achievement was summarized using Cohen's *d* effect sizes based on his meta-meta analyses of over 50,000 studies. Among the six student-level non-cognitive variables, the effect size was the greatest for *engagement* (*d* = .48) and *motivation* (*d* = .48), followed by *self-concept* (*d* = .43), *reducing anxiety* (*d* = .40), *attitude to mathematics/science* (*d* = .36), and *personality* (*d* = .19). From among the teachers' non-cognitive qualities, *teacher clarity* (*d* = .75), *teacher-student relationships* (*d* =.72), *not labeling students* (*d* = .61), and *teacher expectation* (*d* = .43) were highlighted. Large effect sizes were also reported for the five school-level non-cognitive variables: *classroom behavior* (*d* = .80), *peer influences* (*d* = .53), *classroom cohesion* (*d* = .53), *classroom management* (*d* = .52), *implementation of social-skills programs* (*d* = .40), and *decreasing disruptive behavior* (*d* = .34).

In Lee's (2014) study the focus was on cross-national generalizability of the effects of students' non-cognitive variables on academic performance using the PISA 2009 data. Among a host of attitudinal and learning strategy-type non-cognitive variables (i.e., enjoyment, attitude toward school, student-teacher relations, diversity of reading, online reading, and five learning strategy variables), students' *enjoyment* and students' ability to *summarize* reading text were the two best predictors of reading achievement in both Eastern and Western high-performing countries (see Lee, 2014, Table 3). Extensive analyses in Hattie's (2009) and Lee's (2014) studies certainly demonstrated the critical influences of non-cognitive factors on student learning, from student-, teacher-, and school-perspectives and cross-nationally.

NON-COGNITIVE MEASURES IN THE PISA 2003 STUDENT QUESTIONNAIRE

Following on from the recognition that it may be worthwhile to examine a variety of non-cognitive constructs simultaneously, Lee and Stankov's (2013) study was focused on the investigation of a potential higher-order factor structure among 15 primary variables/scales employed in the PISA 2003 project. Each of these 15 scales corresponds to Lee and Shute's (2010) non-cognitive framework, with *anxiety, self-concept, self-efficacy, instrumental motivation, interest, attitude toward school, sense of belonging* to the student engagement variables; *control strategies, elaboration, memorization, competitive learning, cooperative learning* in the students' learning strategy variables; *and student-teacher relationships, teacher support, and disciplinary climate* as a cluster of school climate variables. Several models were tested, hypothesizing the structure among the primary first-order 15 measures and their relationships to the PISA 2003 mathematics achievement scores. The analyses indicated a good model fit when the 15 primary variables defined four second-order factors representing academic self-beliefs, motivation, learning

strategies, and attitudes toward school and a non-cognitive factor extracted from the four broad domains at the third order. This general factor of non-cognitive dispositions was defined mostly by motivation (β = .82) and attitude toward school (β = .72) while the standardized loadings of the self-beliefs factor on this third-order factor were the lowest (β = .25, see Lee & Stankov, 2013, Figure 1). This means that three students' self-belief variables – anxiety, self-concept, and self-efficacy – were somewhat distinct from the other 12 primary variables. They have relatively little in common with the rest of the non-cognitive battery.

The second aim of the Lee and Stankov (2013) study was to examine the effects of the non-cognitive measures and higher-order factors derived from these measures on mathematics achievement scores of the PISA 2003. The most plausible Structural Equation Model (SEM) had two significant and equally strong paths leading to the mathematics achievement. One path was from the broad third-order, non-cognitive factor. But there was a surprise: the broad non-cognitive factor correlated *negatively* with the PISA mathematics scores. Thus, the more motivation one has to do mathematics, the more one uses cognitive strategies in solving mathematics problems, and the more positive attitude one has towards school, the lower his or her overall PISA mathematics score tends to be! A closer examination showed that this is due to the fact that most of the fifteen scales had small, near zero, but negative raw correlations with mathematics when the data were analyzed pan-culturally (i.e., treating each data point separately without taking into account the group/country membership). These low correlations add up to a significant negative predictor of achievement at the third-order level. The other significant paths in the SEM model were from the three measures of self-beliefs – self-concept, anxiety and self-efficacy – to the mathematics achievement. Each of the three self-beliefs primary measures was individually linked to the mathematics achievement scores, independent of the third-order, non-cognitive general factor. Self-efficacy was the strongest positive predictor and its predictive power was comparable to that of the common part of all 15 primary variables captured by the general non-cognitive factor. As such, domain-specific (i.e., mathematics) self-efficacy (i.e., one's belief that he or she can solve a math problem like calculating the square footage of a room) turned out to be the best non-cognitive predictor of mathematics achievement in the PISA 2003 data.

Two conclusions follow from Lee and Stankov's (2013) study. First, self-beliefs, and self-efficacy in particular, are the best predictors of achievement in mathematics among the international samples of the 15-year olds who participated in the PISA 2003 survey. Thus, psychological processes captured by the self-beliefs measures do matter. Second, measures of motivation (both intrinsic and extrinsic), strategies, and attitude towards school are not as important predictors as what has been shown in many empirical studies conducted locally within the single-country settings.

NON-COGNITIVE MEASURES IN THE TIMSS 2003 STUDENT QUESTIONNAIRE

Before the OECD's PISA received much attention from educators around the world, the International Association for the Evaluation of Educational Achievement (IEA) was the main organization that carried out large-scale cross-national student assessments. Their first cross-national studies, known as the "Pilot Twelve-Country Study", were conducted in 1960 with Belgium, England, Finland, France, Germany, Israel, Poland, Scotland, Sweden, Switzerland, United States, and Yugoslavia for mathematics, reading comprehension, geography, science, and non-verbal ability (refer to http://www.iea.nl/pilot_twelve-country_study.html for more information, also see Naemi et al., 2011 for the history of other international student assessments). The current 'form' of the TIMSS (Trends in International Mathematics and Science Study) was launched in 1995 with 46 parcipating countries, and has been conducted every four years (1999, 2003, 2007, and 2011) with more than 60 countries to participate in the TIMSS 2015. The core non-cognitive variables that have been measured across the 2003, 2007, 2011 TIMSS include: *students' self-expectation of educational level, positive affect to mathematics and science, confidence with mathematics and science, valuing mathematics and science, engagement in math and science lessons, feeling safe in school,* and *attitude toward school*.

The TIMSS 2003 assessment year coincides with the PISA 2003 assessment cycle. From the TIMSS 2003, cross-national data were available on *students' self-expectation of educational level, confidence with mathematics, confidence with science, valuing mathematics, valuing science, feeling safe in school,* and *attitude toward school.* When the correlations were calculated pan-culturally, the order of the strength in their relationship to the TIMSS mathematics was found from *student self-expectation of educational level* (r = .30)*, feeling safe in school* (r = .26)*, confidence with mathematics* (r = .21)*, confidence with science* (r = –.01)*, valuing mathematics* (r = –.09)*, valuing science* (r = –.18)*,* and *attitude toward school* (r = –.19)*.* As such, students' self-expression of academic aspiration was the best non-cognitive variable for both mathematics and science in the TIMSS 2003. Oddly enough, the exact same order was retained with respect to the science achievement scores (i.e., confidence with mathematics was a better predictor of science achievement than confidence with science)! On the other hand, students' overall attitude toward school showed *negative* correlations with both mathematics and science achievement scores!

When the same variables were analyzed for the within-country level correlations with the TIMSS 2003 mathematics scores, the order of 'importance' slightly changed. Now *confidence with mathematics* shows the highest correlation with the mathematics scores among the seven TIMSS 2003 non-cognitive variables (r = .373). It is followed by *students' self-expectation of educational level* (r = .367)*, confidence with science* (r = .19)*, valuing mathematics* (r = .15)*, feeling safe in school* (r = .11)*, valuing science* (r = .09)*,* and *attitude toward school* (r = .03)*.* Most

noticeable changes in the order are found in *confidence with mathematics* (r = .21 in pan-cultural analysis increasing to r = .373 in the within-country analysis); and in *feeling safe in school* (r = .26 in pan-cultural analysis dropping to r = .11 in the within-country analysis). Other than the changes in the strength of the correlation, what is also noteworthy is that (1) negative correlations which appeared in the pan-cultural analysis no longer existed in this country-average correlation; and (2) with the exception of *students' self-expectation of educational level*, both confidence-related variables – *confidence with mathematics* and *confidence with science* – showed stronger associations with the mathematics achievement scores than the other non-cognitive variables in this TIMSS non-cognitive variable list.

Before leaving this section, it is necessary to point out that TIMSS' measures of confidence differ from the measures employed in our own work which will be described in a later section of this chapter. In short, TIMSS's *confidence with mathematics* refers to a general feeling of competence in solving mathematics problems whereas our measurement of confidence is based on "real-time" answers to a test item by asking the respondents to report on their confidence level right after they solve a given cognitive problem or task.

PREDICTABILITY GRADIENT OF MAJOR NON-COGNITIVE DOMAINS

Several studies of ours (Morony, Kleitman, Lee, & Stankov, 2013; Stankov, 2013; Stankov, Lee, Luo, & Hogan, 2012; Stankov, Morony, & Lee, 2014) were carried out to assess predictive validity of non-cognitive measures. These studies employed items from the PISA 2003 item pool together with a host of other scales. This body of empirical studies was summarized in Stankov and Lee (2014a; see also Stankov, 2013), where a large number of non-cognitive measures that have been most extensively examined to date were classified and ordered in terms of their effect sizes (e.g., correlations, regression coefficients, and path coefficients) on students' cognitive performance, including achievement and intelligence. A gradient of predictability of non-cognitive variables was proposed by Stankov (2013) where correlation coefficients lower than r = .20 were treated as 'non-substantial'; correlations between r = .20 and r = .35 as 'moderate'; correlations greater than r = .35 as 'substantial'; and correlations greater than r = .45 recognized as 'high importance' in educational/psychological studies. Four sets of psychological measures emerged from this review (Stankov, 2013).

(1) *Psychological constructs, largely independent of cognitive performance*. Many non-cognitive measures are poor predictors of achievement and intelligence. The list includes measures of depression, well-being, toughness and modesty as well as motivation and learning strategies as mentioned above. Among the Big Five measures of personality, extraversion and neuroticism do not correlate with the ability measures. On the other hand, agreeableness and conscientiousness occasionally show correlations close to the r = .20 mark.

(2) *Psychological constructs that reflect a moderate level of relationship to cognitive activities*. Measures of rationality, self-assessment of intelligence, and domain-specific self-concepts correlate up to $r = .35$ with cognitive performance. Among the Big Five personality measures, the highest correlation (around $r = .30$) is with the openness to experience scale.

(3) *Psychological constructs that may be seen as 'substantial' correlates of cognitive performance*. Self-efficacy and anxiety show correlations reaching $r = .45$ with achievement test scores of the corresponding domains. This finding was supported by large-scale international studies (i.e. PISA, see Lee & Stankov, 2013).

(4) *Psychological constructs that are highly related to one's cognitive performance*. The best predictors of any kind of cognitive performance turned out to be the measures of confidence, expressed as a self-evaluative belief in the correctness of one's cognitive act. The traditional measure of this kind is by use of confidence ratings. Frequently reported correlations are $r = .45$ and higher.

Further evidence relevant for the predictability gradient hypothesis became available in 2014 from five studies reported in the Special Issue of *Educational Psychology*. Stankov and Lee's (2014a) summary of the Special Issue arrived at the conclusion that the overall findings from these series of studies provide a good support for the analysis reported in Stankov (2013). First, measures of psychological adjustment and maladjustment (general depression and anxiety, well-being and toughness) are poor predictors of academic achievement. Measures of motivation, including popular constructs of mastery and performance orientation, are only slightly better. Second, measures of self-concept correlate moderately with academic achievement. It is noteworthy, however, that even though mathematics self-concept correlates moderately with achievement, it shows significant correlations with the choice of courses at the university level. Third, item-based measures of self-efficacy from the PISA 2003 project correlate highly (i.e., above .40) with academic achievement. Fourth, item-based measures of confidence have the highest correlation with academic achievement.

UNIQUE PROPERTIES OF CONFIDENCE RATING SCORES

As mentioned above, confidence is measured at the item level in our work, by asking a participant to indicate how confident he/she is that the answer to a just-submitted cognitive task is correct. Cognitive tasks can be verbal, non-verbal, perceptual (visual or auditory), multiple-choice or open-ended measures of either achievement or ability. The level of confidence is assessed on a percentage scale, ranging from 0% to 100% typically in 10% steps. Thus, the answer may be "70%" indicating that the participant is 70% sure that his/her choice to the test item is correct (please see an example in Stankov & Lee, 2008, Figure 1). Much of our work is based on three scores: (a) confidence: average confidence over all items in a

test; (b) accuracy: percentage of correctly solved items; and (c) bias: the difference between (a) and (b).

It is important to keep in mind that confidence ratings tend to define a common, general factor across different types of cognitive test batteries. Correlations among the confidence scores obtained from different cognitive tests tend to be even higher than the correlations typically obtained across different cognitive test batteries themselves. For instance, in Stankov et al. (2012), correlations among the confidence scores ranged between $r = .67$ and $r = .83$ while the performance scores correlated with a range of $r = .39$ to $r = .60$ across the tests of Number, Algebra, Geometry, and Statistics. As a consequence, when the performance accuracy scores and confidence scores were analyzed together, two strong, broad factors emerged: one capturing accuracy and the other confidence across the test batteries. On the basis of these and other similar findings, Stankov, Kleitman and Jackson (2014) argue that confidence is an important, general psychological trait.

Clearly, the presence of a general confidence factor suggests that confidence differs from the other measures of self-beliefs in terms of its broadness. On the other hand, self-concept and self-efficacy are best understood as domain-specific constructs. That is, if you think that you are good at mathematics (high mathematics self-concept), you tend to think that you are not as good, or perhaps average, or even bad in another subject, such as English. Confidence scores, however, are domain-general in the sense that confidence expressed in working on verbal problems (e.g., vocabulary) is related to one's confidence in solving mathematics problem (e.g., arithmetic). As this unique feature of confidence scores resembles the findings with the general ability factor of intelligence, it has the same, powerful implications of confidence in one task predicting confidence in other potentially unrelated tasks (for more detailed discussions on conceptual and theoretical differences between confidence, self-concept and self-efficacy, see Stankov & Lee, 2015).

Furthermore, the strong link between confidence and achievement is evident if one compares the effect sizes of correlational and regression analyses. In Stankov et al.'s (2012) study, seven types of self-beliefs variables were employed. These were: math confidence, math self-efficacy, math anxiety, math self-concept, academic self-concept, reasoning self-concept, and memory self-concept. When these variables were entered as independent predictors of the mathematics achievement test scores, the standardized beta coefficients were substantially reduced for all variables except for confidence. This suggests that the common variances captured across the self-beliefs measures were 'absorbed' into the confidence variable and the other variables were left with little variance in their prediction of the mathematics performance. On the other hand, the correlation and regression coefficients of confidence remained virtually the same.

Another piece of empirical evidence showing the importance of confidence is available from the factor analyses of self-beliefs measures together with, and also without, the math accuracy scores (see Stankov et al., 2012, Table 5). That is, math

confidence, PISA 2003 scales of math self-efficacy, math anxiety, math self-concept, as well as academic self-concept, reasoning self-concept, and memory self-concept formed one general factor of self-beliefs. However, when the accuracy scores were analyzed together with these non-cognitive factors, the confidence scores and a part of math anxiety loaded on a separate factor together with the accuracy scores while the rest of the self-beliefs constructs hung together as a factor on its own. This is a strong indication that confidence has its unique place in-between cognitive and non-cognitive domains.

Perhaps the most important conclusion about the role of confidence in non-cognitive measurement arises from the joint consideration of the presence of the general confidence factor and the powerful predictive validity of confidence scores. Thus, confidence in working on one task can predict confidence on the other task (i.e., general factor). Since correlation between confidence and accuracy across different tasks is substantial, it follows that confidence on one task can also predict accuracy on another task. For example, *confidence* on a verbal task may be a good predictor of *accuracy* on an arithmetic task. This may be used profitably in personnel selection and in many other fields of education and psychology.

RECENT METHODOLOGICAL DEVELOPMENTS WITH CONFIDENCE MEASURES

In this section we review some recent studies that have focused on the comparison between confidence and accuracy scores. The object of these calibration studies is to establish how accurate (or realistic) our confidence judgments are. This relationship has been of particular interest to researchers working in the area of decision making. Economists and organizational psychologists have been studying decision making for several decades but educational psychologists have become aware of its importance only recently.

Bias score – e.g., the difference between the average of confidence rating and percentage correct score – is a global measure reflecting this relationship that has been used frequently in our work to date. Another approach to calibration is based on the item response theory (IRT). Paek, Lee, Stankov and Wilson (2013) provide a technical description of the method and Stankov, Lee and Paek (2009) provide substantive elaboration of the IRT application in the confidence-calibration studies. In this work, an IRT model (typically Rasch-based) is developed for the accuracy scores, which leads to the generation of IRT accuracy-based item response curves (IRC). Subsequently, average confidence scores are calculated for every ability level. These averages are linked to form a confidence curve which can be compared to the IRC for accuracy. A typical finding based on IRT modeling is that the discrepancies between accuracy and confidence scores are large for low ability levels and small for high ability levels. In other words, people who have low ability are *overconfident* and think that they know more than what they actually know. Another way to

conceptualize this finding is in terms of the steepness of the two curves between high- and low-performing participants. The difference is larger for accuracy between these two groups than it is for confidence scores. That indicates that difference in the confidence of high- and low-performing participants was not as pronounced as the difference in the accuracy scores. Stankov and Lee (2014b) showed that the same effects may be obtained at the country level. That is, countries and world regions that have lower average scores on the fluid ability measure are more overconfident than the countries showing higher average scores, and the differences in the bias scores are typically due to accuracy rather than confidence scores.

Some recent work in the area of decision making has focused on the study of seven cognitive biases: anchoring effect, belief bias, overconfidence bias, hindsight bias, base rate neglect, outcome bias and sunk cost effect (Teovanović, Knežević, & Stankov, 2015). They found that these seven cognitive biases do not correlate among themselves and therefore do not define a separate cognitive bias factor. It follows that each bias measure taps mostly something that is unique. These cognitive biases also do not correlate with measures of fluid and crystallized intelligence. The only exception was the overconfidence score which has a significant loading on the fluid intelligence factor. This finding was expected because a fluid intelligence test (Letter Counting) was used to calculate the overconfidence bias score in Teovanović et al.'s (2015) study. It appeared that other types of cognitive biases do not tap cognitive abilities of the kind used in measures of intelligence.

Finally, Jackson, Kleitman, Stankov and Howie (2015) developed a new measurement framework called decision pattern analysis (DPA) for studying individuals' consistent decision making behavior. In addition to obtaining scores on accuracy and confidence from cognitive tests, they also asked the participants to state whether they wanted to submit their answer for scoring. The authors conceptualized that this procedure would allow them to self-evaluate different aspects of decision making process, namely, *competence, optimality, recklessness, hesitancy* and *decisiveness*. Convergent validity was assessed via cognitive abilities, metacognitive confidence and a control criterion imposed on confidence that determines the decision to be made, which is labelled as "the point of sufficient certainty". Personality variables were also included to assess discriminant validity. As hypothesized, cognitive abilities showed positive correlations with competence and optimality. The higher one's confidence is, the higher decisiveness and recklessness are. Also, high confidence leads to lower hesitancy in decision making. Overall, Jackson et al. (2015) showed that the use of DPA can be a promising, new method that can capture multi-layered, nuanced approaches in evaluating individual differences in decision making.

BEYOND PREDICTABILITY CONSERVATISM AND EDUCATIONAL ATTAINMENT

As mentioned in the introduction, non-cognitive variables may be of interest in their own right as well as be treated as the influences on educational attainment. One

area that has attracted attention recently is the relationship between the measures of academic achievement and measures of social attitudes and, in particular, social conservatism. Such social "Conservative syndrome describes a person who attaches particular importance to the respect of tradition, humility, devoutness and moderation (i.e., Traditional values) as well as to obedience, self-discipline and politeness (i.e., Conformist values), social order, family, and national security (Security values) and has a sense of belonging to and a pride in a group with which he or she identifies (In-group Collectivism). A conservative person also subscribes to conventional religious beliefs" (Stankov, 2009, p. 300). Negative correlations were reported between cognitive ability scores and measures of conservative syndrome. This negative relationship was found both at the individual-level and in the aggregate data that used countries as the units of analysis. In other words, people who have low scores on cognitive measures tend to be more conservative in their outlooks. This negative relationship was also evaluated using the TIMSS 2003 data. We focused on the 13 countries that participated in the TIMSS 2003 survey that also had conservatism scores from the Stankov, Lee and van de Vijver (2014) study. As it turned out, at the countries' level of analysis, the correlation of social conservatism is $r = -.78$ with TIMSS 2003 mathematics scores, and $r = -.78$ with TIMSS 2003 science scores. Thus, in agreement with Stankov (2009), Stankov and Lee (2014), and Stankov et al. (2014), countries that have low average academic achievement also tend to endorse more conservative social attitude statements.

Meanwhile, our correlation-based analysis does not suggest that non-cognitive measures (i.e., conservatism) cause low achievement scores. If anything, the current zeitgeist would point to the opposite direction of causation – i.e., poor education can lead to social conservatism. Our point is that non-cognitive measures of conservatism are interesting in their own right because of their role in shaping our social and political viewpoints. In addition, they are related to educational attainment, which may be useful for an improved understanding of the conservatism syndrome. Needless to say, Conservatism is just one example of a non-cognitive disposition that shows a strong link to educational achievement. International assessment programs such as PISA and TIMSS contain a large body of country-level data that can be readily linked to economic and social development. As we argue below, educational attainment needs to be linked to these other domains so as to arrive at a better understanding of the important influences across many sectors of our lives.

FUTURE MINING OF THE PISA AND TIMSS NON-COGNITIVE DATABASE

We are currently conducting a series of analyses to document how countries have improved, stagnated, or deteriorated across a variety of student- and teacher-level, non-cognitive measures of the PISA 2003, 2006, 2009, and 2012 and TIMSS 2003, 2007 and 2011 surveys, and are investigating the predictability of the PISA and TIMSS achievement scores from non-cognitive variables over this time period.

Although the TIMSS background questionnaire has a smaller number of non-cognitive variables than the PISA, it provides a good benchmark to compare similar or related findings from these two, large-scale country-level databases. While it is unlikely to find the "same" country mean values on identical/similar constructs even after proper scale adjustment and standardization, the relative location/ranking of each country in terms of their non-cognitive student outcomes should not differ much between the TIMSS and PISA datasets.

The PISA 2012 background questionnaires contain a wide range of psycho-behavioral and attitudinal variables, presenting us with a unique opportunity to draw nuanced conclusions about the effects of the system- and group-level factors. The increased number of teacher-behavior variables in the PISA 2012 Student Questionnaire is particularly noteworthy, i.e., the cross-national records from the eyes of students, not from the teachers themselves, about how the students are treated on a typical day of school. Specific variables collected on teacher behaviors in the PISA 2012 include: *teacher's tendency to use formative assessment* ("telling students how they are doing"), *student-orientation* ("students to help plan classroom activities"), *teacher-directed instruction* ("check whether students understood"), *cognitive activation in mathematics lessons* ("teacher asks questions that make students reflect on the problem"), *classroom management in mathematics lessons* ("starts lessons on time"), *teacher support in mathematics* ("students are given the opportunity to express opinions") in addition to the three more "traditional" PISA scales (i.e., used since 2003) of *student-teacher relationship* ("interested in students' well-being"), *disciplinary climate* ("students cannot work well") and *teacher support* ("shows an interest in every student's learning"). The availability of these new behavioural scales allows us to make inferences about how teachers interpret their roles and cultural norms: a snapshot of what is *really going on* in the classroom.

Our preliminary analyses of the PISA 2012 data have shown that some countries are doing exceptionally well in terms of students' non-cognitive outcomes. Such countries include United Arab Emirates, Australia, Canada, Portugal, Turkey, and the US. As can be seen, this group is a mix of "highly expected" Western countries and countries that have not been known as "celebrated" examples of excellent school systems. It is also noticeable that there is an absence of Western European countries from the list of these "model" countries on the non-cognitive domains. On the other side, low-scoring groups are predominantly from the East Asian countries/systems (Hong Kong, Korea, Taipei, Japan) although four European countries also appear to share a similar pattern of non-cognitive outcomes with this East Asian group (Belgium, The Netherlands, Czech Republic and Slovakia). Korea stood out in this group as it was flagged as "bad" on 20 out of 21 non-cognitive variables considered in our analyses. It is also of note that not all Asian countries/systems can be bundled up in this list of low scorers. In particular, Shanghai-China and Singapore turned out to be among the best in terms of non-cognitive student outcomes.

A particularly intriguing observation in PISA 2012 non-cognitive measures was that there appears to be a general tendency in a country/system to have similar ranking/position across a variety of non-cognitive variables. In other words, a country with a low score on one non-cognitive variable is likely to show a low score again in another non-cognitive variable. This applies to the high-scoring countries as well – i.e., the high-scoring countries listed above were high across all 21 analyzed, non-cognitive variables. This generality in the non-cognitive measure outcomes at the country-level suggests that educationists should look into deep-rooted cultural values and the ways in which people interact with each other because non-cognitive variables can have long-standing, *across-the-board*, consequences on the education systems. This point was also noted in Hattie (2009), Lee and Shute (2010), and Stankov (2010). For instance, Hattie (2009) emphasizes, in his example of giving feedback to student work, that it is not so much about what type of feedback students receive (e.g., length, amount, details, and content) but more importantly, it is the way that students are respected in the form of interactions with teachers that makes the ultimate, real differences in student learning outcomes (Hattie, 2009, p. 4). As such, the extensive undertaking of our current research projects is to examine a wide range of system-level, development and well-being data from the UN, OECD, and the World Health Organization (WHO) over the past 30 years, as well as the recent Democracy and Freedom Index developed by the Economist Intelligence Unit (EIU) and the World Governance Indicators by Kaufman, Kraay, and Mastruzzi (2010), and link them to students' academic and non-academic outcomes.

The main theme of these ongoing projects is to examine challenges and issues in promoting balanced school outcomes across both cognitive and non-cognitive domains. Careful consideration of both the academic and psychological well-being of students is a fairly familiar concept within a small number of industrialized Western countries, but may be of lesser concern elsewhere. Non-cognitive school activities may include learning and appreciation of Art, Music, Physical Education, extracurricular programs with no direct link to fundamental cognitive skills, and a variety of school-based programs aimed at social-emotional skills development. Studies of non-cognitive school outcomes can look into both students' and teachers' attitude, self-beliefs, well-being, life satisfaction, physical health, social relationships, and emotional management and regulation. Within the Lee and Shute's (2010) non-cognitive framework (cf. Table 1), this means that students are engaged in various school activities (engagement, on-task behaviors) not just to get better marks or pass the examination, but to enjoy and to learn for the sake of learning (intrinsic motivation). They feel good about themselves and learning (self-concept), are confident or comfortable (confidence) in what they can do in school and are positive about their future (instrumental motivation). From the teachers' perspective, Lee and Shute (2010) emphasize teachers' collective efficacy, empowerment, and sense of affiliation and school leaders' collegiality, high morale, and clear goals as having strong empirical links to students' academic outcomes. In the same vein, the

mega-analysis of Hattie (2009) concludes that "the conception of what it means to be a teacher" (p. 4) is the foremost foundation in the multitudes of ways that teachers interact with students, which ultimately produces positive learning experiences as well as outcomes.

We would also like to add that teachers' non-cognitive dispositions are not entirely up to individuals alone. These dispositions are created, grounded, and intertwined within the complex and intricate web of macro-level factors such as cultural heritage, societal structure and bias, financial and pension benefits, to name a few (cf. Stankov & Lee, 2012). Arguably, it is impractical or unfair to judge non-cognitive qualities of a system, a teacher, or students without placing them in a broader context of societal virtues, customs, and challenges. Stankov (2010) argues that one of the strongest cultural influences on student learning habits and outcomes is Confucianism of East Asian countries. We look into identifying other cultural values that provide similarly strong foundations to students' cognitive and non-cognitive development.

CONCLUDING REMARKS

Our analyses of the PISA and TIMSS non-cognitive data indicate that these measures are important in several ways. First, non-cognitive variables predict performance on the achievement tests. The prediction effects vary and it is possible to formulate a predictability gradient that orders variables from those that have low or essentially zero correlation (e.g., general measures of mental health such as depression and well-being) to those that have high correlations. Strong predictors of achievement are psychological measures of self-beliefs (self-efficacy and anxiety) and, in particular, measures of the trait of confidence that indicate how sure a person is that a just-completed cognitive act, such a solution of a mathematics problem, is correct. Predictability of confidence surpasses that of self-efficacy and anxiety and, importantly, it captures much of the predictive variance of these two constructs. The non-cognitive trait of confidence is an important construct for the prediction of scores on tests of achievement and ability. Confidence is about as good or perhaps even better predictor of performance than are the measures of socio-economic status. Measures of confidence have been used extensively in the area of behavioral decision making that is a part of economics and management sciences. Decision making is certainly important in many aspects of our lives and it is poorly represented in both educational curricula and in cognitive tests in use today. We reviewed recent studies that employed confidence ratings in order to assess cognitive biases and five components of decision making: competence, optimality, recklessness, hesitancy and decisiveness.

Second, non-cognitive constructs may be of interest on their own. An example is social conservatism which is captured by a collection of measures of social attitudes, including religiosity. Conservatism (and its obverse liberalism) is important both in political preferences and in social interactions. It is well-established

that conservatism is correlated negatively with measures of intelligence and achievement. We believe that this correlation may be helpful in our understanding of conservatism. For example, it can be hypothesized that low ability leads to a limited comprehension of one's social life, which in turn, leads to a fear of unusual things and events and therefore reinforces conservatism. Another example is Confucian work ethics and lifestyle which are also linked to both high achievement scores in these countries and to high anxiety and self-doubt.

Third, there are some 70 different non-cognitive variables measured in PISA and TIMSS background questionnaires over the past decade. Many of these have not been examined as yet and, conceivably, a few may still prove to be strongly correlated with academic achievement. Also, it may be useful to include additional measures and of particular importance may prove to be new measures of self-beliefs beyond anxiety, self-efficacy, and confidence.

Fourth, country-level cognitive and non-cognitive educational measures may be related to a host of economic, political and sociological variables that are available in the publications of large international bodies such as the United Nations, the Organization for Economic Co-operation and Development (OECD), and cross-cultural studies that are based on a large number of countries. This holds promise for identifying system-level dimensions along which countries differ and therefore it may inform policy makers about the possible avenues for improving educational system and other aspects of life in a society. Given that international data are available for the years prior to the inception of the PISA and TIMSS surveys, it will be possible to use trend analysis in order to examine the effects of changes that may affect the functioning of societies in the world today.

It is important to keep in mind that the emphasis on non-cognitive variables does not challenge the body of evidence showing that cognitive performance is important for individual-level outcomes in education, finance, social relations, and psychological and physical health. The available evidence augments the well-established significant roles of cognition and knowledge in human life. The emphasis we have placed on predictability gradient is in full agreement with this position.

Finally, the findings from large-scale studies of non-cognitive measures may be used to shape the theoretical underpinnings of education. In PISA, for example, committees for the selection of non-cognitive measures make their decisions of what to include in the assessment after careful consideration of the literature. A measure is chosen if there is some empirical evidence for its relevance. Our examinations (Lee & Stankov, 2013) showed that in fact, many measures employed in large-scale international assessments do not necessarily correlate with academic performance (e.g., measures of motivation, learning strategies and school climate in PISA 2003 database). It is still left as an important task for large-scale assessment experts to identify non-cognitive variables with strong cross-national relevance and applicability across diverse systems.

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9. A SYNTHESIS OF CAUSAL EVIDENCE LINKING NON-COGNITIVE SKILLS TO LATER OUTCOMES FOR CHILDREN AND ADOLESCENTS

The concept of 'non-cognitive skills' was introduced by sociologists Bowles and Gintis (1976) as a catch-all phrase to distinguish factors other than those measured by cognitive test scores such as literacy and numeracy. The term "non-cognitive", however, creates a "false dichotomy" between cognitive abilities and what are often seen as psychosocial or soft skills (Farrington et al., 2012). While it is tempting to contrast cognitive and non-cognitive factors, it is an erroneous distinction as "few aspects of human behavior are devoid of cognition" (Borghans, Duckworth, Heckman, & terWeel, 2008, p. 974). Cognitive and non-cognitive skills interact and cross-fertilise each other and human development would not be possible without their continuous interaction. Therefore, it is important to note that there is little agreement even on whether 'non-cognitive skills' is the right way to describe the set of issues under discussion, and terms such as 'character skills', 'competencies', 'personality traits', 'soft skills' and 'life skills' are also widely used. The term thus has to be used with this caveat in mind.

There is now growing evidence to suggest that a range of so-called 'non-cognitive' skills are potentially as important, or even more important than, cognitive skills or IQ in explaining academic and employment outcomes (Bowles & Gintis, 2002; Farkas, 2003; Heckman, Stixrud, & Urzua, 2006; Jencks, 1979; Lleras, 2008). In a range of studies from a variety of disciplines, researchers have established an association between early indicators of non-cognitive skills and later academic, social, behavioural, and employment outcomes (e.g., Blanden, Gregg, & Macmillian, 2007; Coneus & Laucht, 2011; Heckman & Rubenstein, 2001; Heckman et al., 2006; Jacob, 2002; OECD, 2015). Researchers have further suggested that social investments in the development of these non-cognitive skills not only would generate substantial returns in future outcomes, but also would help to close the attainment gap between advantaged and disadvantaged youth (e.g., Bowles & Gintis, 2002; Farkas, 2003; Heckman et al., 2006; Jencks, 1979; Lleras, 2008). A better understanding of the specific or set of non-cognitive skills which are most predictive of successful educational outcomes for children and adolescents is therefore highly desirable not only to promote social justice, but also to enhance the educational system and increase productivity in the economy (Heckman et al., 2006).

Despite the increasing number of studies showing that non-cognitive skills are significantly associated with positive outcomes, only a handful of reviews have

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assessed and integrated the findings (Rosen, Glennie, Dalton, Lennon, & Bozick, 2010; Farrington et al., 2012). While these reviews provide a framework for understanding the importance of non-cognitive skills in the classroom and school settings, there still remain several gaps in the literature/evidence base. One of the most significant gaps concerns the malleability of diverse non-cognitive skills in an experimental context. An investigation of the causal evidence examining the extent to which specific non-cognitive skills can be improved will provide a greater understanding of the particular skills that are 'fixed' and the ones that can be 'taught' or 'learned'. Another issue concerns the nature of the association between non-cognitive skills and later outcomes. Since most studies of non-cognitive skills employ correlational rather than experimental methods, there is little consensus concerning whether the relationship between non-cognitive skills and later outcomes is a causal one. Within the same vein, it is necessary to consider the strength of the causal evidence and whether these effects are shown to sustain in the longer term future.

In consideration of the growing evidence, as well as the ambiguity, of non-cognitive skills, this review aims to shed light on their malleability, causality and sustainability. In order to do this, we examine the causal evidence on a diverse set of non-cognitive skills, assessing whether they can be enhanced and how far they can lead to improved longer term outcomes in a variety of domains. We also considered whether one of these diverse skills seems to be the most important in predicting future outcomes. Since we aim to identify key competencies that can be modified, we focus on seemingly more flexible, malleable characteristics which have been linked to positive educational outcomes for children and adolescents. Overall, six factors which have been identified as potential key non-cognitive skills of children and young people are examined including: self-perceptions of ability, motivation, perseverance, self-control, metacognitive strategies, and social and emotional skills.

In the following we describe the method used to conduct our review. The aim was not to do an exhaustive review of the literature but to provide an informed overview and synthesis. We then give a definition of the key constructs that we reviewed and assess the evidence regarding the malleability, causality and sustainability of different skills before we provide a final discussion and evaluation of the evidence.

METHOD

In order to conduct the review, we first searched Science Direct, PsychInfo, Springerlink, ERIC and Google Scholar, from 1990 to 2013 for English-language journal articles. Searches were conducted separately for each non-cognitive skill. Search terms included 'experiment', 'quasi-experimental', 'children', 'adolescents', 'students', 'intervention' and 'non-cognitive'. For self-perceptions, 'self-concept' and 'self-efficacy' are included. For motivation, 'achievement motivation', 'mind-set', 'intrinsic', 'extrinsic' 'expectancy-value', 'value' and 'interest' are included. For perseverance, 'engagement' and 'grit' are included. For metacognitive strategies,

'metacognition', 'metacognitive' and 'strategies' are included. For social and emotional skills, 'social skills', 'personal skills' and 'social emotional skills' are included.

Multiple selection criteria were required for inclusion of an article. First, only quasi-experimental and experimental studies published in peer-reviewed journals are reviewed. The term 'experimental' alludes only to those studies which use random assignment of a control and treatment group. Studies which use control and experimental groups without random assignment are 'quasi-experimental'. Second, the review is limited to school-age children and adolescents, excluding those focused on university-age students and adults. Studies with mentally or physically handicapped subjects or indicated populations (Munoz, Mrazek, & Haggerty, 1996) were not included. Lastly, the review focuses on meta-analytic studies of experimental research for specific non-cognitive skills. Meta-analysis, which combines and compares estimates from different studies, can yield more reliable and precise estimates of impact than an individual study examined in isolation (Lipsey & Wilson, 2001). In cases where there are no meta-analytic studies examining a particular non-cognitive skill, the published individual experimental studies are examined, providing greater detail on the most exemplary.

The effect size is provided, whenever available. The effect size, Cohen's *d*, is the standardised mean difference between two groups, such as treatment and control groups. For example, an effect size of .25 would represent a difference of one-quarter of a standard deviation on the outcome measure. Guidelines have been suggested for what can be considered a small (.20), medium (.50) or large (.80) effect size (Cohen, 1988). Hattie (2009) uses these effect sizes for educational outcomes: small (.20), medium (.40) or large (.60). In some cases, the average correlation, Pearson's *r*, is reported. Cohen also provides the following guidelines for the Pearson's *r*, where .10 is small, .30 is medium and .50 is large.

For each of these skills in focus, a definition is first provided. Then, causal evidence of malleability is examined, which indicates whether the skill can be taught or improved. Next, causal evidence showing whether the skill leads to better outcomes later is assessed. Lastly, conclusions are offered, discussing the strengths and weaknesses of the specific skill in question as a causal factor.

SELF-PERCEPTIONS OF ABILITY

Self-perceptions of ability are an individual's own beliefs about whether or not they *can* accomplish a goal or task. Self-perceptions are often seen as precursors to striving for achievement; and therefore, they are used in many of motivational models (Deci & Ryan, 1985; Wigfield & Eccles, 2000). Positive self-perceptions predict greater motivation which, in turn, encourages students to apply greater effort, leading to improved performance. The main theoretical approaches concerning self-perceptions include self-concepts of ability (Harter, 1982; Marsh & Shavelson, 1985; O'Mara et al., 2006; Valentine, DuBois, & Cooper, 2004) and self-efficacy (Bandura, 1977; Bandura, 2001). The two concepts differ both conceptually and

psychologically. In principle, self-concept of ability evaluates how an individual has felt about general past performance, while self-efficacy measures expectations about performing specific tasks in the future.

Self-Concept of Ability

Self-concept of ability has been defined an individual's perception of their ability shaped through their experiences and interactions with their environment (O'Mara et al., 2006; Valentine et al., 2004). Several theorists (e.g., Harter, 1982; Marsh & Shavelson) have conceptualized self-concept in a hierarchical manner, with a global self-concept at the apex of the hierarchy, other subcategories in the middle including academic and non-academic self-concepts, and domain-specific self-concepts such as math self-concept at the bottom. For example, academic self-concept is a student's perception of his or her general ability in school, while math self-concept is his or her belief that they can do well in mathematics.

Numerous interventions have demonstrated that children's and adolescent's self-concepts can be improved. These effects have been calculated in two meta-analytic studies (Haney & Durlak, 1998; O'Mara, Marsh, Craven, & Debus, 2006). In the earlier meta-analysis, Haney and Durlak found that programs which specifically focused on self-concept enhancement were effective in improving self-concept of ability. The mean effect size from pre-test to post-test was .57. A more recent meta-analysis of interventions aimed at children up to age 18 found similar results (O'Mara et al.). The mean effect size for intervention studies which focused on enhancing self-concept from pre- to post-intervention was .67. Together, these studies suggest that self-concept of ability is malleable for school-age populations.

While there is a wealth of correlational research showing that academic self-concept is positively associated with academic achievement (e.g., Denissen, Zarrett, & Eccles, 2007), there is little evidence that this is a causal relationship. This likely reflects the dynamic nature of academic self-concept. Academic self-concept is a reflection of students' experiences and interactions with others (i.e., parents, teachers, or peers), which inevitably changes as they progress through schooling. In a series of studies, Marsh and colleagues (2006) investigated the causal ordering of self-concept and achievement, concluding that the relationship between academic self-concept and achievement is reciprocal. In other words, the causal pathways move from academic self-concept to achievement and vice versa. Consequently, Marsh and colleagues argue that researchers and practitioners should simultaneously aim to improve both academic self-concept and academic skills. According to Marsh and colleagues, interventions which enhance self-concepts without improving performance are likely to show short-lived improvements in self-concept of ability. Conversely, interventions which enhance students' performance without also fostering self-beliefs of their ability will unlikely show long lasting gains.

In conclusion, while there is overwhelming evidence of a positive relationship between academic self-concept and achievement-related outcomes, there is little

empirical evidence of a causal one. While intervention studies have shown that self-concept of ability can be improved, there is a dearth of experimental studies which have manipulated self-concept and then measured its subsequent effect on later outcomes including those which extend beyond academic achievement. As Marsh and colleagues argue (2006), while self-concept of ability might be a useful measure to determine how perception of one's own ability changes in regard to an intervention, it is not likely to be a factor which, without simultaneously raising performance, will predict substantial change in subsequent outcomes.

Self-Efficacy

Self-efficacy is an individual's belief that they have the capability to succeed at a particular task in the future (Bandura, 1977, 2001). Students' beliefs in their own self-efficacy determine their personal goal-setting, their choice of strategies to achieve their goals, their perseverance when faced with setbacks, and their performance under taxing conditions (Bandura, 1997). Efficacious students are more likely to put forth effort and persevere to achieve a goal, even when facing potential setbacks and failures (Pajares, 1996; Pajares, 2003). Student's beliefs that they can succeed at a particular task are a necessary antecedent to putting forth sustained effort towards its accomplishment in the future.

A multitude of experimental studies conducted in the 1980s examine whether self-efficacy can be enhanced using a variety of different methods including goal-setting, learning strategies, classroom models, attributional feedback, and rewards (e.g., Bandura & Schunk, 1981; Schunk, 1981, 1982, 1983, 1984; Schunk & Hanson, 1985; Schunk, Hanson, & Cox, 1987). Together, this constellation of studies by Schunk and his colleagues (e.g., Bandura & Schunk, 1981; Schunk, 1981, 1982, 1983, 1984; Schunk & Hanson, 1985; Schunk, Hanson, & Cox, 1987) show that perceived self-efficacy is malleable over short-term periods.

Most previous studies examining self-efficacy beliefs in children and adolescents are correlational which is likely due to the difficulty involved with manipulating self-efficacy in an experimental setting. As noted, there are several experimental studies from in the 1980s which have manipulated self-efficacy beliefs which, in turn, predicted better academic outcomes including task persistence, interest and/or performance (e.g., Bandura & Schunk, 1981; Schunk, 1981, 1982, 1983, 1984; Schunk & Hanson, 1985; Schunk, Hanson, & Cox, 1987). Multon and colleagues (1991), furthermore, conducted a meta-analysis of experimental studies examining the relationship between self-efficacy and academic outcomes. There was a large effect size ($r = .58$) when examining the relationship of self-efficacy to persistence and academic performance. However, there is less evidence that self-efficacy has a causal relationship with outcomes in non-academic domains.

In conclusion, experimental studies suggest that self-efficacy for a particular task is malleable and that improved self-efficacy predicts greater persistence, interest, and performance later. Together, these findings indicate that self-efficacy beliefs are

an essential prerequisite to enhancing both cognitive and non-cognitive skills. In other words, young people may more likely to persist at learning new skills when they believe that they are capable of eventually succeeding, which is especially important when faced with challenging tasks (Pajares, 1996, 2003).

A few caveats must be kept in mind, however. First of all, most of these studies are locally-based and conducted by the same group of researchers in the 1980s. A wider evidence base is necessary to indicate with certainty that increases in self-efficacy lead to improvements in the related skill area, especially in non-academic domains. Second, there is little evidence of a lasting impact of manipulations on later outcomes. Most of these experimental studies measured the outcomes at the end of the trial period; therefore, it is difficult to know whether an increase in self-efficacy was sustained and whether there was an impact on longer term outcomes. One issue to keep in mind is that a lasting impact of any intervention may depend on an individual's continued improvement in that skill area. As with self-concept of ability, there is likely to be a reciprocal association between self-efficacy and academic performance. Strong academic performance validates self-efficacy, strengthens motivation, and reinforces effort and persistence toward academic tasks (Farrington et al., 2012). Lastly, the strength of self-efficacy as a predictor of later outcomes is likely to vary according to the generality versus specificity of its measure (Bandura, 2006). The best predictors of academic performance in a particular domain are self-efficacy beliefs pertaining to the relevant academic subject (Pajares, 1996). Therefore, programs which target self-efficacy beliefs will likely experience greater impact when they focus on a specific area of improvement and seek to improve self-efficacy beliefs regarding that particular domain, e.g., mathematics.

MOTIVATION

Motivation concerns the study of *why* individuals think and behave as they do. A wealth of motivational theories has focused on understanding the relationship between one's motivation and their later achievement. These include the theory of intrinsic/extrinsic motivation (Deci & Ryan, 1985), achievement goal theory (Dweck & Leggett, 1988; Ames, 1992); attribution theory (Weiner, 1979); expectancy-value theory (Eccles et al., 1983; Wigfield & Eccles, 2000) and locus of control (Rotter, 1966). Here we examine achievement goal theory, expectancy-value theory and intrinsic/extrinsic motivation, all of which have shown some degree of malleability in experimental studies.

Achievement Goal Theory

Achievement goal theory proposes that motivation and achievement-related behaviors can be understood by considering the reason or purpose individuals adopt while engaged in academic work (Ames, 1992; Dweck & Legget, 1988). Achievement goal theory distinguishes two types of goal orientations: (a) a learning

orientation is focused on gaining competence in a subject area or skill and (b) a performance orientation is focused on demonstrating competence to others, seeking competition, and comparing performance to others. When individuals believe that they can increase their ability through their own efforts, they are more motivated, put forth sustained effort and persistence, and use strategies to accomplish their goals. Conversely, individuals who believe that their ability is fixed and cannot be changed are more likely to be dependent on others' assessments of their ability and easily give up when they experience a setback or failure.

Recent research has focused on implementing brief treatments or short-term programs designed to promote growth mindsets. According to Dweck (2006), a learning orientation is equivalent to a "growth mindset", in which the fundamental belief is that "your basic qualities are things you can cultivate through your efforts" (p. 7). A performance orientation, on the other hand, is equivalent to a "fixed mindset" in which the fundamental belief is that "your qualities are carved in stone" (p. 6). Current work in this area has concentrated on changing academic mindsets. Most of this research has focused on university-age students, but there are three published experimental studies of school-age children and adolescents examining growth mindset (Blackwell, Trzesniewski, & Dweck, 2007; Donohoe, Topping, & Hannah, 2012; Good, Aronson, & Inzlicht, 2003).

Two of these studies have both before and after measurements assessing whether children can develop a growth mindset as a result of the intervention. In their intervention, for example, Blackwell and colleagues randomly placed 91 seventh-grade students (age 12) in one of two weekly workshops for eight sessions which were led by trained undergraduate mentors. In the treatment group, students were taught that intelligence is malleable (incremental theory) rather than fixed (entity theory) and that learning changes the brain by forming new connections. In the control group, students were taught only study skills. After the eight-week intervention, the researchers tested the understanding of all students regarding the brain, as well as measured whether student's theory of intelligence (incremental versus entity) changed over the intervention. They found that students in the treatment group endorsed the incremental theory of intelligence more strongly after participating in the intervention (4.36 pre-intervention vs. 4.95 post-intervention (d = .66), but participants in the control group did not change their beliefs about the nature of intelligence (4.62 pre-intervention vs. 4.68 post-intervention (d = .07). In another example, a quasi-experimental study investigated the impact of Brainology (an online interactive program aimed at encouraging a growth mindset) on the mindset, resiliency and sense of mastery of 33 pupils aged 13–14 years (Donohoe et al., 2012). The program led to a significant increase in mindset scores from pre-test to post-test for the intervention group. The mindset scores of the intervention group also differed significantly from the comparison group (d = 1.20). However, there was no significant difference between their pre-test and follow-up scores three months later, suggesting that the initial impact of the intervention was not sustained.

Evidence further indicates that students in an experimental condition which promotes a growth mindset show significant academic gains compared to their peers in a control condition. For example, Good and colleagues (2003) grouped 138 seventh-grade students, who were mostly minority and low-income adolescents, with an undergraduate mentor. There were four randomly assigned groups. In the first group, students had mentors who also discussed the expandable nature of intelligence. In the second group, students had mentors who discussed that most students initially experience difficulty during the seventh grade transition but that this improves with time. In the third group, students had mentors who discussed the first two messages about the expandable nature of intelligence and the seventh grade transition. In the control condition, students had mentors who focused on the dangers of drug use. At the end of the year, students took standardized tests in math and reading. Students in the experimental conditions had significantly higher reading standardized test scores compared to students in the control condition. Furthermore, female students in the experimental conditions had significantly higher math standardized test scores compared to female students in the control condition. In the study described above, Blackwell et al. (2007) also found that their intervention had a significant effect on students' academic outcomes. Prior to the intervention, both the treatment and control groups had declining maths grades. After the intervention, the grades of students in the control group continued to decline, while this decline was reversed for the experimental group. At the end of the year, there was an overall difference of .30 grade points between the treatment and control groups. In contrast, students who participated in the Brainology evaluation did not report significant changes in their resiliency or sense of mastery following the intervention (Donohoe et al., 2012). Due to the small size of the sample, however, their findings may not be generalizable.

The results of these interventions suggest that it is possible to change students' mindsets and that doing so may result in small to medium-size improvements in later performance. These findings are supportive of programs focused on developing growth mindsets for children and adolescents. However, there are a number of considerations which must be kept in mind. First of all, only a handful of small, school-based interventions have been conducted which focus on school age children, specifically early adolescents. Therefore, it is not known whether the effects are similar for younger children and whether they are generalizable and transferable across different contexts. Second, much of the research has focused on short-term interventions; and therefore, it is not known whether these interventions translate into long-term, lasting effects. As Donohoe et al.'s (2012) investigation of Brainology suggests, promoting a growth mindset may not necessarily lead to sustained improvement. However, their contrasting findings may reflect inherent differences in an intervention led by undergraduate mentors versus one that employs an interactive online program. It may be that adolescents respond more positively to young people whom they have developed a close relationship compared to a computer software program. This highlights the need for future research which considers the essential characteristics of mindset programs to ensure their transferability and sustainability. Despite these

concerns, the evidence so far suggests that promoting growth mindsets enhances the academic achievement of adolescents, particularly when taught by a trained mentor. However, these conclusions must be taken with caution as the findings to date have focused mainly on short-term outcomes in the academic domain; therefore, it is unknown whether these findings translate to other skill-areas and contexts.

Intrinsic/Extrinsic Motivation

Intrinsic and extrinsic motivation distinguishes between different reasons or goals that give rise to an action (see Sansone & Harackiewicz, 2000, for a review). Intrinsic motivation refers to doing something because it is inherently interesting or enjoyable. When intrinsically motivated, a person is moved to act for the fun or challenge involved rather than because of external prods, pressures or rewards. Extrinsic motivation, on the other hand, refers to doing something for instrumental or other reasons, such as getting a good grade. Self-determination theory (SDT) elaborates on the intrinsic/extrinsic motivation distinction with the idea of autonomy versus control (Deci & Ryan, 1985). According to Deci and Ryan, intrinsic motivation develops as a result of autonomous, self-determined decisions that give individuals a sense of control and power. In contrast, extrinsic motivation is created when individuals are forced or compelled to act through controlling situations.

Findings of meta-analytic studies suggest that intrinsic motivation can be manipulated in an experimental setting. In a meta-analysis of 128 experimental studies, Deci, Koestner and Ryan (1999) examined the effects of extrinsic rewards on intrinsic motivation. They found that tangible rewards significantly undermined the intrinsic motivation of children (d = –.39). Another meta-analysis of 41 experimental studies found that choice enhanced intrinsic motivation (d = .55) for children (Patall, Cooper, & Robinson, 2008).Together, these studies indicate that intrinsic motivation can be improved under certain circumstances.

Several recent quasi-experimental and experimental studies have also shown that increased intrinsic motivation leads to higher performance. In a series of studies, Guthrie and colleagues examined the role of intrinsic motivation on reading performance (e.g., Guthrie, Wigfield & Vonsecker, 2000; Guthrie et al., 2006). In one study, for example, Guthrie et al. (2006) investigated how interesting, hands-on tasks in the classroom stimulate intrinsic motivation for reading. Children in grade 3 (aged 8) were in one of four classrooms which varied according to the number of interesting, hands-on activities (e.g., observations and experiments) that were taught. Students with a higher number of hands-on tasks increased their reading comprehension after controlling for initial comprehension more than did students in comparable intervention classrooms with fewer hands-on tasks. Students' intrinsic motivation further predicted their level of reading comprehension after controlling for initial comprehension.

In another set of experimental studies, Vansteenkiste and colleagues examined the role of goal framing on later performance (Vansteenkiste, Simons, Lens, Sheldon, &

Deci, 2004; Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005). Students were randomly assigned to an experimental condition. Each experiment framed students' learning in terms of whether it served a long-term intrinsic or extrinsic goal. Results indicated that test performance and subsequent persistence were greater in the intrinsic-goal condition than in the extrinsic-goal condition. The effect sizes for the intrinsic versus extrinsic-goal condition were .59 for motivation, .21 for test performance and .12 for persistence. These results were replicated in a variety of studies using different intrinsic goals (e.g., personal growth and health), extrinsic goals (e.g., physical attractiveness), learning materials (business communications) and age groups (5th- to 6th-graders, 11th- to 12th-graders, university students).

Together, these studies indicate that intrinsic versus extrinsic-related goals encourage greater motivation, more persistence and higher achievement for students of all ages. These studies further highlight the "here and now" nature of intrinsic/extrinsic motivation (Vallerand, 1997) by demonstrating that context plays an important role in one's orientation toward either intrinsic or extrinsic goals when engaged in a specific activity. This has positive implications for educators, as it indicates that teachers can help shape student's intrinsic motivation for learning through their teaching methods and classroom context. Nevertheless, this further suggests that intrinsic motivation may not necessarily be an expertise that can begained through participation in an intervention which then is applicable to other situations and environments. While enhancing intrinsic motivation is an important tool in supporting educational contexts, there is little evidence that intrinsic motivation is a skill that can be cultivated in relation to future outcomes.

Expectancy-Value Theory

According to expectancy-value theory, motivation to achieve is best described as consisting of (1) students' expectations of success and (2) their perception of the overall value of the activity or task. Eccles and colleagues (1983) have defined expectancies for success as individuals' beliefs about how well they expect to do on upcoming tasks, either in the immediate or long-term future. Expectancy beliefs are measured in a similar manner as Bandura's (1997) self-efficacy beliefs. However, expectancy beliefs are considered to be effective only when the task is also considered valuable to the individual. The expectancy-value theory thus includes an additional aspect (i.e. task-value) which has to be considered when predicting engagement with a task.

A few recent experimental studies have examined the role of expectancy-value theory in improving students' school-related outcomes (Cohen, Garcia, Apfel, & Master, 2006; Cohen, Garcia, Purdie-Vaughns, Apfel, & Brzustoski, 2009; Hulleman & Harackiewicz, 2009; Harackiewicz, Rozek, Hulleman, & Hyde, 2012). Together, these studies show that interventions can increase students' interest in, and value of, academic tasks and course subjects. Hulleman and Harackiewicz, for example, implemented a school-based intervention where ninth-graders (i.e., age 14) wrote essays each month about weekly topics in science class. Students

were randomly assigned to either a treatment or control group. Students in the treatment group were encouraged to write about the connections between their lives and what they were learning in their science course, while students in the control group were told to write summaries of weekly science topics. After the intervention, students in the treatment group reported a greater interest in science and were more likely to plan to take science-related courses in the future compared to students in the control group. In another study, Harackiewicz and colleagues implemented a three-part intervention which consisted of two brochures mailed to parents and a Web site, all highlighting the usefulness of STEM (Science, Technology, Engineering and Mathematics) courses. Participants were randomly assigned to either an experimental or control group. Mothers in the experimental group reported higher perceived utility value of mathematics and science for their child than did mothers in the control group. The intervention also had an indirect effect on student's perceived utility value through both mother's perceived utility value and conversations; in other words, students perceived more STEM utility if their mothers had higher levels of perceived utility and if they had more conversations with their parents about the value of taking STEM courses. According to Harackiewicz and colleagues, these findings demonstrate that a modest intervention focused on parents can produce significant changes in both parents' and student's perceived utility value of participating in STEM courses.

Experimental studies have documented positive findings, indicating that interventions which increase students' expectations for academic success as well as their personal value of schooling can have a significant impact on their academic choices and achievement in the future. In the study described, for example, Harackiewicz and colleagues (2012) found that their intervention led students whose parents were in the experimental group to take, on average, nearly one semester more of science and mathematics in the last two years of high school, compared with the control group. In another study, Cohen and colleagues (2006; 2009) designed an intervention aimed at reducing the racial achievement gap by countering negative stereotypes about academic abilities and achievement. The researchers focused specifically on students' reflections concerning personally important, overarching values as a way to lessen the threat and stress of negative stereotyped ethnic minority students. The researchers asked African American and White seventh-graders to complete brief writing exercises three to five times during the year. The researchers conducted this experiment with three independent cohorts (N = 133, 149 and 134). Students were randomly assigned to either a treatment or control group. In the treatment group, students wrote about values that were important to them. In the control group, students wrote about a neutral topic. Over two years, the grades of African Americans were, on average, raised by .24 grade points. Low-achieving African Americans were particularly benefited. Their GPA improved, on average, .41 points and their rate of remediation or grade repetition was less (5% versus 18%). In their study of high school students, Hulleman and Harackiewicz, (2009) found similar results. Students in the treatment group who

started out with low expectations for success had the greatest improvement in their subsequent grades compared to the control group (.80 grade points difference) at the end of the term. However, there was no significant difference in the grades of students in the treatment group who already had high expectations for success. These findings suggest that expectancy-value interventions may be particularly effective in enhancing the academic outcomes of low-achieving, low-expecting students.

In summary, expectancy-value theory provides a possible framework that may be useful in interventions focused on enhancing self-perceptions and subsequent motivation. Experimental studies designed with an expectancy-value framework show that encouraging young people to consider the value and meaning of a task in their own lives is likely to support their interest and engagement in that domain in the future. This was especially relevant for students who had low expectancies for success. Research has also shown that task values play a crucial role in the employment of learning strategies. It is not enough for students to know about learning strategies, students must also value the work in order to voluntarily utilize those strategies (Pokay & Blumenfeld, 1990). This is further highlighted by causal evidence indicating that the value of learning tasks may be enhanced by highlighting future intrinsic rather than extrinsic goals (Vansteenkiste, Simons, Lens, Soenens, Matos, & Lacante, 2005). Together, these findings highlight the importance of underscoring the value of tasks for children and adolescents in interventions aimed at improving self-perceptions, motivation, and engagement, more generally. This is particularly salient for females and ethnic minority groups who may encounter negative stereotypes in particular domains regarding their social membership. However, there are only a few school-based experimental studies which have focused on expectancy-value theory, so additional evidence would enhance our understanding of how best to implement interventions in the classroom and beyond.

PERSEVERANCE

Perseverance is a widely used concept within research which involves steadfastness on mastering a skill or completing a task. In this review, we focus on two manifestations of perseverance: engagement and grit. Both concepts concern an individual's investment in accomplishing a task or goal, yet they are distinguishable both conceptually and psychologically. Engagement involves how students behave, feel and think regarding their commitment to academic tasks, activities or school more generally (Fredricks, Blumenfeld, & Paris, 2004), while grit refers to a trait-level perseverance and passion for long-term goals which is related to the personality trait of Conscientiousness (Duckworth, Peterson, Matthews, & Kelly, 2007).

Engagement

Engagement is a meta-construct which includes behavioral, emotional and cognitive components (Fredricks et al., 2004). 'Behavioral engagement' draws on the idea of

participation; it includes involvement in academic, social or extracurricular activities and involves a range of behaviors such as effort, persistence, concentration, attention, asking questions and contributing to class discussion that are considered crucial for achieving positive outcomes.'Emotional engagement' encompasses affective reactions to teachers, classmates, academics and school. 'Cognitive engagement' incorporates thoughtfulness and willingness to exert the effort necessary to comprehend complex ideas and master difficult skills. Recent evidence suggests that the three dimensions are interlinked (Li & Lerner, 2013; Wang, Willett, & Eccles, 2011), yet can develop differently over time (Wang & Eccles, 2012).

For the most part, the research on engagement has employed correlational methods and most studies have used engagement as an outcome rather than a predictor (Fredricks et al., 2004; Jimerson, Campos, & Greif, 2003). Evidence from intervention studies, however, suggests that students' engagement may be improved (Christenson et al., 2008; Gregory, Allen, Mikami, Hafen, & Pianta, 2014). Using a randomized controlled design, Gregory and colleagues analyzed the efficacy of the My Teaching Partner-Secondary program to increase behavioral engagement. The program provides teachers personalized coaching and systematic feedback on teachers' interactions with students, using systematic observation of video recordings of teacher-student interactions in the classroom. Findings indicated that teachers in the intervention had significantly higher increases, albeit to a modest degree, in observed student behavioral engagement in their classrooms after one year of program involvement compared to the teachers in the control group (explaining 4% of variance). Another intervention program entitled Check and Connect was developed by Christenson and colleagues (Christenson et al., 2008) to promote student engagement (which includes academic, behavioral, cognitive and affective components), support regular attendance and improve the likelihood of school completion for students at-risk of school drop-out. Students are assigned a mentor to work with them for at least two years to build relationships with the student, their family and the school staff. The mentor routinely monitors their school attendance and checks for warning signs of school disengagement. They also teach the student problem-solving strategies and encourage active participation in school-related activities. A series of studies have been conducted which measure pre- and post-treatment outcomes, without a control group. Findings show that students enrolled in Check and Connect showed increased levels of school engagement. However, evaluations of the Check and Connect program do not explore the impact of the program on students in comparison to a control group who are not enrolled.

There is scant experimental evidence regarding the role of school engagement in improving students' later outcomes. Findings, for example, indicate that students enrolled in Check and Connect show improved school attendance (Lehr, Sinclair, & Christenson, 2004; Sinclair, Christenson, Elevo, & Hurley, 1998). In particular, the quality and closeness of the relationship between students and intervention staff was associated with improved school attendance, highlighting the importance of emotional school engagement for high-risk young people (Anderson, Christenson, Sinclair, & Lehr, 2004).

In conclusion, research shows a significant correlation between school engagement and positive outcomes including achievement, school retention and emotional wellbeing (e.g., Li & Lerner, 2011; Schoon, 2008; Schoon & Duckworth, 2010; Wang & Eccles, 2012). Evidence from intervention programs also indicate that school engagement may be improved which, in turn, may lead to greater school attendance and participation (Anderson, Christenson, Sinclair, & Lehr, 2004). However, there is very little experimental evidence which has demonstrated a causal relationship between engagement and later outcomes. The difficulty establishing a causal relationship focuses on the nature of engagement, itself. It has been defined more as an outcome of a situational context, rather than a characteristic of the individual. Thus, school-wide interventions are likely to be the most successful avenue for raising engagement in a learning context.

Grit

More recently, the notion of 'grit' has received much attention. Grit is seen as a non-cognitive trait, based on an individual's passion and perseverance for a goal (Duckworth et al., 2007). The factor that distinguishes grit from other aspects of perseverance is its *long-term* quality: those with grit will work persistently on accomplishing a single over arching goal over an enduring period of time despite facing failure, adversity, boredom or lack of progress (Duckworth et al., 2007).

Duckworth and her colleagues have demonstrated that grit is associated with achievement in a number of correlational studies focused on academically talented students (Duckworth et al., 2007; Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2011). Further studies have found positive correlations between grit and positive affect, happiness and life satisfaction (Singh & Jha, 2008); the use of learning strategies (Duckworth et al., 2011) and exercise behavior (Reed, Pritschet, & Cutton, 2012). However, there are no experimental studies to date investigating whether it is possible to improve one's grittiness and whether such improvement has an impact on subsequent outcomes.

In conclusion, there is no causal evidence linking grit to positive outcomes. This is likely due to the conception of grit, which is considered to be an inherent personality trait—related to Conscientiousness (Duckworth et al., 2007). On the same note, however, there is little evidence that grit is, in fact, a stable character trait. Grit has yet to be measured at multiple time points to determine whether it changes or remains constant across time. As with other facets of perseverance, grit is likely to be influenced by multiple factors, including developmental and situational contexts. There is a wealth of research showing that students' persistence at tasks changes over time and in different situations, such as the studies included this review related to self-efficacy and motivation. This further begs the question whether grittiness is adaptive at all times, in all circumstances and for all individuals. In some instances, there may be hidden costs to being gritty. For example, it may be most productive for an individual to cut their losses and re-focus their energies on a different task

with a greater likelihood of success rather than stay the course on one doomed to failure (Heckhausen, 2000). This may be especially salient for those individuals who do not have extraordinary talent in a specific area. However, since the most of the research on grit has focused on understanding what—beyond intelligence and talent—distinguishes exceptional individuals, these studies cannot easily be generalized to broader populations. Given the lack of experimental evidence and the other concerns noted, there seems little evidence that grit is a possible factor to target for interventions at this time. It may be, however, that further research provides greater clarity on this issue.

SELF-CONTROL

Most recently, researchers have focused attention on the construct of self-control and its related terms including self-discipline, delay of gratification, self-regulation and impulse control (Duckworth & Kern, 2011). While the operational definitions vary widely, self-control is defined as the ability to resist short-term temptations and impulses in order to accomplish a higher pursuit. According to Baumeister, Vohs and Tice (2007): "self-control is the capacity for altering one's own responses, especially to bring them into line with standards such as ideals, values, morals and social expectations and to support the attainment of long-term goals" (p. 351).

Self-control is considered to have stable individual differences as measured by Conscientiousness as one dimension of the Big Five aspects of personality. According to Gottfredson and Hirschi (1990), self-control is comprised of six inter-related characteristics including: (1) impulsivity and inability to delay gratification, (2) lack of persistence, tenacity, or diligence, (3) partaking in novelty or risk-seeking activities, (4) little value of intellectual ability, (5) self-centeredness and (6) volatile temper. These characteristics are believed to come together for individuals with low self-control. Furthermore, Gottfredson and Hirschi posit that self-control is malleable during the first 10/12 years of life, but after this point, while self-control tends to improve with age due to socialization, it is largely unresponsive to any external intervention effort. Thus, although absolute levels of self-control may change within persons (increasing rather than decreasing), relative rankings between persons will remain constant over the life course (Gottfredson & Hirschi).

Interventions have focused on improving self-control, most notably to reduce delinquency and problem behaviors in clinical and non-clinical samples. A recent meta-analysis, for example, examined studies that investigated the effect of early self-control improvement programs (up to age 10) on improving self-control and/or reducing delinquency and problem behaviors (Piquero, Jennings, & Farrington, 2010). Studies which had a randomized controlled evaluation design that provided post-test measures of self-control and/or delinquency and problem behaviors among experimental and control subjects were included. The meta-analysis found that self-control improvement programs are an effective intervention for improving self-control and reducing delinquency and problem behaviors. The effect sizes of

the programs were positive and significant and ranged from having a small effect (.28) to having a rather substantial moderate effect (.61), suggesting that self-control improvement programs are by and large successful at improving self-control. The mean effect size of self-control improvement programs for reducing delinquency ranged from –.09 to –.30. The authors conclude that self-control improvement programs should continue to be used to improve self-control and reduce delinquency and behavior problems up to age 10. Considering these results, future efforts should be made to examine the long-term effectiveness and cost-benefit of self-control improvement programs after age 10 (Piquero et al., 2010).

In the most notable research testing the importance of self-control for academic achievement, Mischel (1981) conducted a series of 'marshmallow' experiments from 1968 to 1974. In those studies, a total of 653 children participated in at least one experiment. Four-year-old children at the Stanford University preschool were left alone with one marshmallow after being told they could have two marshmallows if they waited to eat the one marshmallow until the experimenter returned. "Wait time" was the length of time the child could wait before eating the marshmallow. There was a positive relationship between wait time for the second marshmallow and higher academic achievement and social functioning more than one decade later (e.g., Shoda, Mischel, & Peake, 1990). However, wait time was only associated with later achievement when the marshmallow was put in plain sight and when the children were not taught specific distraction strategies to avoid thinking about the marshmallow. Children who could delay gratification longer were able to devise their own distraction strategies while in plain sight of the marshmallow (Mischel & Mischel, 1983). The underlining message from these studies is not necessarily that self-control predicts achievement but that higher intelligence may make it easier to initiate self-control strategies (Farrington et al., 2012).

In conclusion, correlational evidence suggests that childhood self-control predicts achievement and adjustment outcomes, even in adulthood (e.g., Duckworth & Seligman, 2005; Moffitt et al., 2010; Tangney, DuBois, & Cooper; 2004; Wolfe & Johnson, 1995). Furthermore, experimental studies find that self-control can be improved up to age 10 (Piquero et al., 2010). However, there is little or no experimental randomized evidence showing that self-control is malleable after that point, particularly for adolescents and young adults. This lack of evidence cannot refute Gottfredson and Hirschi's argument (1990) that self-control after age 10 becomes fixed. Nevertheless, researchers suggest that individuals can strengthen their ability to control their feelings, desires and motivations through practice or exercise (Muravan & Baumeister, 2000). Although self-control may be considered a personality trait – the factors that underlie it—may be influenced by the strategies one employs to delay gratification. For example, the situational context undeniably plays a role in the exhibition of self-control. Circumstances may make it easier or more difficult to control one's impulses, as demonstrated by the Mischel's examination of differing conditions (i.e., putting the marshmallow in plain sight and providing strategies for waiting) on children's wait times. In another interesting

twist on Mischel's study, for instance, children were tested using the marshmallow task in an environment demonstrated to be either unreliable or reliable (Kidd, Palmeri, & Aslin, 2013). Children in the reliable condition waited significantly longer than those in the unreliable condition, suggesting that wait times reflected rational beliefs about whether waiting would ultimately pay off. Thus, wait times on sustained delay-of-gratification tasks (e.g., the marshmallow task) may not only reflect differences in self-control abilities, but also rational beliefs about the stability of their environment. Therefore, while individuals may have different innate levels of self-control as a personality trait, the degree to which they demonstrate self-controlled behaviour may depend on their meta cognitive skills as well as their beliefs about the nature of their environment.

METACOGNITIVE STRATEGIES

Metacognitive strategies are goal-oriented efforts to impact one's learning behaviors and processes through focusing awareness on employing strategies which are most conducive to learning (Zimmerman, 2001). Metacognitive strategies, for example, include setting goals, planning and problem-solving, being aware of one's strengths and weakness, monitoring one's progress, and understanding and knowing when and why to use certain strategies (Pintrich, 2000). The use of different metacognitive strategies also varies according to the developmental stage of the child or young person (Kuhn, 1999; Steinberg, 2005). For instance, younger children are more likely to use overt strategies such as talking aloud during problem-solving (i.e., self-talk), while older children are more likely to use complex strategies such as evaluating their own style of learning and assessing what they know and what they do not know (i.e., self-appraisal).

There is a wealth of experimental studies showing that metacognitive strategies can be learned, particularly within specific academic subjects. A recent meta-analytic study has synthesized these effects. Dignath et al. (2008) examined 48 studies investigating the effect of training in self-regulation on learning and use of strategies among students in first to sixth grades. The overall effect size for all studies examining the effect of any type of self-regulation training on the use of cognitive or metacognitive strategies was .73. Training that specifically emphasized metacognitive strategies had an effect size of .54. Training approaches that combined metacognitive components with other aspects of self-regulation, such as cognitive or motivational strategies, were even more successful, with average effect sizes of .81 and .97, respectively. The most effective metacognitive strategies included the combination of planning and monitoring (mean effect size = 1.50) and the combination of planning and evaluation (mean effect size = 1.46), both of which were more successful than teaching any of the skills in isolation or teaching a combination of all three metacognitive skills (planning, monitoring and evaluation).

Four meta-analytic studies have further demonstrated medium to large effects of teaching metacognitive strategies on later performance. In an earlier meta-analysis

of quasi-experimental studies by Haller, Childs and Walberg (1988), for example, the average effect size of metacognitive instruction on reading comprehension across 20 studies contrasting experimental and control groups was .71. They found that children aged 12 to 13 benefitted most from metacognitive strategy instruction and that reading comprehension was greatest when instruction combined the use of several metacognitive strategies rather than focusing on only one or two (Haller, Childs, & Walberg). Hattie, Biggs and Purdie (1996) meta-analyzed 51 studies in reading and other subject areas, including quasi-experimental, pre- and post-test, and other designs. They found that the average weighted effect sizes due to training in cognitive and metacognitive skills were .57 on performance, .16 on study skills expertise, and .48 on positive affect. Higgins, Hall, Baumfield and Moseley (2005) conducted a meta-analysis of 29 studies that evaluated the impact of thinking skills programs in schools. Quasi-experimental studies were selected for the meta-analysis if they had sufficient quantitative data to calculate an effect size (relative to a control or comparison group of pupils) and if the number of research subjects was greater than .10. They found that thinking skills programs have an above average effect size of .62 on learning outcomes compared to other researched educational interventions. There was relatively greater impact on tests of mathematics (.89) and science (.78), compared with reading (.40). In the meta-analysis already described, Dignath and Buttner (2008) found that training produced an average effect size of .69 across mathematics, reading/writing and other subjects. Effect sizes were higher when the training was conducted by researchers instead of regular teachers. Moreover, interventions attained higher effects when conducted in the scope of mathematics than in reading/writing or other subjects. Together, these studies show that meta-cognitive training has large effects on mathematics and science and medium size effects on reading and positive affect.

In summary, there is clear evidence that metacognitive strategies are malleable and can be taught or otherwise developed in both younger and older students and across a wide range of academic subjects. They have also been shown to have medium to large effects on a number of academic outcomes. However, there a few caveats to keep in mind. First and foremost, it has not been shown whether or not the positive effects of training persist over longer term and whether students are able to transfer learning strategies from one context to another, particularly non-academic domains. For example, there is evidence suggesting that the benefits of "thinking skills" programs often fade over time and do not generalise to other subjects or situations (Claxton, 2007). Second, these studies often rely on student self-reports of strategy use or teacher reports of observable student behavior. As a result, researchers cannot be certain whether metacognitive strategies have actually been learned and employed or whether students are simply reporting what they think should to the researchers, based on the content of the training (Farrington et al., 2012). Third, as already discussed, students must be motivated to utilize metacognitive strategies in the first place. Schunk and Ertmer (2000) argue that teaching a strategy does not necessarily guarantee that students will continue to use it, especially if they believe that the strategy is not considered

as important for their success compared to other factors. Students must believe they have the capacity to learn strategies and be motivated to put forth the additional effort necessary to make use of them. Previous research documents the relationship between academic self-efficacy, motivation and metacognitive strategy use (e.g., Pintrich, 1999; Zimmerman, Bandura, & Martinez-Pons, 1992); thus, underscoring interventions need to consider the interplay among these factors. Providing feedback concerning both the value of the strategy and how well students are applying it, furthermore, increases achievement and the use of self-regulatory strategies more than instruction in strategy use alone (Zimmerman, 2001). In consideration of these concerns, further research is needed to identify the causes which underlie the positive effects of meta-cognitive skills programs, to determine whether their impact is due to specific aspects of the particular program or to broader changes in teaching and learning processes resulting from their implementation (Higgins et al., 2005).

SOCIAL AND EMOTIONAL SKILLS

Social and emotional skills are defined as "socially acceptable learned behaviors that enable a person to interact effectively with others and to avoid socially unacceptable responses" (Gresham & Elliot, 1990, p. 1). They include a range of pro-social behaviors such as being cooperative, sharing, helping, communicating, expressing empathy, providing verbal support or encouragement, and showing kindness. Most studies tend to examine different types of pro-social behaviors together, as a single construct. As a result, there is less information regarding the predictive nature of individual facets of social skills on other outcomes. For example, there are few studies examining the role of communication skills in predicting later achievement, with the exception of research focused on clinical populations (e.g., autistic children). Furthermore, a wealth of research embeds pro-social behavior in the more expansive concept of social-emotional learning (SEL).

Despite these limitations, there are several meta-analyses of SEL programs showing that, social skills can be fostered (Durlak, Weissberg, & Pacha, 2010; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Payton et al., 2008). Many of these programs address social and emotional learning (SEL) in school-aged children and most show medium effect sizes for enhancing social skills. In their universal review of 180 studies, for example, Payton et al. found that children participating in SEL universal programs demonstrated improved enhanced social and emotional skills, with an effect size of .60. In another large-scale meta-analysis of SEL programs, Durlak et al. reported that SEL interventions had an average effect size of .57 on improving SEL skills.

Meta-analytic studies further show small to medium effects of SEL interventions on a variety of positive outcomes. In a meta-analysis of After School Programs (ASP) to promote personal and social skills in children, Durlak et al. (2010) found significant mean effects ranging from .12 for school grades, .17 for achievement test scores, .14 for school bonding, .19 for positive social behaviors, .19 for problem

behaviors and .34 for child self-perceptions (i.e., increased self-confidence and self-esteem). In their meta-analysis of school-based universal interventions, Durlak et al. (2011) found that SEL interventions had an average effect size of .23 on attitudes, .24 on positive social behavior, .22 on conduct problems, .24 on emotional distress and .27 on academic achievement. The average follow-up period was 92 weeks (median = 52 weeks). The mean follow-up effect sizes remained significant in spite of reduced numbers of studies assessing each outcome: SEL skills (.26), attitudes (.11), positive social behavior (.17), conduct problems (.14), emotional distress (.15) and academic performance (.32).

In conclusion, there is strong evidence that social skills are malleable and that SEL programs have positive, lasting effects on associated factors. However, there are several limitations of this work. First, most of the research bundles positive social skills together; therefore, it is difficult to isolate changes in specific social skills such as communication or cooperation and their subsequent effects on other outcomes. Second, research tends to focus on social skills in younger children, but it is likely that such skills manifest themselves differently as young people transition into high school and beyond, which often requires more complex social norms and interpersonal interactions. While we understand intuitively that social skills are crucial as young people prepare for their future, there is less understanding of how to cultivate these skills in 'real world' settings. This is particularly salient considering that, as students proceed through schooling, social skills are less utilized as independent tasks and exams often determine their grades rather than group work or projects (Farrington et al., 2012). Lastly, fewer longitudinal studies have assessed the impact of social skills on achievement and adjustment in the longer term and the mechanisms through which they impact future outcomes, such as employment, relationships and parenthood. More longitudinal research is needed on how we can enhance social skills, particularly for adolescents in settings such as schools, early employment and volunteer experiences, and whether these learned skills then translate to more successful outcomes in adulthood.

DISCUSSION

Current debate on non-cognitive skills sometimes implies that there is one key factor – whether, grit, self-control or resilience – that is the 'key to success' for young people and that it is this one crucial ingredient that enables them to succeed over and above cognitive ability or test scores, to overcome disadvantage and flourish even in the face of serious adversity. Whilst this narrative is right to emphasize the importance of non-cognitive factors in determining outcomes for young people over and above cognitive or academic competences, our review finds that there does not seem to be one non-cognitive skill that predicts positive outcomes for young people. Rather, many skills are inter-linked and the enhancement of one of these skills without improvement of the others is unlikely to lead to lasting changes.

The evidence is compelling that there are strong *associations* between non-cognitive factors and positive outcomes for young people. Measurable factors such as self-control and school engagement are correlated with positive outcomes in the future such as academic attainment, labour market outcomes, and reduced crime (Blanden, Gregg, & Macmillian, 2007; Heckman & Rubenstein, 2001; Heckman et al., 2006; Jacob, 2002). But as our review shows, robust, causal evidence that improvement in non-cognitive skills leads to better longer term outcomes is much more limited. Most experimental studies look at single non-cognitive skills in isolation and over relatively short time frames. So far, the evidence is relatively weak on whether improvements to non-cognitive skills are transferable across domains and are sustained into the future.

That said, there are significant signs of promise. When developed in combination, skills such as self-efficacy, motivation, and meta-cognitive strategies appear to be influential in improving academic learning and success in children and young people. Future studies should provide more of an empirical basis of their impact on outcomes other than academic achievement, especially regarding those which are longer term. The enhancement of social and emotional skills, in addition, has been shown to lead to a variety of positive outcomes. Programs that foster social and emotional development have shown to have low to moderate effects on improving associated skills including positive self-perceptions, social and emotional adjustment and academic achievement.

In conclusion, there is no definite estimation regarding whether there is a single characteristic which is the crucial 'silver bullet' to improve or facilitate attainment across a wide distribution of outcomes. In fact, many of these factors are interlinked and there is much overlap among them, yet most studies either investigate them in isolation or subsumed under the rubric of non-cognitive skills without parcelling out their unique effects. Furthermore, within any given concept such as 'motivation' or 'self-control', there is a long history of theory and measurement and competing definitions of what is being discussed and measured. Given this complexity, it is little surprise that debate sometimes becomes focused on a simple, single measure of potential. What this review suggests, ultimately, is that it is essential to keep a broad view and consider a range of skills in combination with each other. When developed in combination, skills such as self-efficacy, motivation and meta-cognitive strategies appear to be influential in improving academic learning and success in children and young people.

Despite significant gaps in the evidence, there are areas of promise and that further, long-term studies will help to build the case for investing in the development of non-cognitive skills and improving outcomes for young people. Priorities for future research should be to understand the extent to which skills can be influenced through intervention, the transferability of skills across domains and how far changes can be sustained into the future. Future studies should also provide more of an empirical basis of the impact of non-cognitive skills on outcomes other than

academic achievement, especially regarding longer-term outcomes such as health, wealth, wellbeing and social integration.

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10. NON-COGNITIVE FACTORS OF LEARNING AS EARLY INDICATORS OF STUDENTS AT-RISK OF FAILING IN TERTIARY EDUCATION

INTRODUCTION

It is increasingly evident that significant numbers of college students do not complete the courses on which they enrol, particularly for courses with lower entry requirements (ACT, 2012). Enrolment numbers to tertiary education are increasing, as is diversity in student populations (OECD, 2013). This adds to the challenge of both identifying students at risk of failing, and provisioning appropriate supports to enable all students perform optimally (Mooney et al., 2010).

Learning is a latent variable, typically measured as academic performance in assessment work and examinations (Mislevy et al., 2012). Factors impacting on academic performance have been the focus of research for many years (for example, Allick & Realo, 1997; Farsides & Woodfield, 2003; Hembree, 1988; Lent et al., 1994; Moran & Crowley, 1979; Powell, 1973). It still remains an active research topic (Buckingham Shum & Deakin Crick, 2012; Cassidy, 2011; Jayaprakash et al., 2014; Komarraju & Nadler, 2013; Nandagopal & Anders Ericsson, 2012) indicating the inherent difficulty in both measurement of learning (Knight et al., 2013; Tempelaar et al., 2013), and modelling learning process, particularly in tertiary education (Pardos et al., 2011).

Cognitive ability remains an important determinant of academic performance (Cassidy, 2011), often inferenced from prior academic achievement. Age has also been cited as significant in tertiary education (Naderi et al., 2009), as are data gathered from learner activity on online learning systems (Bayer et al., 2012; López et al., 2012). In addition to the data systematically gathered by tertiary education providers, there are other, non-cognitive factors of learning that are indicative of potential academic performance in first year of study. For example, models predicting academic performance that include factors of motivation (e.g. self-efficacy, goal setting) with cognitive ability yield a lower error variance than models of cognitive ability alone (reviewed in Boekaerts, 2001; Robbins et al., 2004). Research into personality traits, specifically the Big Five factors of openness, conscientiousness, extroversion, agreeableness and neuroticism, suggests some personality factors are also indicative of potential academic performance (Chamorro-Premuzic & Furnham, 2004; Chamorro-Premuzic & Furnham, 2008; De Feyter et al., 2012).

M. S. Khine & S. Areepattamannil (Eds.), Non-cognitive Skills and Factors in Educational Attainment, 199–237.

Learning approach (deep or shallow) and self-regulated learning strategies are also relevant, and have been shown to mediate between other factors (such as factors of personality and factors of motivation) and academic performance (Biggs et al., 2001; Entwhistle, 2005; Swanberg & Martinsen, 2010).

Early modelling of students at risk of failing informs provisioning of supports and modifications to learning environment, to enable more students perform optimally (Lauria et al., 2013). Colby (2004) identified week two as a critical point in identifying at-risk students. Milne et al. (2012) reported successful results in predicting students at risk of failing based on analysis of online behaviour in week one. This chapter reports on a study to investigate if non-cognitive factors of learning, measured during first year student enrolment/induction, are predictive of academic performance at the end of first year of study. Participants were from a diverse student population that included mature students and students from disadvantaged socio-economic backgrounds.

LITERATURE REVIEW OF NON-COGNITIVE FACTORS OF LEARNING, AND CORRELATIONS WITH ACADEMIC PERFORMANCE

This section reviews a range of non-cognitive factors that are directly or indirectly related to academic performance in tertiary education. Specifically, four key areas are reviewed: personality, motivation, learning strategies and learner modality. Available evidence on correlations between individual attributes and academic achievement is outlined. Unless stated otherwise, studies cited are based on tertiary education.

Personality, and its Correlations with Academic Performance

While there are many factors associated with personality, factor analysis by a number of researchers, working independently and using different approaches, has resulted in broad agreement of five main personality dimensions (Ackerman & Heggestad, 1997; John et al., 2008). These are commonly referred to as the Big Five (Cattell & Mead, 2008; Goldberg, 1992; Goldberg, 1993; Tupes & Cristal, 1961) or the related Five-Factor Model (Costa & McCrae, 1992). The five factors include: openness, agreeableness, extraversion, conscientiousness and neuroticism, and are described in Table 1. While the Big Five concept is empirical rather than a theory of personality (John & Srivastava, 1999), good reliability and consistency has been reported (de Raad & Schouwenburg, 1996; John et al., 2008).

There is a consensus across studies that conscientiousness is the best personality based predictor of academic performance (O'Connor & Paunonen, 2007; Poropat, 2009; Swanberg & Martinsen, 2010). A number of studies report openness has the highest correlation with general intelligence (for example Ackerman & Heggestad, 1997; Chamorro-Premuzic & Furnham, 2008; Poropat, 2009). However, while significant correlations between openness and academic performance have also

Table 1. Big Five personality dimensions and their labels in three commonly used scales (Cattell & Mead, 2008; de Raad & Schouwenburg, 1996; Goldberg, 1993)

Big five (Costa and McCrae)	*16PF (Cattell)*	*Five-factor Model (Goldberg)*	*Explanation of each factor*
Extraversion	Introversion/ Extraversion	Surgency	Tendency to move towards, or away from human interaction.
Neuroticism	Low Anxiety/ High Anxiety	Emotional stability	Temperamental, moody, nervousness.
Openness	Tough-Mindedness/ Receptivity	Intellect or culture	Openness to feelings, emotions, new ideas and imagination. Curiosity. Creativity.
Agreeableness	Independence/ Accommodation	Agreeableness	Kindness, trust, warmth.
Conscientiousness	Self-Control/ Lack of Restraint	Conscientiousness or dependability	Organised, thorough, reliable, work ethic.

been reported, correlations with academic performance are generally not as high as conscientiousness (see Table 2). Kappe and van der Flier (2010) reported that open personalities tend to do better when assessment methods are unconstrained by submission rules. Sub-factors of conscientiousness such as persistence, and sub-factors of openness such as intellectual curiosity, creativity and open-mindedness, have been associated with an effective thinking and learning disposition (Buckingham Shum & Deakin Crick, 2012; Tishman et al., 1993). Encouragement of an effective learning disposition in tertiary education in turn prepares students for the complexity of challenges presented by the workplace (Buckingham Shum & Deakin Crick, 2012).

The relationship between neuroticism and academic performance is influenced by assessment type. For example, Chamorro-Premuzic and Furnham (2003) found neuroticism had a significant negative impact on end of year examination performance ($r = –0.28$, $p < 0.01$, $n = 70$); on the other hand, Kappe and van der Flier (2010) found neuroticism to be positively correlated with academic performance when assessment is free from time constraints and supervision ($r = 0.18$, $p = 0.04$, $n = 133$).

Research is inconsistent regarding the remaining two personality dimensions of extraversion and agreeableness and their relationship with academic performance. Introverts tend to have better study habits and are less easily distracted (Entwistle & Entwistle, 1970 cited by Chamorro-Premuzic & Furnham, 2006, p. 78), while extraverts tend to perform better in class participation, oral exams, seminar presentations and multi-choice style questions (Furnham & Medhurst, 1995;

Table 2. Correlations with academic performance in tertiary education

Study	*N*	*Age*	*AP*	*Temperament*		*Motivation*			*Learning approach*			*Self-regulation*		
				Concientious	*Open*	*Self-efficacy*	*Intrinsic*	*Extrinsic*	*Deep*	*Shallow*	*Strategic*	*Metacognitive self-regulation*	*Study time*	*Study effort*
Bidjerano & Dai, 2007	217	m = 22	GPA										0.23**	0.33**
Cassidy, 2011	97	m = 23.5	GPA			0.40***			0.31**	–0.01	0.32**			
Chamorro-Premuzic & Furnham, 2008;	158	18–21	GPA	0.37**	0.21**				0.33*	–0.15	0.18*			
Dollinger et al., 2008[+]	338	m = 21.9	1 exam	0.11*	0.14*		0.21**						0.21**	
Duff et al., 2004	146	17–52	GPA	0.21	0.06				0.10	–0.05	0.15			
Eppler & Harju, 1997	212	m = 19.2	GPA				0.30***	0.13						
Eppler & Harju, 1997	50	m = 29.8	GPA				0.28*	0.08						

Study	*N*	*Age*	*AP*	*Temperament*		*Motivation*			*Learning approach*			*Self-regulation*		
				Concientious	*Open*	*Self-efficacy*	*Intrinsic*	*Extrinsic*	*Deep*	*Shallow*	*Strategic*	*Metacognitive self-regulation*	*Study time*	*Study effort*
Kappe & van der Flier, 2010	133	18–22	GPA	0.46**	-0.08									
Komarraju et al., 2011	308	18–24	GPA	0.29**	0.13*									
Komarraju & Nadler, 2013	257	m = 20.5	GPA			0.30**						0.14*	0.31**	0.39**
Ning & Downing, 2010	581	m = 20.48	GPA									0.42**		0.24**
Robbins et al., 2004[+]	meta analysis, 18+		GPA			0.50		0.18						
Swanberg & Martinsen, 2010	687	m = 24.5	1 exam						0.16	–0.25				

**p < 0.05; **p < 0.01; ***p < 0.001; +: studies cited achievement goals in general rather than intrinsic or extrinsic gaols specifically; AP: Academic Performance.*

Kappe & van der Flier, 2010). In their meta-analysis of a number of studies investigating personality as a predictor of academic performance, O'Connor and Paunonen (2007) concluded agreeableness is not associated with academic performance in tertiary education.

Theories of Motivation That Relate to Academic Performance

Ryan and Deci (2000) define motivation as being 'moved to do something'. Defining how learners are motivated to learn is more complex, and is characterised by a range of complementary theories which aim to explain both the level of individual motivation and the nature of the motivation (Steel & Konig, 2006). Current theories in turn encompass a number of factors, some of which are relevant, directly or indirectly, to academic performance (Robbins et al., 2004). The following sections discuss two such theories, relating to expectancy and goals.

Measurement of expectancy motivation and correlation with academic performance. Expectancy models of motivation explore the extent to which a person regards outcome as being a consequence of behaviour. Levels of expectancy motivation are influenced by the extent to which a person believes they are in control of the outcome (locus of control) (Cassidy, 2011). There are two strands of expectancy motivation (Eccles & Wigfield, 2002; Pintrich & DeGroot, 1990):

- Outcome expectation refers to a belief that a particular behaviour will lead to a particular outcome, e.g. *active engagement in class work results in better grades*.
- Self-efficacy refers to a person's belief that they can achieve that outcome e.g. *I can actively engage in class and so I can achieve better grades*. High self-efficacy is associated with setting more challenging goals, a willingness to work hard, and persistence with a task.

A number of studies found self-efficacy specifically to be a useful predictor of academic performance (Brady-Amoon & Fuertes, 2011; Cassidy, 2011; Yusuf, 2011). Indirect relationships between self-efficacy and academic performance mediated by either other motivational factors or learning strategies are also cited (Brown et al., 2010; Yusuf, 2011). On the other hand, Pintrich and DeGroot (1990) found that self-efficacy was not significantly related to academic performance when cognitive engagement variables such as self-regulation and learning strategies were also considered, thereby concluding that self-efficacy facilitates cognitive engagement, but cognitive engagement itself is more directly linked to academic performance. Nevertheless, study results suggest self-efficacy is an important indicator of motivation in tertiary education. In addition, self-efficacy is associated with an effective learning disposition (Buckingham Shum & Deakin Crick, 2012; Deakin Crick & Goldspink, 2014), is malleable, and can be fostered through positive encouragement to persist with a task that is challenging but achievable (Bandura, 2009).

Measurement of achievement goals and correlation with academic performance. The concept of achievement motivation has been the cause of some debate; perspectives vary from regarding achievement motivation as being needs based, to regarding achievement motivation as being goal driven (Bandura, 2009). A literary review by Gray et al. (2014) concluded achievement goals were more predictive of academic performance in tertiary education than needs based motivation. Achievement goals fall into two categories: learning (intrinsic) goals where an individual is looking to increase their competency and performance (extrinsic) goals where an individual is looking for favourable feedback (Covington, 2000; Dweck, October 1986; Dweck & Leggett, 1988; Eccles & Wigfield, 2002; Eppler & Harju, 1997). Achievement goals influence approach to learning task (Covington, 2000). Learning goals are motivated by the desire to increase existing competencies and master new skills and, therefore, tend to be more challenging in nature and result in active engagement in the learning process (Covington, 2000). Learning goals are associated with high self-efficacy, a belief that ability is dynamic, and a belief that increased effort will result in increased success (outcome expectancy). This is regarded as an important learning disposition (Buckingham Shum & Deakin Crick, 2012). Performance oriented goals are associated with a tendency to engage in tasks in which a student is guaranteed to excel, and avoid tasks that may highlight incompetence (Dweck, 1986). This approach can inhibit a student from challenging and enhancing existing competencies. It is also associated with superficial cognitive processing and inefficient use of study time (Covington, 2000).

Studies have found learning goals to be more strongly correlated with academic performance than performance goals (see Table 2). Eppler and Harju (1997) found a statistically significant difference in the average GPA of students with high learning goals (some of whom also had high performance goals) and those with both low learning goals and low performance goals. They also found older students to be stronger in their endorsement of learning goals, while younger students in tertiary education tended towards performance oriented goals.

Learning Strategies

A number of studies found the relationship between academic performance and temperament or motivation is mediated by a student's approach to the learning task itself. Important factors include learning approach (e.g. Bruinsma, 2004; Chamorro-Premuzic & Furnham, 2008; Diseth, 2011; Sins et al., 2008) and self-regulation (e.g. Nasiriyan et al., 2011; Ning & Downing, 2010). The following sections discuss both learning approach and self-regulation.

Measurement of learning approach and correlation with academic performance. Learning approach has its foundations in the work of Marton and Säljö (2005) who classified learners as shallow or deep. Deep learners aim to understand content, while shallow learners aim to memorise content regardless of

their level of understanding. Later studies added strategic learners (Entwhistle, 2005, p. 19), whose priority is to do well, and will adopt either a shallow or deep learning approach depending on the requisites for academic success. Both personality and motivation are indicative of personal approaches to learning. Openness, conscientiousness and intrinsic motivation are associated with a deep learning approach, while neuroticism and extrinsic motivation are associated with a shallow learning approach (Busato et al., 1999; Duff et al., 2004; Marton & Säljö, 2005).

There are some inconsistencies regarding which learning approach has highest correlation with prior academic achievement; some studies found correlations are higher for a deep learning approach (e.g. Chamorro-Premuzic & Furnham, 2008; Snelgrove, 2004), while others cite marginally higher correlations with a strategic learning approach (e.g. Cassidy, 2011; Duff et al., 2004). Many studies concur with a negative correlation between a shallow learning approach and academic performance (see summary in Table 2). Volet (1996) found correlations between academic performance and learning approach varied with assessment type; for example, correlations between academic performance and a continuum from shallow to deep learning approach were lower for examinations ($r = 0.21$, $p < 0.01$) than for course work ($r = 0.28$, $p < 0.05$). A lack of correlation between a deep learning approach and academic performance is in itself an insightful result, as it suggests an assessment design that fails to reward an important, malleable learning disposition (Buckingham Shum & Deakin Crick, 2012; Knight et al., 2013).

Measurement of self-regulation and correlation with academic performance. Self-regulated learners take responsibility for setting and achieving their own learning goals (Covington, 2000). This is done by planning their learning, having effective time management, using appropriate learning strategies, persisting with tasks considered boring or difficult (effort regulation), continually monitoring and evaluating the quality of their own learning (metacognitive self-regulation) and altering their learning strategies when required (Schunk, 2005; Zimmerman, 1990). Such learners regard learning as a process that they can control, but their motivation factors can vary (Pintrich & DeGroot, 1990). To be motivated to self-regulate, a student must be confident that they are able to set goals and organise their study, and in addition be confident that the effort they spend on studying will result in good marks (high self-efficacy). Volet (1996) argues that self-regulated learning is more significant in tertiary level than earlier levels of education because of the shift from a teacher-controlled environment to expected self-management of the learners own study. Furthermore, Lucieer et al. (2015) contend that encouragement of self-regulation strategies is important for life-long learning. Nicol and Macfarlane-Dick (2006) found that both training and formative feedback can improve self-regulation, resulting in a more effective learning disposition.

A number of studies cite significant correlations between academic performance and factors of self-regulation, see Table 2 for a summary. For example, a longitudinal study of first year students ($n = 581$) found self-test strategies ($r = 0.48$, $p < 0.001$)

and monitoring strategies ($r = 0.42$, $p < 0.001$) were more strongly correlated with academic performance than time & effort strategies ($r = 0.24$, $p < 0.01$) (Ning & Downing, 2010). However, Komarraju and Nadler (2013) found effort management ($r = 0.39$, $p < 0.01$) had higher correlation with academic performance than other measures of self-regulation and found that self-regulation (monitoring and evaluating learning) did not account for any additional variance in academic performance over and above self-efficacy, but study effort and study time did account for additional variance. A study comparing the relative importance of both learning approach (deep or shallow) and learning effort, found that learning effort had a higher impact on academic performance than learning approach (Volet, 1996).

Effective Learning Strategies Can Be Informed by Awareness of Learner Modality

Learner modality. Learner modality describes learner preferences regarding modes of presenting information. The commonly used VAK model of learner modality distinguishes between Visual, Auditory and Kinaesthetic learners (Fleming, 1995). Visual learners have a preference for visual representations of information, some prefer written text while others prefer graphical visualisations such as charts and diagrams; auditory learners have a preference for learning by listening and discussing; kinaesthetic learners learn best by application of theory to practice, i.e. learn by doing (Fleming, 1995). While awareness of learner modality by student and lecturer can improve student-learning experience (Duffin & Gray, 2009a; Gilakjani, 2012), there is no evidence to suggest that learner modality is predictive of academic performance (Gilakjani, 2012; Kablan, 2014).

THE STUDY DATASET

This section describes the study participants and study factors used. Some data were gathered from an online learner profiling tool developed for the study. The tool itself and questionnaire reliability are discussed.

Description of Study Participants

The study participants were first year students at the Institute of Technology Blanchardstown (ITB), Ireland. The admission policy at ITB supports the integration of a diverse student population in terms of age and socio-economic background. Course entry requirements in Institutes of Technology are generally lower than corresponding university courses (Mooney et al., 2010).

Each September 2010 to 2012, all full-time, first year students at ITB were invited to participate in the study by completing learner profiling administered during first year student induction. Participation was optional, and the profiler included a request for permission to use student data in this study. A total of 1,207 (46%) full-time, first year students participated in the study.

Participants ranged in age from 18 to 60, with a mean (m) age of 23.27 (standard deviation (s) = 7.3); of which 355 (29%) participants were mature (23 and over[1]), 713 (59%) were male and 494 (41%) were female. Participants were enrolled on a range of courses in the disciplines of Business (n = 402, 33%), Humanities (n = 353, 29%), Information Technology (n = 239, 20%), Engineering (n = 172, 14%) and Horticulture (n = 41, 3%). Summary statistics by year are included in Table 3; summary statistics for subgroups in the dataset by course of study, age group and gender are given in Table 4.

Table 3. Participant age and gender by year

		Age			*Gender*	
Year	*n*	*Range*	*m±s*	*Over 23*	*Male*	*Female*
2010	418	[18,60]	24±8	133 (32%)	261 (62%)	157 (38%)
2011	353	[18,59]	23±7	106 (30%)	209 (59%)	144 (41%)
2012	436	[18,53]	23±7	116 (27%)	243 (56%)	193 (44%)

Table 4. Participant age and gender by subgroup

			Age		*Gender*	
Subgroup	*n*	*Range*	*m±s*	*Over 23*	*Male*	*Female*
All participants	1207	[18,60]	23±7	355 (29%)	713 (59%)	494 (41%)
Horticulture (BSc)	41	[18,52]	28±11	21 (51%)	32 (78%)	9 (22%)
Engineering (BEng)	172	[18,43]	22±5	35 (20%)	157 (91%)	15 (9%)
Computing (IT) (BSc)	137	[18,59]	24±8	50 (36%)	125 (91%)	12 (9%)
Creative Digital Media (BA)	102	[18,48]	23±7	30 (29%)	69 (68%)	33 (32%)
Sports Management & Coaching (BA)	95	[18,50]	23±6	28 (29%)	80 (84%)	15 (16%)
Business general (BBus)	183	[18,56]	21±5	19 (10%)	98 (54%)	85 (46%)
Business with IT (BBus)	60	[18,46]	22±6	13 (22%)	36 (60%)	24 (40%)
International Business (BBus)	64	[18,44]	21±5	8 (13%)	27 (42%)	37 (58%)
Early Childcare & Education (BA)	80	[18,41]	22±5	15 (19%)	5 (6%)	75 (94%)
Social & Community Dev. (BA)	127	[18,59]	25±8	50 (39%)	37 (29%)	90 (71%)
Applied Social Care (BA)	146	[18,60]	28±9	86 (59%)	47 (32%)	99 (68%)
Age [18,23]	875	[18,23]	20±1	23 (3%)	504 (58%)	371 (42%)
Age [24,28]	131	[24,28]	26±1	(100%)	83 (63%)	48 (37%)
Age [29,60]	201	[29,60]	38±7	(100%)	126 (63%)	75 (37%)
Males	713	[18,60]	24±8	223 (31%)	(100%)	(0%)
Females	494	[18,52]	23±7	132 (27%)	(0%)	(100%)

Study Factors and Instruments Used

The study dataset included data from three sources: non-cognitive factors of learning measured during first year induction; student registration; and exam results from first year of study at ITB, supplied by the college. Study factor names are in italics.

Non-cognitive factors gathered. The following sections discuss fifteen non-cognitive factors of learning included in the study, and the profiling tool used to gather the data. With the exception of learner modality, questions were taken from openly available, validated instruments, with some changes to wording to suit the context. The questionnaire was administered during first year student induction using an online tool developed for the study (http://www.howilearn.ie). The wording of some questions was changed to suit the context, for example *Follow a schedule* was changed to *I like to do things according to a plan or schedule*. Unless otherwise stated, items used a five-level Likert scale. Table 5 gives descriptive statistics for each factor. Questionnaire length can affect the quality of response (Burisch, 1997; Galesic & Bosnjak, 2009). Consequently, the number of items was reduced for some scales by removing similar items despite the likely negative impact on internal reliability statistics, discussed at the end of this section.

The personality factors included were *conscientiousness* and *openness*. Items for both scales were taken from the International Personality Item Pool (IPIP) scales (Goldberg et al., 2006). Six items were selected from the Conscientiousness Big-Five Domain scale, and six items were selected from the Openness to Experience, NEO Domain scale.

Motivation was assessed based on *self-efficacy*, and two achievement motivation scales, *intrinsic* (learning) *goal orientation* and *extrinsic* (performance) *goal orientation*. Scales were based on the Motivation Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991). All four items from each of the *intrinsic goal orientation* and *extrinsic goal orientation* scales were included. Three of the eight items from the *self-efficacy* scale were included.

Three factors of self-regulation were included: *metacognitive self-regulation*, time & study environment (*study time*), and effort regulation (*study effort*). Scales were from MSLQ, items were selected based on their relevance to prior academic experiences to facilitate administration during student induction. Five items were included from the twelve-item metacognitive self-regulation scale, four items were included from the eight-item time and study environment scale, and three items were included from the four-item effort regulation scale.

Learning approach was assessed based on the Revised two-Factor Study Process Questionnaire (R-SPQ-2F) published by Biggs et al. (2001). The published questionnaire provided separate scales for *shallow* and *deep learning approaches*. Items used a five-level Likert scale. The question style was changed for this study forcing participants to choose between a *deep*, *strategic* or *shallow learning*

approach. Each item on a four-item scale asked participants to pick one of three statements: two statements, relating to *deep* and *shallow learning approach*, were taken from R-SPQ-2F; the third statement, relating to a *strategic learning approach*, was compiled in collaboration with the National Learning Network Assessment Service[2] (NLN) based on campus at ITB. The style of question matched the style of items on a learning styles profiler designed by NLN and used by ITB in previous years.

In agreement with NLN, scales from their learning styles questionnaire were also included. This covered learner modality (*Visual*, *Auditory* and/or *Kinaesthetic* (VAK) (Fleming, 1995)) which was scored from six questions, each offering two choices of modality, resulting in four items per modality across the six questions. Preference for solo or *group work* was also asked.

Table 5. Study factors, mean and standard deviation (m ± s)

Category & Instrument	*Factor*	*m ± s*	*95% CI*
Prior academic achievement	Prior academic achievement	4.61 ± 2.50	[4.47, 4.75]
Personality, Goldberg's IPIP scales (http://ipip.ori.org)	Conscientiousness	5.95 ± 1.53	[5.86, 6.03]
	Openness	6.07 ± 1.29	[5.99, 6.14]
Motivation, based on MSLQ Pintrich et al., 1991	Self-efficacy	6.85 ± 1.42	[6.77, 6.93]
	Intrinsic Goal Orientation	7.09 ± 1.36	[7.03, 7.17]
	Extrinsic Goal Orientation	7.81 ± 1.38	[7.73, 7.89]
Self-regulated Learning, based on MSLQ Pintrich et al., 1991	Metacognitive self-regulation	5.88 ± 1.36	[5.80, 5.95]
	Study Effort	5.93 ± 1.77	[5.83, 6.03]
	Study Time	6.17 ± 2.32	[6.04, 6.30]
Learning style, based on R-SPQ-2F, Biggs et al. (2001).	Deep Learner	5.36 ± 2.91	[5.20, 5.53]
	Shallow Learner	1.33 ± 1.95	[1.22, 1.44]
	Strategic Learner	3.41 ± 2.48	[3.27, 3.55]
Preferred learning channel, NLN Learning Styles Questionnaire.	Visual	7.17 ± 2.06	[7.05, 7.28]
	Auditory	3.13 ± 2.17	[3.04, 3.29]
	Kinaesthetic	4.67 ± 2.42	[4.53, 4.80]
	Preference for group work	6.55 ± 3.36	[6.36, 6.74]

Range for all attributes is [0,10]

Questionnaire validity and internal reliability were assessed using a paper-based questionnaire that included both the revised wording of questions used on the online questionnaire (reduced scale), and the original questions from the published instruments (original scale). The paper questionnaire was administered during scheduled first year lectures across all academic disciplines. Results are detailed

in Table 6. Pearson correlations between scores calculated from the reduced scale, and scores calculated from the original scale, were high for all factors (≥0.9) except *intrinsic goal orientation* and *study time*. Internal reliability was assessed using Cronbach's alpha. All factors had acceptable reliability (>0.7)[3] given the small number of questions per scale (between 3 and 6), with the exception again of *intrinsic goal orientation* and *study time*. These two scales included items based on material to be studied and study environment, and so may have been affected by the timing of administration. Interestingly, Komarraju and Nadler (2013) reported similar difficulties with the *intrinsic goal orientation* scale when administered in the first week of term. *Intrinsic goal orientation* and *study time* were not removed from the dataset, however it is acknowledged that inferences based on these factors may be unreliable.

Table 6. Questionnaire validation – correlations and Cronbach alpha

		Study questionnaire		*Full questionnaire*			*Published*
Factor	*n*	*α*	*items*	*α*	*items*	*Correlation**	*α*
Openness	47	0.70	6	0.84	10	0.90 (95% CI [0.82, 0.94])	0.82
Conscientiousness	42	0.69	6	0.80	10	0.95 (95% CI [0.91, 0.97])	0.79
Intrinsic Goals	43	0.63	4	0.53	4	0.81 (95% CI [0.68, 0.89])	0.74
Extrinsic Goals	48	0.69	4	0.58	4	0.90 (95% CI [0.82, 0.94])	0.62
Effort	41	0.69	3	0.74	4	0.98 (95% CI [0.96, 0.99])	0.69
Self-efficacy	48	0.82	3	0.81	7	0.93 (95% CI [0.89, 0.97])	0.94
Metacognitive Self-regulation	38	0.70	5	0.70	12	0.90 (95% CI [0.81, 0.95])	0.79
Time and study	48	0.55	4	0.68	8	0.79 (95% CI [0.65, 0.87])	0.76
Learning Style	42	0.76	4				

**Correlations between original scale and reduced scale scores.*

Student registration data. Some prior knowledge of a student available to the college at registration, namely gender, age and prior academic achievement, was available to the study. Gender was not included in study models because of bias in the dataset: engineering and computing courses had low entry requirements and were predominantly male; humanities courses had higher entry requirements and were predominantly female. Gender balance by course is included in Table 4.

Access to full time college courses in Ireland is based on academic achievement in the Leaving Certificate, a set of state exams at the end of secondary school. College places are offered based on CAO[4] points, an aggregate score based on passing grades achieved in a student's top six leaving certificate subjects, which include

mathematics, English, Irish and a foreign language. CAO points were unavailable for 189 (16%) of study participants because they were over 23. An additional 22 (2%) participants had less than the required six subjects, so *prior academic achievement*, measured as CAO points, was under estimated. Summary statistics for *prior academic achievement* is included in Table 5.

Year 1 academic performance. First year academic performance was measured as Grade Point Average (GPA), an aggregate score of between 10 and 12 first year modules, range [0,4]. GPA is calculated as a weighted average of grades achieved, where the weights are the number of credits per module. A GPA<2.0, or a result of fail in any individual module, results in an award of Fail overall. Otherwise a student is awarded a Pass result and may progress to the next academic stage. Repeat examination results were excluded from the study.

METHODS

The analytical techniques used are explained in this section, namely: correlation analysis; analysis of group differences; linear regression; decision tree classification model; Naïve Bayes classification model and a *k*-Nearest Neighbour classification model. Readers not interested in method details can skip to the results section.

Classification and regression models were generated for all participants and subgroups by *age* (3 groups) and course of study (10 groups). Study factor mean and standard deviations were initially compared for ten age categories: 18, 19, 20, 21, 22–23, 24–25, 26–28, 29–32, 33–39 and ≤40. Age groups were combined to ensure at least 60 students per group.[5] Analysis of differences in group means reduced the ten categories to three, namely: [18,23] (n = 875); [24,28] (n = 131); and [29,60] (n = 201). This was based on a lack of statistically significant differences for study factors in age groups within these three age categories. Younger participants (age: [18,23]) and courses with awards of BSc, BEng or BBus had the highest failure rates (range: [41%,67%]), therefore corresponding subgroup samples generally had a good class balance between instances representing a passing and a failing GPA. Courses with an award of BA had lower failure rates (range: [15%,31%]), so corresponding subgroup samples had fewer examples of students in the GPA range [0,2]).[6]

Correlation Analysis

Pearson product-moment correlation coefficients (r) were calculated for all study factors and GPA. The calculation is detailed in Equation 1 where x and y are the two variables, x_i and y_i are the values of x and y in row i respectively, and $\bar{x}$ and $\bar{y}$ are the means of x and y respectively (Chatfield, 1983). An assumption of calculating the significance of a Pearson's correlation is that attributes are normally distributed. However, all study attributes failed a Shapiro-Wilk normality test (p>0.05). This

is common in data relating to education and psychology (Kang & Harring, 2012; Micceri, 1989) which is likely to be skewed, have a heavy or light tail, and/or be multimodal (Smith & Wells, 2006). Therefore significance was verified using 1,999 bootstrap confidence intervals[7] (B-CI) using the bias corrected and accelerated method (BCa) (Carpenter & Bithell, 2000) as implemented in **R** version 3.0.2.

$$r = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum [y_i - \bar{y}]^2}} \tag{1}$$

Analysis of Group Differences

Group differences were assessed for two GPA bands, namely fail (GPA<2.0) and pass (GPA≥2.0). Student's t-test assumes normal distribution and equality of variance for the test statistic, attribute mean. A Shapiro-Wilk test applied to attribute means of 50 bootstrap samples verified all attribute means were normally distributed; however, a Brown-Forsythe test found variances were unequal for most attributes. Therefore, results from Welch's t-test are reported although significances found concurred with the results from Student's t-test. The calculation for Welch's t-test is given in Equation 2 where x and y represent values in two subgroups, $\bar{x}$ and $\bar{y}$ are the means of x and y respectively, s_x^2 and s_y^2 are the variances of x and y respectively, and n_x and n_y are the group size for x and y respectively. Degrees of freedom were estimated using Welch-Satterthwaite DF estimate, as given in Equation 3.

Welch's t-test:

$$t = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}}} \tag{2}$$

Welch – Satterthwaite DF estimate:

$$df = \frac{\left(\frac{s_x^2}{n_x^2} + \frac{s_y^2}{n_y^2}\right)^2}{\frac{\left(\frac{s_x^4}{n_x^2}\right)}{n_x - 1} + \frac{\left(\frac{s_y^4}{n_y^2}\right)}{n_y - 1}} \tag{3}$$

Hierarchical Linear Regression

Regression models predicting GPA were used to assess the significance of study factors in explaining variance in GPA. Linear regression models predict a continuous attribute, the dependent variable, by estimating the linear relationship mapping dataset attributes to the dependent variable. Equation 4 depicts this linear relationship where y is the dependent variable, a is the intercept and represents the mean value of y when all attributes equal 0, z is the number of attributes in the model, x_z represents the value of attribute z, b_z represents the coefficient for attribute z, and $\in$ is the error term calculated as the difference between the estimated value of y ($\hat{y}$) and the actual value of y. Training a model involves solving for a and $b_1 \ldots b_z$ to minimise $\in$.

$$y = a + b_1 x_1 + b_2 x_2 + \ldots + b_z x_z + \in \tag{4}$$

Model fit is reported as the coefficient of determination (R^2) to facilitate comparison with other studies. R^2 attempts to measure the extent to which the model explains the variance in the dependent variable, however it can be affected by variability in underlying independent variables (Achen, 1982). Equation 5 gives the calculations for R^2 where y_i is the actual value of y in row i, $\hat{y}_i$ is the predicted value of y in row i and $\overline{y}$ is the average value of y.

$$R^2 = 1 - \frac{\sum_i \left(y_i - \hat{y}_i\right)^2}{\sum_i \left(y_i - \overline{y}_i\right)^2} \tag{5}$$

Hierarchical linear regression models predicting GPA were used to assess the significance of adding non-cognitive factors of learning after *age* and *prior academic achievement* were controlled for. Step 1 included *prior academic achievement* and *age* only. Step 2 included all study factors; the increase in R^2 indicated the proportion of variance in academic performance accounted for by the non-cognitive factors of learning once *prior academic achievement* and *age* were controlled for. An F-test comparing model fit without, and with, non-cognitive factors indicated if the increase in R^2 was significant. Regression models for step 2 were based on optimal attribute subsets identified using an exhaustive search as implemented in the *regsubsets* function in **R** V3.0.2 (*leaps* package V2.9). All attributes were scaled to a mean of 0 and variance of 1.

Classification

Classification models were evaluated for all participants and 13 subgroups by *age* (3 groups) and course of study (10 groups). Model accuracies for three classification

algorithms were compared. Two classification algorithms were linear classifiers, namely: Naïve Bayes (NB) and Decision Tree (DT), one was non-linear, namely *k*-Nearest Neighbour (*k*-NN). All models were trained using 10-fold cross validation. A binary class label distinguished between a failing GPA (<2.0) and a passing GPA (≥2.0). RapidMiner version 5.3 (rapidminer.com) was used for modelling.

Decision tree model. A Decision Tree (DT) represents patterns in a dataset as a simple tree structure. Each non-leaf node represents an attribute to be tested, branches represent attribute values or value ranges, and leaf nodes represent class allocation as illustrated in Figure 1. Dataset instances are allocated to a leaf node based on matching the corresponding branch conditions. DTs are easy to interpret, and patterns found tend to be robust provided the tree is kept small (Han & Kamber, 2006, p. 304). However DTs are limited in the type of patterns identified. Each branch represents a subgroup within the dataset, but subgroup boundaries are linear and parallel to the axis.

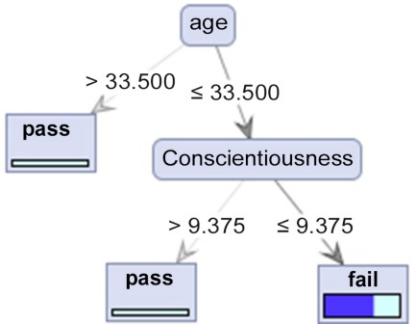

Figure 1. Decision Tree example

The DT algorithm grows the tree top down, starting with a single node that matches all instances in a dataset. If all instances matching a node are in the same class the node becomes a leaf node and is labelled with the class name. Otherwise the algorithm selects an attribute to split the instances matching that node and so grow the tree. This process is repeated recursively until stopping criteria are met such as a maximum tree depth. Leaf nodes are labelled with the majority class amongst matching instances.

There is a range of heuristic measures for selecting the best attribute at each node of the tree. Preference is given to attributes that generate pure or almost pure branches, i.e. matching instances belong to the same class (see Han & Kamber (2006) for more details). Selecting the attribute with the highest gain ratio gave best accuracy for the study dataset. Equations 6–9 give the calculations for gain ratio where *a* is an attribute, *k* is the number of branches generated, *d* is the parent node before splitting, *n* is the sample size, *t* is a node on the tree, *j* is the number of

classes in the dataset, and $p(j|t)$ is the proportion of rows in class j at node t (Han & Kamber, 2006).

$$GainRatio(a) = \frac{InfoGain(a)}{SplitInfo(a)} \tag{6}$$

$$SplitInfo(a) = -\sum_{k} \frac{n_k}{n_d} log_2 \frac{n_k}{n_d} \tag{7}$$

$$InfoGain(a) = Entropy(d) - \sum_{k} Entropy(k) \tag{8}$$

$$Entropy(t) = -\sum_{j} p(j \mid t) log_2 p(j \mid t) \tag{9}$$

k-Nearest neighbour model. The *k*-Nearest Neighbour (*k*-NN) model was the only lazy learner used in the study. Rather than compressing a dataset into a model representing its predictive pattern, *k*-NN classifies data directly from instances in the training dataset. A new instance is allocated to the majority class amongst its nearest neighbours in the training dataset, selected based on a distance measure. Neighbourhood size and distance measure are configurable.

Neighbourhood size (k) affects model performance. If k is too large, adjoining clusters in a different class may influence classification; if k is too small, classification may be influenced by unusual cases not typical of the class allocation for the neighbourhood. *k*-NN models were trained on values of k in the range [2,30]. The most common distance measures for numeric attributes is Euclidean distance (Larose, 2005, p. 99) and was used in this study. The calculation is given in Equation 10 where i and j are rows of data, x_{i1} represents attribute 1 in row i, and z is the number of attributes.

$$d_{Euclidean}(i, j) = \sqrt{(x_{i1} - x_{j1})^2 + (x_{i2} - x_{j2})^2 + \ldots + (x_{iz} - x_{jz})^2} \tag{10}$$

Naïve bayes model. Bayesian classifiers are based on probabilities as defined by Bayes Theorem. The probability that an instance (X) is in a particular class (C_j) is based on the distribution of attribute values in (C_j), calculated from a training dataset. X is allocated to the class with the highest probability for $P(C_j|X)$. Equation 11 gives the formula to calculate $P(C_j|X)$ where z is the number of attributes, x_z is the value of attribute z in instance X, $P(Cj)$ represents the proportion of rows in the training dataset that are in class C_j, $P(X)$ is the probability of X which is the same

for each *Cj* so it can be ignored, and $P(X|C_j)$ represents the combined probability that each attribute value in X could occur in class C_j. Naïve Bayes assume attributes are independent. This simplifies the calculation of $P(X|C_j)$ as the probability of all attribute values occurring together is the product of their individual probabilities. For nominal attributes, the individual probability for an attribute value (x_z) occurring in class C_j is calculated as the proportion of rows in C_j that have the value x_z. This is estimated from a training dataset. Numeric attributes are assumed to have a Gaussian distribution. The probability of x_z occurring in C_j is based on the probability distribution characterised by the mean (m_{zj}) and standard deviation (s_{zj}) of variable z in class C_j. The calculation is given in Equation 11 where g is the class-conditional probability defined by Equation 12 (Tan et al., 2014, p. 233).

$$P\left(C_j \mid X\right) = \frac{\sum_z P\left(x_z \mid C_j\right) P\left(C_j\right)}{P\left(X\right)} \tag{11}$$

$$P\left(x_z \mid C_j\right) = g\left(x_z, m_{zj}, s_{zj}\right) \tag{12}$$

$$g\left(x_z, m_{zj}, s_{zj}\right) = \frac{1}{\sqrt{2\pi s_{zj}}} e^{-\frac{\left(x-m_{zj}\right)^2}{2s_{zj}^2}} \tag{13}$$

If attributes are truly independent, Naïve Bayes accuracy is optimal (Domingos & Pazzani, 1997). Attributes are rarely independent in practice, however, empirical evidence shows Naïve Bayes can also achieve good predictive accuracy when assumptions are violated (Domingos & Pazzani, 1997).

Classification model accuracies. Classification model accuracies are reported as overall accuracy, and recall on class fail. The equations are illustrated in the confusion matrix in Table 7 which identifies four groups: instances correctly predicted as fail (True Fail); instances correctly predicted as pass (True Pass); instances incorrectly predicted as fail (False Fail); and instances incorrectly predicted as pass (False Pass).

Model accuracies were compared using McNemar's test, run in **R** V3.0.2. McNemar's test, based on chi squared (χ^2), can be used to compare the results of two classification models applied to the same dataset (Dietterich, 1998). The contingency table to compare the two models (M_1 and M_2) is given in Table 8. The null hypothesis is that both models should have the same error variance, this means $n_{10} = n_{01}$ as defined in Table 8. McNemar's test compares the distribution of counts under the null hypothesis to the observed distribution of counts. The test statistic is given in Equation 14.

Table 7. Confusion matrix

	Predicted fail	*Predicted pass*	*Class recall*
Actual Fail	*True Fail* (TF)	*False Pass* (FP)	$\frac{TF}{TF+FP}$
Actual Pass	*False Fail* (FF)	*True Pass* (TP)	$\frac{TP}{FF+TP}$
Class Precision	$\frac{TF}{TF+FF}$	$\frac{TP}{TP+FP}$	Model Accuracy: $\frac{TF+TP}{TF+TP+FF+FP}$

Table 8. Contingency table

(n_{11}) Number of examples correctly classified by both M_1 and M_2.	**(n_{10})** Number of examples correctly classified by M_1 but incorrectly classified by M_2.
(n_{01}) Number of examples incorrectly classified by M_1 but correctly classified by M_2.	**(n_{00})** Number of examples incorrectly classified by both M_1 and M_2.

$$\chi^2 = \frac{\left(n_{01} - n_{10}\right)^2}{n_{01} - n_{10}} \tag{14}$$

Attribute subset selection. Attribute subset selection techniques can improve classification model performance and identify relevant attributes (Hall & Homes, 2003). In a comparison of three wrapper methods for attribute subset selection, namely forward selection, backward selection and a genetic algorithm, Gray (2015) found forward selection generally generated the best model when modelling at risk students. Therefore, forward selection results are reported in this study.

RESULTS

Correlation Analysis and Analysis of Group Differences

With the exception of *visual* and *auditory modality*, all non-cognitive factors of learning were significantly correlated with GPA ($p < 0.05$). Table 9 is a heat map visualisation of correlations between study factors. *Prior academic achievement* ($r = 0.29$, $p < 0.001$), *age* ($r = 0.25$, $p < 0.001$), a *deep learning approach* ($r = 0.23$, $p < 0.001$) and *study effort* ($r = 0.19$, $p < 0.001$) had highest correlations with

GPA. *Openness* ($r = 0.08$, $p < 0.01$) and *group work* ($r = –0.08$, $p < 0.01$) had the weakest significant correlations with GPA. Correlations were comparable with other studies of diverse student populations with the exception of *self-efficacy* ($r = 0.12$, $p < 0.001$) which was lower than expected (for example Cassidy (2011): $r = 0.40$; Diseth (2011): $r = 0.44$; Komarraju & Nadler (2013): $r = 0.30$).

Analysis of group differences between a failing GPA (GPA < 2.0) and a passing GPA (GPA ≥ 2.0) concurred with correlation results as illustrated in Table 10. There were statistically significant different mean averages for all non-cognitive factors of learning with the exception of *visual* and *auditory modalities, openness* and *group work.* Differences in *prior academic achievement* were not significant. However, excluding participants with missing data for *prior academic achievement* resulted in a statistically significant difference between mean CAO points for each group ($t(979) = 10.26$, $p < 0.001$, $n = 1{,}018$); a passing GPA had a higher mean.

Linear Regression Model Fit

As detailed in the methods section, hierarchical regression models were completed in two steps to assess the significance of adding non-cognitive factors of learning after *age* and *prior academic achievement* were controlled for. Results for all participants, and models of subgroups by age group and course of study are given in Table 11. The top half of the table represents subgroups that had good class balance between participants with a passing GPA (≥2) and participants with a failing GPA (<2).

Model fit was higher for the model of younger participants ($R^2 = 0.22$) compared to all participants ($R^2 = 0.18$); this concurs with other studies (e.g. Bidjerano & Dai, 2007; Chamorro-Premuzic & Furnham, 2008; Dollinger et al., 2008; Kaufman et al., 2008; Komarraju et al., 2011; Robbins et al., 2004; Swanberg & Martinsen, 2010). However, the increase in R^2 from step 1 to step 2 was more significant in the model of all participants ($F = 23.17$, $p < 0.001$) compared to the model of younger participants only (*age* ≤ 23, $F = 8.9$, $p < 0.001$) highlighting the relevance of non-cognitive factors learning for models that included mature students. The increase in R^2 was also statistically significant in regression models for subgroups that had good class balance between a passing and failing GPA. However, sample sizes for subgroups were small. Progressive sampling showed a sample size of $n = 1{,}000$ was needed for convergence of R^2.

Classification Model Accuracies

Classification models predicting a binary class label of a passing GPA (≥2.0) or failing GPA (<2.0) identified indicators of students at risk of failing. Table 12 lists classification model accuracies. *k*-NN had highest model accuracy when modelling all participants (accuracy = 71%, recall on fail = 65%); Naive Bayes has the highest recall on fail (accuracy = 67%, recall on fail = 70%), the difference between the

Table 9. Correlations between study factors

SE			*Personality*		*Motivation*			*Self-regulation*			*Learning approach*			*Other*			*Modality*	
	GPA	*Prior*	*Con*	*Open*	*SE*	*EM*	*IM*	*SR*	*StE*	*StT*	*Deep*	*Stra*	*Shal*	*Group*	*Age*	*Gen*	*Vis*	*Aud*
Prior	0.285																	
Con	0.150	−0.017																
Open	0.084	0.108	0.032															
SE	0.120	0.054	0.313	0.178														
EM	0.124	−0.039	0.280	0.049	0.308													
IM	0.149	−0.063	0.334	0.316	0.421	0.381												
SR	0.130	−0.012	0.515	0.101	0.409	0.298	0.429											
StE	0.187	−0.027	0.450	0.064	0.334	0.232	0.330	0.594										
StT	0.101	0.037	0.396	0.009	0.259	0.175	0.227	0.452	0.378									
Deep	0.234	−0.024	0.352	0.209	0.273	0.158	0.417	0.431	0.360	0.285								
Stra	−0.158	0.011	−0.167	−0.174	−0.158	−0.012	−0.274	−0.213	−0.133	−0.115	−0.791							
Shal	−0.146	0.028	−0.330	−0.096	−0.221	−0.234	−0.294	−0.398	−0.394	−0.290	−0.519	−0.103						
Group	−0.080	−0.019	0.052	−0.042	0.056	0.059	0.027	0.113	0.094	0.084	0.020	0.037	−0.081					
Age	0.250	−0.317	0.156	0.038	0.038	0.051	0.257	0.234	0.210	0.023	0.284	−0.200	−0.181	−0.022				
Gen	0.100	0.126	−0.005	0.022	−0.048	0.035	0.004	0.005	0.023	0.086	0.086	−0.001	−0.130	0.026	−0.038			
Vis	0.050	−0.097	0.069	0.063	−0.024	0.041	0.054	0.024	−0.003	0.038	0.067	−0.020	−0.089	0.021	−0.038	−0.046		
Aud	0.020	0.005	0.073	0.023	−0.002	0.013	−0.016	0.065	0.039	0.081	0.077	−0.068	−0.026	−0.097	0.025	0.205	−0.347	
Kin	−0.059	0.077	−0.124	−0.074	0.022	−0.046	−0.032	−0.078	−0.033	−0.105	−0.126	0.078	0.099	0.069	−0.055	−0.144	−0.541	−0.601

Prior:Prior academic achievement; Con:Conscientiousness; Open:Openness; SE:Self Efficacy; IM:Intrinsic Goal Orientation; EM:Extrinsic Goal Orientation;SR: Self Regulation; StE: Study Effort; StT:Study Time; Deep:Deep Learner; Shal: Shallow Learner; Stra: Strategic Learner; Group:Likes to work in groups; Gen = Gender; Vis:Visual Learner; Aud:Auditory Learner; Kin:Kinaesthetic Learner. Correlations with prior academic achievement were based on a reduced dataset of participants with prior academic achievement data (n = 1,081).

Table 10. Group differences by GPA band

Study factor	*Range*	*Fail*	*Pass*		
		n = 459	*n = 748*	*p*	*T*
Prior academic achievement	[0,10]	3.5 ± 1.5	3.7 ± 2.2		1.88
Conscientiousness	[0,10]	5.7 ± 1.6	6.1 ± 1.5	***	4.32
Openness	[0,10]	6.0 ± 1.4	6.1 ± 1.2		1.27
Self-efficacy	[0,10]	6.7 ± 1.5	7.0 ± 1.4	***	3.46
Extrinsic goals	[0,10]	7.6 ± 1.4	7.9 ± 1.3	***	3.71
Intrinsic goals	[0,10]	6.9 ± 1.4	7.2 ± 1.3	***	3.71
Metacognitive self-regulation	[0,10]	5.7 ± 1.4	6.0 ± 1.3	**	3.71
Study effort	[0,10]	5.6 ± 1.8	6.1 ± 1.7	***	4.78
Study time	[0,10]	5.9 ± 2.4	6.3 ± 2.2	***	2.90
Deep learner	[0,10]	4.7 ± 2.8	5.8 ± 2.9	***	6.54
Shallow learner	[0,10]	1.7 ± 2.1	1.1 ± 1.8	***	5.08
Strategic learner	[0,10]	3.8 ± 2.5	3.2 ± 2.5	***	4.05
Group work	[0,10]	6.8 ± 3.3	6.4 ± 3.4	*	2.02
Age	[18,60]	21.4 ± 5.5	24.4 ± 8.0	***	7.71
Gender	[0,4]	0.3 ± 0.5	0.5 ± 0.5	***	6.75
Visual	[0,10]	7.0 ± 2.1	7.3 ± 2.0	*	2.45
Auditory	[0,10]	3.1 ± 2.2	3.2 ± 2.2		0.77
Kinaesthetic	[0,10]	4.9 ± 2.4	4.5 ± 2.4	**	2.81

**p < 0.05; **p < 0.01; ***p < 0.001*

two models was marginally significant ($\chi^2(1,1207) = 4.2$, $p = 0.04$). The Decision Tree model (accuracy = 66%, recall on fail = 46%) was statistically significantly lower than *k*-NN only ($\chi^2(1,1207) = 10.3$, $p < 0.01$).

To assess the improvement in model accuracy attributable to non-cognitive factors of learning, the *k*-NN model of all participants was compared with a model trained on *prior academic achievement* and *age* only. Overall model accuracy based on *prior academic achievement* and *age* was 69.59% (recall on fail = 59.48%), the difference between the two models was not statistically significant ($\chi^2(1,1207) = 1.05$, $p = 0.31$). A *k*-NN model trained on non-cognitive factors only (i.e. excluding *prior academic achievement* and *age*) had a poorer performance (accuracy = 64.79%, recall on fail 30.38%); the difference between this accuracy and the model based on all study factors was statistically significant ($\chi^2(1,1207) = 22.19$, $p < 0.001$).

Table 11. Regression model fits

Group / Subgroup	*n*	n_{fail}	R^2: *step 1*	R^2: *step 2 increase*	*F-test*
All participants	1207	459 (38%)	0.13	0.05	23.17***
Age [18,23]	875	385 (44%)	0.19	0.04	8.9***
Engineering (BEng)	152	102 (67%)	0.31	0.08	3.52**
Computing (IT) (BSc)	137	64 (47%)	0.17	0.15	4.56***
Business general (BBus)	183	103 (56%)	0.04	0.1	3.39**
Business with IT (BBus)	60	28 (47%)	0.24	0.28	5.10***
International Business (BBus)	64	26 (41%)	0.09	0.17	2.26
Sports Management & Coaching (BA)	95	21 (22%)	0.07	0.14	2.49*
Social & Community Development (BA)	127	39 (31%)	0.06	0.11	2.87*
Early Childcare & Education (BA)	80	16 (20%)	0.1	0.1	1.43
Applied Social Care (BA)	146	22 (15%)	0.09	0.07	1.81
Creative Digital Media (BA)	102	21 (21%)	0.03	0.09	1.57
Age [24,28]	131	40 (31%)	0.08	0.01	1.65
Age [29,60]	210	34 (16%)	0.02	0.11	1.53

$*p < 0.05$; $**p < 0.01$; $***p < 0.001$; n_{fail}: sample size of class fail.

Classification model accuracy improved when trained for subgroups by course of study and age with the exception of general business. *k*-NN had highest model accuracy, or close to the highest model accuracy, for all subgroups. Failure rates were low for some subgroups, resulting in a class imbalance between 'fail' and 'pass'. For subgroups with good class balance, recall on fail was generally good, falling in the range [65%, 90%]. However subgroup sample sizes were small. Progressive sampling using Naïve Bayes indicated a sample size > 900 was required for model accuracy convergence.

Misclassifications

A review of classification model predictions when modelling all participants highlighted that algorithms generally concurred on participants misclassified. For example, 82% of participants misclassified by *k*-NN were also misclassified by at least one other algorithm. The confusion matrix for *k*-NN is given in Table 13 identifying four groups as explained in the methods section. Comparison of mean attribute values across the four groups is given in Table 14. A Shapiro-Wilk

Table 12. Classification model accuracies (%)

	k-*nearest neighbour*		*Naïve Bayes*		*Decision tree*	
Group/Subgroup	*Accuracy*	*Recall on fail*	*Accuracy*	*Recall on fail*	*Accuracy*	*Recall on fail*
All participants	70.67	64.05	68.10	69.72	65.61	40.31
Age [18,23]	71.42	68.83	71.76	62.08	67.99	68.83
Engineering (BEng)	79.77	89.81	78.50	87.96	77.84	84.26
Computing (IT) (BSc)	78.96	87.50	75.11	79.69	73.19	85.94
Business general (BBus)	67.22	81.55	65.67	74.76	65.58	67.96
Business with IT (BBus)	78.33	78.57	73.33	78.57	78.33	75.00
International Business (BBus)	76.90	65.38	75.48	61.54	71.90	61.54
Sports Management & Coaching (BA)	81.78	57.14	80.11	19.05	79.00	9.52
Early Childcare & Education (BA)	82.50	56.25	82.50	43.75	76.25	56.25
Social & Community Development (BA)	77.05	41.03	73.85	46.15	67.12	53.85
Applied Social Care (BA)	84.86	31.82	85.67	22.73	78.67	31.82
Creative Digital Media (BA)	83.27	47.62	81.36	19.05	72.45	38.10
Age [24,28]	78.63	50.00	71.81	32.50	66.37	52.50
Age [29,60]	82.07	41.18	81.64	8.82	77.10	26.47

test of fifty bootstrap samples of each group verified group means were normally distributed for each study factor but a Levene's tests found variances were unequal. Group differences were therefore assessed using Welch's t-test.

False Pass differed significantly from *True Fail* in a number of non-cognitive factors, including *conscientiousness*, *intrinsic goal orientation, metacognitive self-regulation*, *study effort*, all learning approaches and *age*. Conversely, *False Pass* did not differ significantly from *True Pass* with the exception of *age* and *visual modality* ($p < 0.05$ for both). *False Fail* differed significantly from *True Fail* in measures of learning approach, *age* and *kinaesthetic modality*. *False Fail* differed from *True Pass* in factors of self-regulation and *age*. *False Fail* also had significantly weaker GPA than *True Pass*.

Table 13. Confusion matrix for k-NN, all participants

	Predicted fail	*Predicted pass*	*Class recall*
Actual Fail	True fail: 294	False Pass: 165	64.05%
Actual Pass	False fail: 189	True Pass: 559	74.73%
Class Precision	60.87%	77.21%	70.67%

Table 14. Group differences for misclassified participants, including group means (m±s)

Attribute	*True fail*	*False fail*	*False pass*	*True pass*	False pass *compared with:*		False fail *compared with:*	
	(n = 294)	*(n = 189)*	*(n = 165)*	*(n = 559)*	True fail	True pass	True fail	True pass
Prior academic achievement	4.45±1.38	4.59±1.77	4.50±-2.64	4.73±-3.06				
Conscientiousness	5.50±1.59	5.82±1.36	6.11±1.52	5.95±1.53	***		*	
Openness	5.88±1.31	5.95±1.21	6.11±1.43	6.07±1.29				
Self-efficacy	6.61±1.50	6.84±1.40	6.76±1.54	6.85±1.42				
Extrinsic Goal Orientation	7.60±1.45	7.82±1.27	7.69±1.44	7.81±1.38				
Intrinsic Goal Orientation	6.77±1.38	6.86±1.43	7.13±1.40	7.09±1.36	**			
Metacognitive self-regulation	5.56±1.35	5.59±1.31	6.00±1.43	5.88±1.36	**			**
Study effort	5.36±1.84	5.57±1.64	5.99±1.73	5.93±1.77	***			*
Study time	5.85±2.43	5.93±2.20	6.07±2.41	6.17±2.32				
Deep learner	4.29±2.75	5.29±2.69	5.35±2.89	5.36±2.91	***		***	
Shallow learner	1.82±2.10	1.36±2.09	1.38±2.02	1.33±1.95	*		*	
Strategic learner	4.00±2.54	3.47±2.37	3.35±2.35	3.41±2.49	**		*	
Group work	6.83±3.29	6.20±3.52	6.71±3.38	6.55±3.36				
Age	19.55±1.58	21.10±4.66	24.78±7.86	23.27±7.32	***	*	***	***
Visual	7.14±2.12	7.41±2.00	6.74±2.04	7.17±2.07	*	*		
Auditory	3.06±2.10	3.10±2.16	3.26±2.30	3.17±2.17				
Kinaesthetic	4.80±2.47	4.50±2.39	5.00±2.38	4.67±2.42				
GPA	0.84±0.65	2.66±0.40	1.02±0.69	2.87±0.45	**	***	***	***

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Attributes Used in Classification and Regression Models

Table 15 represents standard coefficients for study attributes in the regression model of all participants, and for subgroups that had good class balance between a passing and failing GPA, namely younger students, engineering, computing (IT) and business courses. Table 16 illustrates attributes used by classification algorithms for models of all participants and the same subgroups.

Prior academic achievement and *age* are most frequently used attributes in both classification and regression models, and have the most significant standardised coefficients in regression models. There were some variations in subgroup models: *prior academic achievement* was not statistically significant for computing (IT) or international business regression models; in addition, *prior academic achievement* did not improve classification model accuracy for numerate-based course. *Age* was not statistically significant in the regression models for international business ($p = 0.09$, $n = 64$) and had a marginally significant coefficient in general business ($n = 183$, $p = 0.01$); similarly, *age* was selected by all classification models except international business and general business, the two courses with the youngest average *age*.

Extrinsic goal orientation, *study effort* and a *deep learning approach* were the most frequently used non-cognitive factors of learning in regression models, although their co-efficients were not statistically significant for models of larger subgroups ($n > 100$). *Study effort* was also the most commonly used non-cognitive factor of learning in classification models, followed by *visual modality* and *openness*. *Openness* was found to be significant in all models of international business, and had a significant, negative standardised co-efficient the subgoup's regression model ($–0.36$, $p < 0.01$, $n = 64$). Two non-cognitive factors were ignored by all classification models, namely *intrinsic goal orientation* and *metacognitive self-regulation*.

ANALYSIS OF RESULTS

Results from this study indicated that predictive models of students failing in first year of study in tertiary education, trained on data measured prior to commencement of first year of study, can achieve good predictive accuracy. The following sections will discuss the salient outcomes from this study.

Models of Academic Performance

Predictive accuracy. The study dataset was diverse in terms of participant age and course of study. Modes of assessment also varied across courses. For example, humanities courses gave more weighting to end of term examinations, while other courses gave equal or higher weighting to continuous assessment work. Assessment methods can affect academic performance (Pérez-Martínez et al., 2009) and its relationships with factors such as openness and learning approach as discussed in

Table 15. Regression model coefficients

	All participants	*Age: [18,23]*	*Engineering*	*Computing (IT)*	*Business with IT*	*Business general*	*International business*
n	*1207*	*875*	*172*	*137*	*60*	*183*	*64*
	Standardised regression model coefficients						
Prior academic achievement	0.38***	0.42***	0.25 ***	−0.06	0.57***	0.19*	0.06
Conscientiousness		0.08*		0.12	0.20	0.08	
Openness				0.10	−0.19		−0.36**
Self-efficacy			0.17 *			0.06	
Extrinsic Goal Orientation	0.10***	0.09**			0.18	0.12	0.04
Intrinsic Goal Orientation			0.05	0.12			0.01
Metacognitive self-regulation		−0.09*	−0.09				
Study effort	0.09**	0.10**	0.05		0.35**	0.12	
Study time					−0.17		
Deep learner	0.15***	0.10**	0.15	0.11			0.19
Shallow learner				−0.11			
Strategic learner					−0.28*		
Age	0.45***	0.17***	0.59***	0.27*	0.50***	0.22*	0.26
Visual				0.13		0.07	
Auditory							
Kinaesthetic		−0.05				−0.09	0.10

*IT: Information Technology; *p < 0.05; **p < 0.01; ***p < 0.001*

Table 16. Attributes used in classification models

Study factor	*All participants*	*Age: [18,23]*	*Engineering*	*Computing (IT)*	*Business with IT*	*Business general*	*International business*	*Models that used the factor (%)*
Prior academic achievement	3	3			3	2	3	67%
Conscientiousness		1						5%
Openness		1	1	1		1	3	33%
Self-efficacy	1	1	3				1	29%
Extrinsic Goal Orientation		1	1			3		24%
Intrinsic Goal Orientation								0%
Metacognitive self-regulation								0%
Study effort	2		1	2	1	2	1	43%
Study time	1							5%
Deep learner					2		2	19%
Shallow learner			1	2				14%
Strategic learner			1		1	1	1	19%
Group work			1		1	1		14%
Age	3	3	3	3	3			71%
Visual		1	2	2	1	3		43%
Auditory			2					10%
Kinaesthetic			2	2				19%

IT: Information Technology; a count of 3 indicates each of the three classification algorithms used this factor

the literature review. Notwithstanding these sources of variability, classification model accuracy was high (accuracy = 70.67%). The *k*-NN model had best model accuracy, although the difference between it and Naïve Bayes was not statistically significant. Working with similar data, Gray (2015) found 10-fold cross validation model accuracy was similar to model accuracy when models were tested on a difference student cohort, indicating cross validation model accuracies were a reliable indicator of model performance.

Model accuracies for subgroups within the dataset were higher, however samples sizes were below the minimum sample size needed to represent patterns in the dataset; therefore subgroup model results were inconclusive.

Analysis of Misclassifications

Of particular interest were participants incorrectly predicted as *Pass*. Group comparisons of study attributes failed to identify differences between this group and those correctly predicted as *Pass* with the exception of a marginally higher mean *age* (23.3 versus 24.8, $p < 0.05$) and a marginally lower mean score in *visual modality* (7.2 Versus 6.7, $p < 0.05$). There may be a number of reasons for this. Firstly, a number of factors relevant to retention and progression arise after student induction, such as academic and social integration, change in circumstance resulting in economic pressure (Tinto, 2006), and classroom related affects on academic performance such as teaching methods (Ganyaupfu, 2013; Hake, 1998). Such factors may explain why *prior academic achievement* and learning disposition alone are insufficient to predict academic performance in all cases. Secondly, it could be argued that profiling learners during first year student induction is too early in the semester to accurately measure some study attributes. For example, *intrinsic* and *extrinsic goal orientation* may vary depending on the time or situation (Apter, 1989). In addition, Winters et al. (2008) concluded both learner and task characteristics influenced levels and methods of self-regulation. On the other hand, factor correlations in this study concurred with evidence cited in other studies where data were gathered later in the semester making it more likely that factors not included in the study explained incorrect predictions of *Pass*. Further work is needed to accurately determine the potential improvements in model accuracy if additional data gathered after student induction were included in the model.

Overview of Study Factors

The following sections provide an overview of the study factors and their relative usefulness in predicting students at risk of failing.

Prior academic achievement and age. Correlations between prior academic achievement and academic performance in tertiary education are consistent and relatively strong for studies of standard students. For example, a meta-analysis of

109 studies conducted by Robbins et al. (2004) found average correlation between academic performance and high school GPA was r = 0.45. However, Brady-Amoon and Fuertes (2011) reported a lower correlation (r = 0.16) when the student population was more diverse. Results from this study concurred; prior academic achievement was ignored by models for subgroups with a higher average age (Tables 15 and 16).

Correlations between *age* and academic performance are well cited in literature, for example Hoskins et al. (1997), Cassidy (2011), and Wigfield et al. (1996), and evidence from this study concurs with this observation. Both classification and regression models concurred that *age* was a good predictor of academic performance (Tables 15 and 16). The two courses for whom classification models did not select *age*, namely business general and international business, had the lowest average *age* (m = 21 for both courses) indicating a high proportion of younger participants in both class groups.

Factors of personality. As discussed in the literature review, conscientiousness is the best personality based predictor of academic performance in tertiary education particularly for younger students (Allick & Realo, 1997; Chamorro-Premuzic & Furnham, 2008; Kappe & van der Flier, 2010; Kaufman et al., 2008). While correlation results from this study concurred with the available evidence, all except one classification model ignored conscientiousness. This suggested that other study factors accounted for conscientiousness, and there is no additional predictive value in measuring conscientiousness specifically.

The mix of assessment methods used across courses and within courses may explain the low correlation between *openness* and GPA. However, *openness* was used by 33% of classification models suggesting it may be a useful predictor of students at risk of failing for some courses. *Openness* is the most controversial of the BIG-5 personality factors in terms of defining both meaning and sub factors (de Raad & Schouwenburg, 1996, p. 321). The six-question scale used in this study covered four sub factors: creativity (2 questions), intellect (2 questions), imagination and openness to new experience. Creativity, specifically, is frequently cited as an effective learning disposition that is to be encouraged and promoted in assessment design (Buckingham Shum & Deakin Crick, 2012). Further work is required to investigate if sub factors inherent in *openness* may be more appropriate predictors of academic performance than *openness* itself.

Factors of motivation and learning strategies. As indicated in Table 9, there were strong correlations between factors of motivation, self-regulation and learning approach; particularly between self-efficacy, metacognitive self-regulation, study effort and a deep learning approach. 98% (16) of classification models either included self-efficacy, study effort or a deep learning approach. On the other hand, intrinsic goal orientation, metacognitive self-regulation and study time were largely ignored by classification models, in spite of statistically significant correlations with GPA.

This would suggest that when identifying students at risk of failing, the most useful indicators for motivation and learning strategies were self-efficacy as a measure of motivation, study effort as a measure of self-regulation, and a deep learning approach as a measure of learning approach. However, conclusions regarding intrinsic goal orientation and study time may be effected by the poor reliability of their questionnaire items.

Learner modality. As discussed in literature review, there is a lack of evidence suggesting that learner modality is predictive of academic performance. Correlation results and analysis of group differences concurred with this observation with the exception of marginal group differences for visual and kinaesthetic modality. Therefore, it was surprising that learner modality was selected by a number of classification models; in particular, visual modality was selected by 9 (43%) classification models. Students at risk of failing had a lower mean score in visual modality and a higher mean score in kinaesthetic modality. Study results justify a review of potential improvements in academic performance achievable from greater use of 'learn by doing' activities in the classroom.

Malleable learner dispositions. A comparison of classification model accuracies with, and without, non-cognitive factors of learning suggested that the addition of non-cognitive factors of learning did not improve predictive accuracy. Therefore, their value in learner profiling at student induction merits consideration. As discussed in the results section, there were statistically significant differences in the learning profile to students at risk of failing compared to other students. In addition, seven of the non-cognitive study factors are associated with an effective learning deposition (see literature review), namely conscientiousness, openness, self-efficacy, metacognitive self-regulation, study effort and a deep learning approach. Learning disposition is malleable. For example, Miller-Reilly (2006) evidenced teaching approaches changed adult learners' self-efficacy in mathematics. Similarly, a meta analysis of studies on self-regulation by Winters et al. (2008) reported on a number of studies that evidenced improved self-regulation, and consequently learning goals, following self-regulation training and support. A profiling tool facilitates feedback to both students and lecturers that may support other interventions. The profiler used in this study gave immediate feedback to students on their learner profile. However, Duffin and Gray (2009b) found only 56% of students understood their learning profile based on online feedback, this result rose to 83% when profiling was followed up by explanatory workshops. Interestingly, Jayaprakash et al. (2014) found that simply making students aware that they may be at risk of failing significantly increased numbers passing and number of withdrawals, but providing further supports did not affect additional change in either measure. Therefore, further work is needed to assess the impact of timely feedback on learner disposition, specifically on subsequent use of that information optimally.

CONCLUSION

Models of learning developed in this study predicted first year students at risk of failing with an accuracy of 71%. The dataset was diverse in terms of *age*, academic discipline and assessment strategies used (n = 1,207). The seventeen study factors used were measured prior or during first year student enrolment. The compound of factors that were significant in accurate prediction of students at risk of failing across a range of courses included:

- *Age*. The study dataset had an age range of [18,60]; younger students had a greater risk of failing in first year of study.
- *Prior academic achievement*, measured as a single aggregate score, was indicative of students at risk of failing, particularly for models of younger students.
- Factors of self-regulation, particularly *study effort*.
- Factors of motivation, particularly *self-efficacy*.
- Learning approach, particularly a *deep learning approach*.
- *Visual* and *kinaesthetic* learner modalities. A visual modality was weekly indicative of a passing student; A kinaesthetic modality was weakly indicative of a student at risk of failing.

All classification models included at least one factor of motivation, self-regulation or learning strategy. However *conscientiousness*, *intrinsic goal orientation*, *metacognitive self-regulation* and *study time* did not improve model accuracy over and above other factors of learning in spite of statistically significant correlations with GPA. In addition, conclusions from this study that *openness* and learner modality were significant predictors of academic performance were not widely observed in other studies, particularly the significance of learner modality. Therefore further work is needed to determine if their importance in models of learning, as reported in this study, generalises to other student cohorts.

Models generally concurred on participants misclassified. Analysis of misclassifications showed that *fails* misclassified as *passes* did not differ in learning disposition or *prior academic achievement*, from those correctly classified as *pass*. Factors not included in the study, such as academic and social integration, economic pressures, and teaching methods, measurable later in the semester, may explain misclassifications. Further work is needed to determine potential improvements in model accuracy from including data gathered after student induction.

The primary value of non-cognitive factors of learning in this study was to distinguish the learning profile of students at risk of failing from the learning profile of students that passed, rather than provide improvement in model predictive accuracy. It has been argued that non-cognitive factors of motivation, self-regulation and approaches to learning are malleable, and key to an effective learning disposition, which in turn should be a valued learning outcome of courses in tertiary education. Further work is needed to evaluate subsequent benefits of learner profiling during

student induction, both for the student, and for first year mentoring and support programmes.

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NOTES

1 This is a state-wide definition of a mature student, their entry requirements are less strict.
2 The National Learning Network Assessment Service provides functional strategies and support for children, adolescents and adults with specific learning difficulties; they are located on campus at ITB (www.nln.ie).
3 While generally a Cronbach alpha of > 0.8 indicates good internal consistency, Cronbach alpha closer to 0.7 can be regarded as acceptable for scales with fewer items (Cooper et al., 2010; Tavakol & Dennick, 2011).
4 CAO refers to the Central Applications Office with responsibility for processing applications for undergraduate courses in the Higher Education Institutes in Ireland.
5 Applying both a Wilcoxon Rank Sum non-parametric test and a parametric t-test to a range of distributions common in psychometric data, Kang & Harring (2012) reported t-tests inflated Type I errors (incorrect finding of significance) for sample sizes less than 60 only, but performed well for larger samples.
6 [x, y) denotes a range inclusive of x but exclusive of y.
7 Kang & Harring (2012) recommended at least 1000 replicas.

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11. THE MEASUREMENT OF SOCIAL AND EMOTIONAL SKILLS AND THEIR ASSOCIATION WITH ACADEMIC ATTAINMENT IN BRITISH COHORT STUDIES

INTRODUCTION

The British Birth Cohort Studies are multi-purpose, multi-disciplinary longitudinal studies with a host of potential applications, separately or in comparison with each other and with cohort studies in other countries. This chapter illustrates how the data they collect prospectively on social and emotional skills in childhood can be linked to educational attainment at a range of stages, and how these relationships can be analysed in the context of other features of a child's family background. Before presenting our own new results on how social and emotional skills at age 10 can be traced into the academic attainments of the cohort born in Britain in 1970, we review some of the existing attempts to measure 'non-cognitive' skills and their outcomes in other literature using the national British Cohort Studies.

First a brief introduction to the four national birth cohort studies in the UK (a fifth UK national birth cohort study was in its early stages of development at the time of writing but is not being taken forward).

The first national birth cohort study, the Medical Research Council's National Study of Health and Development (NSHD), started, in 1946, as a survey of post-war maternity services, in anticipation of the birth of the National Health Service (Wadsworth, Kuh, Richards, & Hardy, 2006, Wadsworth, 2010). It aimed to recruit all births in a week, using health visitors to collect the data from mothers. In 1948 the study became longitudinal with the follow-up of a stratified sub-sample (5,632), which was as much as resources permitted from 13,687 initial interviews. That cohort was then followed up at frequent intervals in childhood, and less frequent intervals in adulthood. The study is still ongoing with the most recent data collections at around age 63, and ages 68–69, and a new follow-up at age 70. Since 1961 its funding has been largely for medical enquiry. It has emphasised health information, but the life histories recorded have also had applications to social, educational and economic issues, including for example an influential contribution in its time in the debate over selective secondary education.

The second oldest national birth cohort, from 1958, was also initiated as a study of maternal and perinatal health in a cohort born in Great Britain in a week, of March 1958. In 1965 it became longitudinal, at that point to inform the Plowden

M. S. Khine & S. Areepattamannil (Eds.), Non-cognitive Skills and Factors in Educational Attainment, 239–264.

enquiry on primary education, and became known, to this day, as the National Child Development Study (NCDS). It is now mainly supported by the ESRC and housed at the Centre for Longitudinal Studies (CLS) at the University College London Institute of Education (Power & Elliott, 2006).The original cohort included over 17,000 births and the follow-ups in childhood additionally recruited immigrant children within the study birth dates. Table 1 summarizes the types of data collected sweep by sweep. This shows that the fifth follow-up (NCSD5) at age 33 was particularly complex, including a supplementary survey of a sub-sample of the cohort's children already born by 1991, but these children themselves have not (to date) been followed up. The numbers in the bottom row of Table 1 show that NCDS, like indeed most other longitudinal surveys, suffered attrition through the contacts at ages 7, 11, 16 in childhood and up to 55, so far, in adulthood, with the next survey in preparation for age 60 in 2018.

The British Birth Cohort Study of 1970 (BCS70) is also now housed at CLS (Elliott & Shepherd, 2006). It too started with all births in a week across the country, but with the intention to follow up from the outset. The longitudinal study is also based on Great Britain. The surveys at age 5 and age 10 were run from Bristol University, the one at age 16 was put in the field by an independent charity. The ESRC funded a postal survey at age 26 ensuring that the follow-up continued into adulthood, and has subsequently supported follow-up at four year intervals, age 29/30, 34, 38 (a telephone survey) and a face-to-face interview again at age 42, in 2012. A 'biosocial' follow-up (combining biomedical and social data) is planned in 2016 when cohort members are age 46.

No new national birth cohort study was initiated until the Millennium Cohort Study (MCS). The subjects of this fourth national cohort were born shortly after the turn of the millennium. At the first survey the MCS children were 9 months old, and families were then followed up when the cohort child was 3, 5, 7 and 11, in 2012 when the children were in their last year of primary school. A sixth survey took place at age 14 in 2015, with another one planned at age 17 in 2018. The intention is to keep following this cohort too into adulthood, but as yet the cohort has not produced evidence of the educational attainments they will carry into adult life, so they do not figure further in this chapter. See Connelly and Platt (2014) for some of the applications of the study to health matters.

Other British cohort studies outside the scope of this review include ALSPAC (Avon Longitudinal Study of Parents and Children), following children born in the Avon area around Bristol in 1991–1993, and Next Steps, formerly the Longitudinal Study of Young People in England, a cohort of English school children born in 1989–1990 which starts around age 14.

INFORMATION ON NON COGNITIVE SKILLS IN BRITISH COHORT STUDIES

The interest in non-cognitive factors in childhood as predictors and determinants of educational and other adult attainment mostly post-dated the childhoods which were

Table 1. National Child Development Study (NCDS) main sources of information. All births in Great Britain born in a week of March 1958

Year	*1958*	*1965*	*1969*	*1974*	*1981*	*1991*	*1999/2000*	*2002/3*	*2004*	*2008*	*2013*
Age	Birth	7	11	16	23	33	42	44/45	46	50	55
Sweep	0	1	2	3	4	5	6	Biomed	7	8	9
Source	Mother	Parent	Parent	Parent				Biomedical Survey by Nurses	Telephone Survey		Mixed-Mode (online/ phone)
		School	School	School							
	Medical	Medical	Medical	Medical							
		Tests (b)	Tests	Tests						Tests	
		Subject	Subject	Subject	Subject	Subject	Subject	Subject	Subject	Subject	Subject
				Exams 1978		Spouse/ Partner		Biometric Measures		Consent to record Linkage	
						Children (c)		Blood Samples			
						Children's Mother (d)		Saliva Samples		Biographic Interview	
Size (a)	17,415	15,425	15,337	14,654	12,537	11,469	11,419	9,377	9,534	9,790	9,137

Notes:

a. *Cross-sectional achieved sample of cohort members – immigrants with appropriate date of birth included for NCDS1-3.*
b. *Assessments of cognitive skills directly administered to cohort members.*
c. *For a random sample of one in three cohort members. Information was collected directly from 3,008 children of cohort members.*
d. *This could be the Cohort Member, their Spouse, or Partner (same 1 in 3 random sample). 2,588 mothers completed the 'mother' questionnaire, giving information on 4,278 children.*

- *Geographical identifiers permit splicing in of external data from 1974.*
- *For full details of response, sub-studies and questionnaire content see www.cls.ioe.ac.uk/ncds*

Table 2. British Cohort Study 1970 (BCS70): Main sources of information. All births in Britain, born in a week of April 1970

Year	*1970*	*1975*	*1980*	*1986*	*1996*	*2000*	*2004*	*2008*	*2012*	*2016*
Age	Birth	5	10	16	26	30	34	38	42	46
Sweep	0	1	2	3	4	5	6	7	8	9
Source	Mother	Parent	Parent	Parent	Postal			Telephone Survey		
			School	School						
	Medical	Medical	Medical	Medical						
		Tests (b)	Tests	Tests					Tests	Tests
		Subject	Subject	Subject	Subject	Subject	Subject	Subject	Subject	Subject
							Children (c)		Data linkage consents	Biomedical measures
							Children's Mother (d)			Blood samples
Size (a)	16, 571	13,071	14, 874	11621	9,003	11,621	9,665	8,.874	9,841	tbc

Notes:

a. *Cross-sectional achieved sample - immigrants with appropriate date of birth included from age 5 and 10. Numbers for Great Britain only as births in Northern Ireland not followed up.*
b. *Assessments of cognitive skills directly administered to cohort members.*
c. *For a random sample of one in two cohort members. Information was collected directly on 3881 children of cohort members.*
d. *This could be the Cohort Member, their Spouse, or Partner (same 1 2 random sample). 2,846 parents completed the 'mother' questionnaire, giving information on 5207 children.*

- *Geographical identifiers permit splicing in of external data from 1986.*
- *For full details of response, sub-studies and questionnaire content see www.cls.ioe.ac.uk/1970cohort.*

being observed in these studies. Heckman (2000) started a spate of interest, although this idea was not unprecedented; Harris (1940), and Jencks (1979) for example, had raised the question of what determines success in college and beyond. However, researchers have made use of the evidence collected at the time to approximate concepts which crystallized later.

Cohort studies not only follow individuals through time, but they reflect the times in which they are collected, and the sets of questions ('instruments') used in surveys to detect, or subsequently to proxy social and emotional skills have been changed in important ways over the years.

Especially in the case of the earliest sources, the main evidence from these studies about social and emotional skills comes from questions (to parents or teachers) about behavioural problems and difficulties from instruments such as the Rutter scales (Rutter, Tizard, & Whitmore, 1970), while their descendants in Goodman's Strengths and Difficulties Questionnaire (SDQ, Goodman, 1997) are prominent in later studies (such as the Millennium Cohort Study). The Rutter behaviour inventories were developed in the mid-1960s for a cross-sectional study of children's health, education and behaviour in the Isle of Wight. The objective of that research was to identify and understand 'handicap', or obstacles to development, in all three domains, rather than the positive end of each spectrum. In the behavioural domain they were particularly interested in what leads to 'delinquency'. Rutter's behaviour problems questionnaire was used, as a screening device for psychiatric problems and treatment. Screening was also the prime purpose of Goodman's instrument which has replaced it in wide use. On their original purpose, these measure child mental health problems as much as, if not better than, 'skill', particularly where they focus on difficulties rather than positive strengths. The absence of the problems which they capture does not necessarily entail good socio-emotional skills, but their presence is often taken to indicate poor skills.

The language used to describe the data instruments and the concepts to which they are related has gone in and out of fashion in different disciplines, and at different periods of time. For example, the general set of attributes being referred to in this chapter have been variously identified as behavioural adjustment, personality, non-cognitive skills, socio-emotional skills, and character skills, to name but a few.

A LITERATURE REVIEW OF FINDINGS ON SOCIAL AND EMOTIONAL SKILLS AND THEIR LINKS TO EDUCATIONAL ATTAINMENT IN THE BRITISH BIRTH COHORT STUDIES

1946 Cohort Study

In the 1946 cohort surveys in the 1950s there were a few questions to the mother on child behavioural adjustment, at age 8, in 1954, and to teachers at age 10, with items featuring aggression and nervousness, in some ways a precursor of the

Rutter and Strengths and Difficulties instruments which were developed in the following decades, but not much use has been made of that material in the analysis of educational outcomes. There is much richer information gathered from teachers at age 13 and 15 on temperament, behaviour, attentiveness, including questions described as a close forerunner of the Rutter scale. From this material, Colman et al. (2009) derive measures of conduct and emotional problems. There were no questions aimed at identifying hyperactivity in the 1946 cohort, so the terms conduct and externalising are used interchangeably (in later data, such as SDQ, externalizing problems are the sum of hyperactivity and conduct problem sub-scales). Colman et al. (2009) show that severe and mild externalising problems in childhood are related to failing to obtain any qualification, along with a range of mid-life outcomes (mental disorder, alcohol abuse, relationship difficulties, low social class, unemployment, and financial difficulties). The odds ratio they estimate for having no qualifications was 2.3 for mild conduct problems, and 4.0 for severe problems (adjusted for sex, father's social class, cognitive ability, and depression/anxiety in adolescence). In a similarly adjusted model, Richards and Abbott (2009) show that conduct problems in adolescence predict a poorer chance, for both sexes, of obtaining advanced qualifications (A level or higher, see details on p. 254 below) as well as a greater chance of getting no qualifications. By contrast emotional problems (in a model adjusted for class, cognition and conduct), were only significant, and to a lower extent, in raising the odds of girls getting no qualifications. Richards and Abbot (2009) report broadly similar results in a parallel analysis of the 1958 cohort (though emotional problems appeared even less of a disadvantage for educational attainment). They also show conduct problems associated, among other outcomes, with lower hourly earnings, which appears to work through education, which is not controlled in the model predicting earnings. Richards and Huppert (2012) also extracted a rating of positive attitude and social skill from the NSHD teacher material at 13 and 15, which is rare in the literature generally emphasising behaviour problems and psychopathology. The items were: 'very popular with other children' (age 13 only); and at both 13 and 15: 'unusually happy and contented', 'makes friends extremely easily' and 'extremely energetic, never tired; with a maximum score of 7. The rating as a 'positive child' is included as a predictor of various aspects of adult well-being, including educational attainment, alongside conduct and emotional problems, and a measure of extraversion derived from the survey members themselves when they completed a Personality Inventory at age 16. Having at least 2 out of 7 positive ratings was associated with several aspects of mid-life well-being, but not with educational attainment at A level or above, once father's class, cognition and other aspects of the child's mental health were controlled. Neither extroversion nor emotional problems were associated with 'advanced' qualifications, although the association of conduct problems with lower qualifications was also apparent here.

1958 and 1970 Cohort Studies

Despite fewer surveys in childhood, the 1958 and 1970 cohorts have more material on children's non-cognitive characteristics and much more analyses linking them to educational qualifications. The mothers were asked about behaviour problems on various versions of the Rutter behaviour problems questionnaire at 7, 11 and 16 (NCDS) and 5, 10 and 16 (BCS70). Teachers reported on a Rutter instrument at 16 in both cohorts and at age 10 and 5 in BCS70. Teachers of the 1958 cohort completed the Bristol Social Adjustment Guide (BSAG) at ages 7 and 11 (Stott, 1969). Stott shared Rutter's interest in 'Troublesome Children' (Stott, 1966). At 16 members of both cohorts provided self-assessments of their academic motivation and academic self-concept. The 1970 cohort is notable for having obtained evaluations of locus of control and self esteem from the 10 year old respondents. The former attempts to tap the extent to which the child feels events are beyond or within his/her control. It used the CARARLOC instrument developed by Gammage (1975) based on Nowicki and Strikland (1973) and derived from Rotter (1966). Self Esteem was measured on a set of questions (LAWSEQ) developed around that time by Lawrence (1981) following Rosenburg (1965). The 1970 cohort collected some detailed questions on child developmental behaviours from the teacher questionnaire, from which some researchers have inferred elements of personality and from which we draw an indicator of conscientiousness, used below but at no point in the childhood of these cohorts was the full Open-ness, Conscientiousness, Extraversion, Agreeableness, Neuroticism (OCEAN) 'Big Five' personality inventory administered (Digman, 1990). Time is always short on a multi-purpose survey instrument.

The BSAG, taken at two time points in the 1958 cohort, is one of its major sources of evidence on behaviour, and potentially 'non-cognitive' 'skills'. This contained 250 descriptions of behaviour put to teachers at age 7 and 11, with a form of response involving single and double underlining. So far, the results are only available in a reduction of the original items into 12 domains or syndromes, arguably idiosyncratically defined as: (1) Anxiety for acceptance by children; (2) Hostility towards children; (3) Hostility towards adults; (4) Writing off adults and standards; (5) Withdrawal; (6) Unforthcomingness; (7) Depression; (8) Anxiety for acceptance by adults; (9) Restlessness; (10) Inconsequential behaviour; (11) Miscellaneous symptoms; (12) Miscellaneous nervous symptoms. These emphasise problem behaviour, rather than the more positive responses that could be, and were, given, but which were not coded at the time. The raw BSAG data could yield more valuable information if it were more completely coded and re-grouped to reflect more current understandings of social and emotional concepts, as well as to record positive aspects of the child's behaviour as well as the problems.

Carneiro, Crawford and Goodman (2007) for example, use an overall BSAG score as a measure of 'Social skills'. Conti and Hansman (2013) look at individual

domains. Ghodsian (1977) proposed a factor analysis of the 12 Domains into two major dimensions, internalising and externalising problems, notionally at least picking up the same latent characteristics as had been given the same labels (though from different questions to) in the 1946 cohort. Other authors use principal components analysis to construct their own indices of 'personality traits'. Silles (2010), for example, generated scales for aggression (partitioned into active and passive elements) and withdrawal, which were used alongside family background and cognitive score to predict earnings at 23. She concludes that 'social maladjustment' scores are strongly associated with success and failure in both education and the labour market. Daly, Delaney and Baumeister (in progress) use elements of the BSAG to capture self-discipline, or self-regulation. Papageorge et al. (2015) confirm a negative effect of externalising behaviour at 7 and 11 – derived from BSAG at 7 and 11 – on educational attainment, but suggest that there may be a positive 'return', in weekly earnings, to having been more aggressive or disruptive in class, when cognition, internalising problems and school attainment are controlled. Note that the apparent contradiction with Richards and Abbott (2009) could be due to controlling for schooling or a different measure of earnings. They draw a policy conclusion from this that measures to stamp out bad behaviour could have unintended long-term consequences which could be avoided if the policy were instead to adapt teaching style towards the more disruptive child.

Goodman, Joyce and Smith (2011) use NCDS data from birth to 50 to investigate the 'long shadow of ill-health in childhood'. They include summaries of physical and mental health problems in childhood in models of social and economic outcomes at the age of 50, finding childhood mental health to be very important for most of the outcomes they consider, including cognitive function at the age of 50. They assess child mental health problems using reports from the school medical officer and from parents about whether the child had ever been referred to a professional for psychological or behaviour problems, rather than teacher reports from the BSAG or parent reports of behaviour problems (although they are doing so in current work). The age 50 assessment of personality is treated, not as a predictor of career success (as is questionably done by O'Connell & Shaikh, 2011 and Furnham & Cheng, 2013), but as one of the outcomes to be explained at the half-century mark. Three of the 'Big Five' dimensions do turn out to be significantly associated with good childhood mental health (Agreeableness, Conscientiousness and Emotional Stability), each to the tune of about 1.6 standard deviations. There was no effect on Extraversion or Intellect/Openness. While this paper does not report the effect of mental health problems in childhood on educational attainment, it does show that educational attainment in adult life does *not* appear to be a significant pathway through which socio-economic outcomes (such as family income at age 50) are negatively affected.

While freedom from behaviour and emotional problems may be features of non-cognitive skill, another feature commonly cited is motivation. Aspiration and expectation are less generally thought of as 'skills' though they may feed into

motivation. In both NCDS and NCDS there was an attempt to assess motivation, at least in the classroom context, in questions directly put to sixteen year olds. Sacker and Schoon (2007) used the response on academic motivation, along with academic self-concept (how good the student thinks they are at various subjects), the cohort member's expectations and aspirations for further study, and parental interest, aspirations and expectations, to investigate who stayed on at school at 16, and who went on to gain further qualifications. In the NCDS cohort, 62 percent left school at age 16, but some of these leavers (8% of the cohort) went on to return to full–time education by age 42. Family support and personal assets were, as expected powerful predictors of staying on at school and less so eventual qualifications, given whether or not their child left. In a multivariate model, the cohort members' own expectations and aspirations at 16 were significantly associated with staying on at school, and (mostly) with eventual qualifications. Academic self-concept was not independently related to staying on at school, neither was academic motivation, for boys. It did contribute modestly to the chances of girls' staying on and to the model explaining eventual qualifications for both sexes, where there were also some significant but modest effects detected for academic self concept. Very little was significantly associated with resuming full-time education apart from academic motivation and cognitive ability. Schoon, Parsons and Sacker (2004) use similar variables from NCDS on aspirations (parent and child) and motivation to predict exam results. This paper also includes a behavioural adjustment variable based on the Rutter scale. Both motivation and good behaviour are better at predicting exam results among the relatively advantaged sub-sample than among their disadvantaged counterparts. Among other research making use of this information is Schoon's (2008) comparison of the pathway from childhood to adult social status, via educational attainment with direct and indirect influences of cognitive ability and motivation. Educational attainment was measured as the highest level attained on leaving full-time education, and adult social status was a combination of the social class of occupation at age 33/30 and highest qualification attained by that date. She shows that the major determinant of adult status is educational attainment, particularly for the 1970 cohort, but that both cognitive ability and motivation both feed into educational attainment and have an independent effect on adult social status beyond that. The effect of motivation on educational attainment is slightly stronger for females than males, while the reverse is true for the direct effect of 16 year old motivation on status in at 33/30. Further research using motivation variables is reviewed by Goodman, Joshi, Nasim and Tyler (2015).

While resilience – the ability to withstand an adversity or shock or recover from one – is often listed as a trait which helps people survive and 'beat the odds', it is not something that surveys can measure directly in people, in particular in those who might be exposed to a shock but have not experienced it. Resilience has been inferred in analyses of the British birth cohort studies by, for example, Schoon (2006). Children from disadvantaged backgrounds who emerge from school in the top half of the educational attainment distribution are said to be 'resilient'. Children

from disadvantaged backgrounds with lower educational attainments are classified as 'vulnerable'. The 'resilient' individuals also do 'better than expected' in a number of adult outcomes on the labour market and psychological domains, in various ways, sometimes differing for men and women. Among factors with some relationship to explaining who beat the odds were own and parental aspirations and expectations, and parental support (see also Sacker & Schoon, 2007).

The mother's questionnaire about child behaviour at age 10 in the 1970 cohort (Rutter) has been used to yield 3 components, hyperactivity, conduct and emotional problems, the first two often being combined as externalising problems (Maughan, Taylor, Taylor, Butler, & Bynner, 2001). Hyperactivity (loading on restlessness, fidgetiness, and lack of concentration at age 5) was one of the terms included in Flouri's model of educational attainment at 26 (Flouri, 2007). Along with authoritarian parenting it was one of two risk factors associated with low attainment at 26, however hyperactivity made less difference if the child was living in a 'low-stimulation environment' (maternal depression and low maternal educational attainment), just as authoritarian parenting was not related to educational attainment within the lower social class families.

At age 10 the children's responses on their locus of control have been related to educational outcomes by a number of authors: Feinstein (2000), Flouri (2006), Murasko (2007), Conti, Heckman and Urzua (2011). After controlling for parental background and other socio-emotional characteristics at 10, Feinstein found a significant boost to qualifications by 26 from an internal locus of control (belief in own agency) along with teacher-rated 'Attentiveness' at 10. Murasko looked at both the CARALOC locus of control inventory and the LAWESEC inventory on self-esteem. In a model which controlled also for cognitive ability, health, social background, he found that only an internal locus of control, and not self-esteem, was significantly related to continuing training beyond the compulsory school age of 16.

The mother's Rutter questionnaire at age 10 in the 1970 cohort has also been used to capture the concept of self-regulation. For example, O'Reilly, Daly and Delaney (in progress) show that self-regulation is positively associated with a number of measures of educational attainment.

In a recent review of social and emotional skills commissioned by the Early Intervention Foundation, Goodman et al. (2015) use evidence derived from a number of child and teacher items at age 10 in the 1970 cohort to show that internal locus of control, positive academic self-concept, good conduct and conscientiousness (together taken to reflect self-regulation) are all positively associated with the chances of obtaining a degree. The strongest single predictor of educational attainment, however, is cognitive ability. Interestingly, social skills are negatively associated with obtaining a degree, although this is observed only for boys. This report also looked at 19 other adult outcomes in various economic, social and health domains. Estimates were made of how many of the links between childhood skills and adult outcomes worked through effects on education. This was particularly frequent in the case for cognitive ability: in total 11 out of 19 outcomes were

partially or totally mediated by education, particularly for economic outcomes like wages and net wealth. This also applied to locus of control and conscientiousness in 7 and 5 outcomes, respectively, mostly on the labour market. The association of good conduct, (or the absence of externalising problems), with occupational status was partly accounted for by education; its link to life satisfaction, adult heath, and family income in adulthood appeared to work entirely via education. They note that there was not sufficient evidence of motivation or 'resilience' at age 10 to include it the analysis of BCS70, nor for the same reason does it, or the present study, attempt to assess the notion of 'grit', reflecting passion and perseverance, which has been linked to resilience, as there have only recently been attempts to measure it (Duckworth, Peterson, Matthews, & Kelly, 2007).

ANALYSIS OF THE 1970 COHORT STUDY

In the remainder of this chapter we set out some new empirical analysis of the British 1970 birth cohort showing the association between cognitive, social and emotional skills in mid-childhood and educational attainment by age 30.

Measuring Non-Cognitive Skills and Family Background

Non-cognitive skills. We use the following conceptualisation of four dimensions of social and emotional skills measured at age 10, described more fully in Goodman et al. (2015), which in turn builds heavily on Gutman and Schoon, (2013).

1. Self-perception and self-awareness, which relate to a child's knowledge and perception of themselves and their value, and their confidence in their current abilities and a belief in their efficacy in future tasks, are captured by the following variables.

    a. *Locus of Control* – The child's perception of how far things are under his/her own control (internal locus) rather than the result of external forces (external locus), based on the child's response to the CARALOC inventory.
    b. *Self-esteem* – Based on the child's response to the LAWSEQ inventory.
    c. *Academic Self-concept* – Child's own rating of how good s/he is at maths, reading, spelling, creative writing, arts/crafts and other topics/projects.

2. Self-control and self-regulation refer to how children manage and express emotions, and the extent to which they overcome short-term impulsivity in order to prioritise higher pursuits. Lack of self-control is comprised of six inter-related characteristics namely: (1) impulsivity and inability to delay gratification, (2) lack of persistence, tenacity, or diligence, (3) partaking in novelty or risk-seeking activities, (4) little value of intellectual ability, (5) self-centeredness, and (6) volatile temper. It has elements in common with behavioural difficulties, particularly those grouped as 'externalising'. High self-control is associated with

'conscientiousness', one of the Big Five dimensions of personality.

a. *Good Conduct* (reverse of externalising scale) based on mother report on the Rutter inventory
b. *Conscientiousness* – We use selected variables from the teacher-reported Child Development Behaviour Questionnaire to form a measure which we term 'Conscientiousness'. We aggregate over 9 items relating to whether the child daydreams, becomes bored in class, shows perseverance, becomes confused, is forgetful, shows lethargic behaviour, works independently and accepts the goals of the curriculum, before standardising. Each item is on a scale of 1 to 47, and reverse coded where appropriate such that a higher score represents greater conscientiousness.

3. *Emotional Health* (reverse of internalising scale) The child's emotional health is measured using the emotion subscale of the mother-reported Rutter Behaviour Questionnaire, which contains 6 items relating to what extent the child is often worried, miserable, fearful, fussy, sullen or tearful and is a measure of negative feelings, otherwise known as 'emotional problems'. Each item is on a scale of 0 to 100 and the 6 items are aggregated, before standardising.
4. *Social Skills* (peer relationships) generally describe a child's ability and tendency to interact with others, forge and maintain relationships, and avoid socially unacceptable responses. They cover communication, empathy, kindness, sharing and cooperativeness. They are absent when a child is solitary, shy or withdrawn. Social skills are captured in our analysis by teacher-reported peer-relationship questions relating to the child. The teacher is asked to what extent the child is popular with peers, has many friends, shows bold rather than shy behaviour and is cooperative with peers. We aggregate over these four items, which are each on a 1 to 47 scale before standardising.

Cognitive Skills

We examine three domains of cognitive skill also measured at age 10 in the 1970 cohort study (see Parsons, 2014).

a. *The Edinburgh Reading Test* requires children to complete a variety of tasks including matching words to pictures, selecting the incorrect word in a sentence, matching answers to questions, extracting information from a picture, answering questions after reading some text, understanding the meaning of words and putting sentences in the correct order.
b. *The Friendly Maths Test* is a multiple choice test which includes questions on arithmetic, number skills, fractions, algebra, geometry and statistics
c. *The British Ability Scale* is selection from a wider suite of tests of cognitive abilities measuring something akin to IQ. It includes two verbal subscales (word

definitions and word similarities) and two non-verbal subscales (digit recall and matrices).

We utilise 7 measures of social and emotional skills, and 3 measures of cognitive skills, providing 10 distinct dimensions of childhood non-cognitive and cognitive development at age 10. All ten measures are coded such that a higher score represents a higher level of that skill. For the analysis we convert each of the 10 measures into their respective quintiles, where the first quintile represents the bottom 20% of the distribution and the fifth quintile the top 20% of the distribution.

We estimate the effects of each of these cognitive, and social and emotional skills jointly, on the highest level of formal educational attainment by age 30, also conditioning on a wide range of other child, parent and family characteristics, and measured at various ages of the child (as indicated): child's birth weight, gender (birth), ethnicity (age 10), whether the child has older siblings (age 5), education level of parents (birth), their employment status (age 10), maternal mental health (age 5), mother's age at birth of the cohort member, family income (age 10) and social housing tenure (age 10).

Before going on to describe the educational measure in more detail we first show some descriptive statistics relating to how children's social and emotional, and cognitive skills at age 10 are interrelated, and how do they differ across children and their families.

How are Children's Social and Emotional, and Cognitive Skills at Age 10 Interrelated, and How do they Differ across Children and their Families?

We first show how the different social and emotional, and cognitive skills at age 10 are correlated (Table 3). This table shows that there are positive correlations between different skills, meaning that a child with higher skills in one dimension is likely to have higher skills in the other dimensions, too. The correlations range from the relatively low association of 0.06 (e.g. between academic self-concept and emotional health), to a high 0.74 (e.g. between maths and BAS). As a rough guide, a correlation above 0.3 is considered strong.

Within the social and emotional skills, notable are the strong correlation between locus of control with self-esteem (0.42), good conduct and emotional health (0.42) and conscientiousness with both locus of control (0.39) and sociability (0.44).

Correlations with academic self-concept are modest, it being the only skill not correlated with any other skill by more than 0.3. Good conduct is poorly correlated with self-perception/self-awareness measures, and interestingly, with the other skill measure pertaining to self-control/self-regulation, conscientiousness. Other than conscientiousness, sociability appears only modestly associated with the other social and emotional skills.

Table 3. Correlations between social and emotional skills at age 10, BCS70

	Social and emotional skills							*Cognitive skills*		
	Locus of control	*Self-esteem*	*Academic self-concept*	*Good conduct*	*Conscient-iousness*	*Emotional health*	*Sociable*	*Reading*	*Maths*	*BAS*
Locus of Control	1.00	0.42***	0.28***	0.19***	0.39***	0.11***	0.23***	0.48***	0.46***	0.47***
Self-esteem	0.42***	1.00	0.25***	0.15***	0.23***	0.13***	0.22***	0.22***	0.23***	0.22***
Academic Self-concept	0.28***	0.25***	1.00	0.10***	0.25***	0.06***	0.14***	0.27***	0.21***	0.22***
Good Conduct	0.19***	0.15***	0.10***	1.00	0.27***	0.42***	0.24***	0.24***	0.22***	0.22***
Conscient-iousness	0.39***	0.23***	0.25***	0.27***	1.00	0.09***	0.44***	0.53***	0.52***	0.48***
Emotional Health	0.11***	0.13***	0.06***	0.42***	0.09***	1.00	0.28***	0.11***	0.13***	0.12***
Sociable	0.23***	0.22***	0.14***	0.24***	0.44***	0.28***	1.00	0.24***	0.24***	0.22***
Reading	0.48***	0.22***	0.27***	0.24***	0.53***	0.11***	0.24***	1.00	0.73***	0.73***
Maths	0.46***	0.23***	0.21***	0.22***	0.52***	0.13***	0.24***	0.73***	1.00	0.74***
BAS	0.47***	0.22***	0.22***	0.22***	0.48***	0.12***	0.22***	0.73***	0.74***	1.00
Observations	10290	10290	10290	10290	10290	10290	10290	10290	10290	10290

Sample restricted to those with non-missing social and emotional, and cognitive skills; * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$*

Table 4. Correlations between social and emotional skills and background characteristics

	Social and emotional skills							*Cognitive skills*		
	Locus of control	*Self–esteem*	*Academic self–concept*	*Good conduct*	*Conscienti–ousness*	*Emotional health*	*Sociable*	*Reading*	*Maths*	*BAS*
Male	0.01	0.10***	0.01	–0.16***	–0.16***	0.06***	–0.01	–0.07***	0.05***	0.02*
Birth Weight	0.09***	0.05***	0.02*	0.04***	0.05***	0.03**	0.08***	0.11***	0.12***	0.12***
Non–white	–0.07***	–0.01	0.00	–0.04***	–0.01	–0.00	–0.05***	–0.09***	–0.09***	–0.09***
Older Siblings	–0.06***	–0.06***	–0.09***	–0.04***	–0.07***	0.08***	0.01	–0.12***	–0.07***	–0.09***
Low Family Income	–0.17***	–0.11***	–0.08***	–0.11***	–0.14***	–0.06***	–0.13***	–0.20***	–0.19***	–0.19***
Mother Unemployed	–0.05***	–0.03**	–0.01	–0.02*	–0.04***	–0.04***	–0.07***	–0.06***	–0.06***	–0.06***
Father Unemployed	–0.09***	–0.08***	–0.05***	–0.08***	–0.09***	–0.05***	–0.07***	–0.12***	–0.12***	–0.11***
Mother Education 16+	0.20***	0.11***	0.07***	0.11***	0.17***	0.06***	0.08***	0.28***	0.27***	0.30***
Father Education 16+	0.22***	0.11***	0.09***	0.13***	0.20***	0.07***	0.08***	0.28***	0.28***	0.29***
Social Housing	–0.20***	–0.13***	–0.09***	–0.16***	–0.18***	–0.10***	–0.12***	–0.27***	–0.26***	–0.27***
Mother Malaise	–0.14***	–0.12***	–0.05***	–0.25***	–0.14***	–0.26***	–0.14***	–0.17***	–0.18***	–0.17***
Mother Young at Birth	–0.10***	–0.08***	–0.03**	–0.09***	–0.07***	–0.09***	–0.04***	–0.10***	–0.10***	–0.12***
Observations	10290	10290	10290	10290	10290	10290	10290	10290	10290	10290

*Sample restricted to those with non–missing social and emotional, and cognitive skills * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$*

There are stronger associations within the cognitive skills group, where reading, maths and BAS exhibit correlations with each other above 0.7. With respect to associations between social and emotional skills and cognitive skills, it can be seen that the strongest correlations are, by some way, between locus of control and conscientiousness, and the three measures of cognitive skill, where correlations are around 0.5.

Table 4 shows the correlations between the social and emotional, and cognitive skills and other background characteristics of the child. It can be seen that the cognitive skills are more strongly associated with almost all of the child, parent and family characteristics, with the notable exceptions of gender and mother's malaise score (mental distress). It should be noted however, that the social and emotional skills most strongly associated with mother's mental distress are good conduct (0.25) and emotional health (0.26), which are the only two skills of the child which are mother-reported. Part of the relatively strong correlation, therefore, may be due to mothers with poorer mental health tending to report greater emotional and behavioural problems in their children than might a less depressed informant.

The three cognitive skills are most strongly associated with parental education and housing tenure, with correlations ranging from 0.26 to 0.30. More generally, the cognitive skills are particularly strongly associated with measures of parental socio-economic status (parental income, unemployment, education and social housing). This is also true for locus of control and conscientiousness, which were also the two social and emotional skills exhibiting the strongest associations with the cognitive measures.

Measuring Highest Educational Attainment

Our ordinal indicator of educational attainment is based on academic qualifications, namely those usually obtained in school or college, and is categorised by the highest level reached in six stages (Table 5). The sample of 7,495 represents the sample used in the analysis, and is defined by those individuals for whom we have available information on highest educational attainment and all 10 of the social and emotional, and cognitive skills.

The 1970 cohort faced a minimum school leaving age of 16. Around that time they could sit a public examination, which took several forms. In England and Wales, there was a two tier system of CSEs (Certificate or Secondary Education, aimed at the less able) and O-levels (Ordinary level of the General Certificate of Education), which was then replaced by GCSEs (General Certificate of Secondary Education) in 1988. Cohort members therefore largely gained their exams under the two tier system, but may also have subsequently gained GCSEs from the age of 18 onwards. Students normally sat exams in 5–10 subjects, which did not all have to be done at the same time, and might be repeated to redress a failure or improve grades. There were Advanced levels of GCEs (A-levels) taken generally two years later, at the end of secondary schooling, in a smaller number of subjects (around 3). There

Table 5. The educational ladder – highest educational qualifications by age 30 in BCS70

Highest Academic Level	*Total*			*Female*			*Male*		
	Freq.	*Percent*	*Cum.*	*Freq.*	*Percent*	*Cum.*	*Freq.*	*Percent*	*Cum.*
(1) No Quals	1,884	25.14	25.14	901	23.11	23.11	983	27.34	27.34
(2) Below O-level*	643	8.58	33.72	320	8.21	31.32	323	8.98	36.32
(3) O-level*	2,431	32.43	66.15	1,311	33.62	64.94	1,120	31.15	67.46
(4) A-level*	506	6.75	72.91	301	7.72	72.66	205	5.7	73.16
(5) Diploma	497	6.63	79.53	291	7.46	80.12	206	5.73	78.89
(6) Degree	1,534	20.47	100	775	19.88		759	21.11	
Total	7,495	100		3,899	100		3,596	100	

Notes:
1. Variable values given in parentheses.
*2. * denotes 'or academic equivalent'.*

were different but equivalent exams in Scotland. In terms of the age at which it is taken, A-levels resemble qualifications like the baccalaureate or US High School graduation, although the content of what is examined, and the standards attained are not exactly comparable. We use information on two levels of tertiary education in universities and other higher education institutions; the lower level of tertiary education includes qualifications such as diplomas (which may not require more than two year's study, often in those days teaching diplomas), the upper level covers university degrees at bachelor's and postgraduate level (both master's and doctoral). There were too few cases of postgraduate degrees to treat separately in our analysis. Our scheme does not include vocational qualifications such as apprenticeships, which tend to be obtained once employed (and may be less strongly associated with early life antecedents or subsequent outcomes).

The lowest level, no academic qualifications, accounts for 25 percent of our total sample. These people would mostly have left school at 16, in the summer of 1976, although some would have stayed on without sitting or without obtaining passes in any public exams. Some early leavers acquired qualifications later, but these are more likely to have been vocational rather than academic.

The second level have obtained at least some passes in public exams but below the level treated as adequate for academic progression. Many of them would not have stayed on at school beyond 16. Nine per cent fall into this group.

The third threshold was passed by two thirds of the cohort. It marks the group who 'did well' in O-level/GCSE (5 passed at grades A*-C or CSE grade 1) but went no further, representing 32 per cent of our sample, the largest of the categories. Many of them, particularly girls, left school between 16 and 17, albeit with respectable qualifications.

To enter higher education it is generally required to move beyond O-levels/GCSEs, as did about one third of our sample. 7 per cent obtained A-levels but did not progress any further, and this represents the fourth educational level in our analysis. A similar percentage, 7 per cent reached the level of a higher education diploma and no further, representing the fifth level. And finally, approximately 20 per cent of the sample obtained degrees (including 3 per cent with post-graduate qualifications).

There are slight differences between females and males in our sample, with males being more likely to obtain no qualifications, and a degree, but less likely to have intermediate outcomes as the highest level achieved.

Method for Estimating the Relationship between Childhood Skills and Educational Attainment

We estimate an ordered logit model for the ordinal dependent variable, Y, describing the highest level of educational attainment, where larger values (categories) correspond to "higher" rungs of the educational ladder. The ordered logit model can be written as;

$$P(Y_i > j) = g\left(\beta^S \boldsymbol{S} + \lambda^X \boldsymbol{X}\right) = \frac{\exp(\alpha_j + \beta^S \boldsymbol{S}_i + \lambda^X \boldsymbol{X}_i)}{1 + \exp(\alpha_j + \beta^S \boldsymbol{S}_i + \lambda^X \boldsymbol{X}_i)}, j = 1, 2 \ldots, M - 1 \quad (1)$$

where j is an index of the ordinal education variable, Y, M is the total number of categories of (6), and the vector, S, represents the 10 skills, cognitive and non-cognitive. The vector, X, denotes the array of child, parent and family characteristics included as controls.

The ordered logit model described by equation (1) is an example of a proportional odds model which assumes that the β's for each skill (and the λ's for each control) are the same for each value of j. In other words, the effect of a skill is the same across different pairs of educational outcome groups, giving rise to only one set of parameters. For example, this assumption would imply that the effect of a skill on the probability of not being in the bottom education category is the same as its effect on the probability of not being in the bottom two categories, and of not being in the bottom three categories, and so on. We first present these proportional odds estimates for each skill, conditional on all of the other variables in the model being held constant.

Results from the Brant test suggest, however, that the proportional odds assumption is violated for at least one, but not all, of the skills we consider; i.e. some of the β's differ across values of j. This implies that the proportional odds model estimated via the ordered logit is overly restrictive. The generalised ordered logit model can be used to address violations of the proportional odds assumption, and can be written as;

$$P(Y_i > j) = g\left(\beta_j^S \boldsymbol{S} + \lambda_j^X \boldsymbol{X}\right) = \frac{\exp(\alpha_j + \beta_j^S \boldsymbol{S}_i + \lambda_j^X \boldsymbol{X}_i)}{1 + \exp(\alpha_j + \beta_j^S \boldsymbol{S}_i + \lambda_j^X \boldsymbol{X}_i)}, j = 1, 2 \ldots, M - 1 \quad (2)$$

where the parameters β^S and λ^X are allowed to vary across values of j, as shown in the subscripts. However, the results of the Brant test also imply that the generalised ordered logit, which for each skill estimates a unique β for each j, would be estimating more parameters than is necessary, as for some of the skills, the proportional odds assumption holds. We therefore estimate a special case, the partial proportional odds model, which allows the β coefficients for some of the skills to be the same for all steps up the educational ladder (values of j) while others are free to differ, depending on whether the proportional odds assumption holds. We present estimates of β for each of the 10 skills, from both the ordered logit (proportional odds model), and the generalised ordered logit (partial proportional odds model) for different values of j. The estimated coefficients presented are as percentages, conditional on the full set of controls.

Results: How Important are Social and Emotional Skills at Age for Educational Attainment by Age 30?

Table 6, below, presents our main findings, corresponding to estimates based on equations (1) and (2). It shows the effect in per cent of moving up a quintile in each social and emotional skill, and for comparison, each cognitive skill, on the likelihood of attaining a particular stage of education, conditional on the child, parent and family characteristics outlined above (Section 4.1). The first column displays the results from the ordered logit regression. It can be seen that of the social and emotional skills, a one quintile increase is positively associated with the likelihood of being one rung further up the educational ladder for academic self-concept (5.4%), locus of control (10.1%), good conduct (10%) and conscientiousness (14.2%). The proportional odds assumption implies that this effect is the same irrespective of how the 'higher' and 'lower' education groups are defined (i.e. the value of j in equation (1)).

As we also found in our earlier report (Goodman et al., 2015), sociability is negatively associated, albeit modestly, with the likelihood of higher levels of educational attainment. This finding has several possible interpretations: sociability may be associated with behaviours and levels of academic effort which inhibit the ability of an individual to proceed to the higher levels of attainment. However, sociable individuals may instead (or in addition) have different preferences and attitudes toward education, and the lower likelihood of attaining higher levels of education may in fact reflect the choices of those individuals. The analysis here cannot establish the mechanisms underlying this observed negative 'impact' of sociability on educational attainment.

Emotional health is also found to be negatively associated with the likelihood of higher educational attainment. In our previous work, with a slightly different sample, we also observed a negative, but insignificant estimate. Plausible interpretations for this negative association are also elusive. A sensitivity analysis of this finding suggests that the inclusion of good conduct in particular is the key skill which determines the nature of the association between emotional health and educational attainment. When good conduct is excluded, emotional health is not negatively associated with educational attainment. This suggests that the relatively high correlation between emotional health and good conduct may be driving the peculiar findings for emotional health. Self-esteem is the only skill included in our model which is not associated either way with the likelihood of higher levels of educational attainment.

The proportional odds model in column one also suggests that the three cognitive skills predict stronger likelihood of rising up the educational ladder than do social and emotional skills. Note in particular the estimates for maths (22.3%) and reading (18.9%).

Column 2 presents the p-values from the skill-specific Brant test of the proportional odds assumption. If the p-value is smaller than 0.01, the proportional

Table 6. Effects of skills (%) on highest level of education from proportional and partial proportional odds model

	Proportional odds	*Brant test*	*Partial proportional odds*				
			P(Y>No Quals)	*P(Y>Below O–level)*	*P(Y>O–level)*	*P(Y>A–level)*	*P(Y>Diploma)*
Social and emotional							
Locus of Control	10.1***	0.000	5.2*	7.7***	12.7***	9.6***	17.7***
Self–esteem	1.2	0.055	1.0	1.0	1.0	1.0	1.0
Academic Self–concept	5.4***	0.671	5.4***	5.4***	5.4***	5.4***	5.4***
Good Conduct	10.0***	0.008	6.8**	9.3***	13.6***	10.9***	10.3***
Conscientiousness	14.2***	0.000	9.7***	17.2***	13.1***	12.0***	18.7***
Emotional Health	–5.6**	0.389	–5.6**	–5.6**	–5.6**	–5.6**	–5.6**
Sociable	–3.5*	0.002	1.2	–2.4	–5.3*	–3.2	–7.6**
Cognitive							
Reading	18.9***	0.001	13.4***	19.2***	22.3***	15.3***	22.8***
Maths	22.3***	0.009	15.3***	21.6***	23.8***	22.8***	30.5***
BAS	14.1***	0.019	13.9***	13.9***	13.9***	13.9***	13.9***
Pseudo R–squared	0.137		0.141				
Observations	7495	7495	7495				

Notes:
1. Coefficients are in percentages.
2. If Brant test significant (p<0.01) proportional odds assumption violated.
3. Proportional odds model estimated by Ordered Logit regression.
4. Partial proportion odds model estimated by Generalised Ordered Logit regression.
*5. Child, parent and family controls included in all models, including Brant test * p<0.05 ** p<0.01 *** p<0.001*

odds assumption is rejected, i.e. the effect of the skill is not the same across different pairs of outcome groups defining higher and lower rungs of the educational ladder. The Brant test does not reject the proportional odds assumption for self-esteem, academic self-concept, emotional health and the 'IQ' measure, BAS. This implies that the estimated effects of these skills do not significantly vary across different pairs of outcome groups along the educational highway. In contrast, the p-values of the Brant test for the remaining skills all suggest that the assumption of proportional odds is inappropriate, and that the effects of these skills vary by educational stage (across values of *j*, from equation (1)).

Columns 3 through 7 thus present the results from a generalised ordered logit, estimating a partial proportion odds model. Here, the proportional odds assumption is relaxed for those skills for which the assumption is violated, based on the Brant test. The effects of these skills are allowed to vary at each rung between educational levels. Columns 3 (P(Y>No Quals)) through 7 (P(Y>Diploma)) correspond to estimates based on equation (2), for values of *j* equal to 1 through 5, respectively.

For the skills for which the proportional odds assumption holds (self-esteem, emotional health, sociability and BAS), the estimated effect is constrained to be the same over values of *j*. Note that these estimates may not be exactly the same as those from the proportional odds model (column 1), as they are estimated from a partial proportional odds model in which other skills are not constrained. For example, self-esteem has an effect of 1.2% from the proportional odds model, and 1% from the partial proportional odds model, both not significant.

Those skills for which the proportional odds assumption does not hold, show differential effects depending on values of *j*, the level of educational attainment. Locus of control, conscientiousness, reading and maths all exhibit stronger impacts when considering the likelihood of obtaining a degree versus all lower education categories (P(Y>Diploma), $j = 5$) than lower values of *j*. This suggests that the educational return to these skills is strongest at the transition into the highest levels of educational attainment. Maths skills also exhibit the strongest effect at this point, with a one quintile improvement associated with a 30.5% higher likelihood of obtaining a degree. The negative impact of sociability also manifests most strongly at the transitions to degree, where a one quintile increase is associated with a 7.6% reduction in the likelihood of obtaining a degree, with a smaller effect on the likelihood of progressing beyond O level.

Where the proportional odds assumption does not hold, estimates do not vary in any orderly sequence. The returns to many skills are relatively strong in transitioning beyond O-levels (P(Y>O-level)). For good conduct, this is in fact the strongest effect across values of *j*. For locus of control, reading and maths, the effect size is second only to the effect associated with the likelihood of obtaining a degree, the final column. This suggests that moving beyond O-levels is particularly sensitive to a number of the social and emotional, and cognitive skills. Conscientiousness seems particularly strongly associated with getting a foothold at O levels (as well

as a degree). The dominance of the cognitive over social and emotional skills in predicting academic attainment applies all the stages of the educational pathway.

CONCLUSION

Our findings here confirm and extend the earlier literature using the British cohort studies that educational attainment does not depend on cognitive skill alone. Cognitive skills raise educational attainment particularly in getting over the hurdle to a university degree. There are also some non-cognitive skills that contribute strongly. In particular, conscientiousness and internal locus of control have a substantial association with obtaining a university education, as well as intermediate qualifications. Good conduct also appears to be particularly helpful in the middle of the range. Academic self-concept appears to give a constant proportional boost to moving up the educational ladder at all stages. Self-esteem, by contrast, does not appear to enhance the chance of academic success, although we have found elsewhere that people with higher self-esteem at 10 had, on some indicators, better mental health as adults.

Curiously, perhaps, emotionally healthy children have lower chances of academic success, all else equal, although in other work we show positive emotional health is associated with better adult outcomes in other domains. We find, here and in our previous work, a similar deficit in educational attainment for those who display social skills at age 10. When we examine differences by gender, we find that the negative association between sociability and educational attainment is confined to males, and is not observed for females. Further, the positive educational returns to both measures of self-regulation, good conduct and conscientiousness, are found to be stronger for boys. As we saw in Table 3 boys exhibit poorer conduct and conscientiousness than girls, suggesting the higher returns to both skills may be related to the lower initial levels. Exploring the differences in the returns to the skills across other dimensions in addition to gender, such as ethnicity and levels of disadvantage, is a direction for future work.

For the educational outcome examined here, there is thus evidence of social and emotional characteristics as educationally productive skills: particularly, internal locus of control, conscientiousness and good conduct. The strength of our work lies in the quality and range of cognitive and non-cognitive skills that were captured among study members in their childhood, alongside their educational attainment up to two decades later. One limitation is that by confining attention to skills measured at age 10, we have not included measures of motivation and ambition that were actually measured later in the cohorts' adolescence. Other authors have shown that this would add to the evidence of positive skills alongside the absence of psychological pathology.

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12. NON-COGNITIVE ASSESSMENT AND STUDENT ENGAGEMENT

The views expressed in this chapter are those of the authors and not necessarily their employing organizations.

BACKGROUND: BALANCING NON-COGNITIVE FACTORS IN EDUCATIONAL SETTINGS

For many decades education systems were focused on accounting for cognitive components of student educational attainment, and summative standardized tests emerged as important ways of measuring academic outcomes. The evolving 21st century societal and associated education systems are distinguished by increased complexity and dynamism of all their major elements, including intertwined multi-cultural and demographic realms, family structures and ever changing domestic and world economies, which consistently confront society and education with evolving demands and challenges. Besides the pressure to meet challenging education standards in the time when college readiness becomes a norm, school students face other daily issues associated with peer pressures, uses of technology and mass media, unhealthy relationships (including bullying), struggling with sexual and gender identity, substance abuse, etc. Additionally, growing proportions of immigrant and minority students may face challenges of cultural and language adjustments, fitting in with their peers, meeting academic demands and other issues.

Research demonstrates that various non-academic factors can be very impactful in student behaviors and academic outcomes. For example, in the meta-analysis of 213 school-based universal social and emotional learning (SEL) programs, Durlak, Weissberg, Dymnicki, Taylor and Schellinger (2011) demonstrated significant gain in student academic achievement. Consequently, school staff face the necessity of delving into a broad array of non-academic, social, emotional and other realms, in order to create school climates that are equitable, safe, inclusive and socially and academically stimulating for diverse student populations.

Increased complexity of evolving contemporary education systems compel more comprehensive approaches to balancing and measuring system aspects that span beyond traditionally considered cognitive educational components into an intricate domain of "non-cognitive" factors, which are conceptualized in diverse ways. These non-cognitive concepts, which often relate to each other, include "positive personal

M. S. Khine & S. Areepattamannil (Eds.), Non-cognitive Skills and Factors in Educational Attainment, 265–292.

qualities other than cognitive ability" (Willingham, 1985; quoted in Duckworth & Yeager, 2015, p. 239), (e.g., self-control, emotional intelligence, resilience, confidence, etc.), as well as beliefs, values, attitudes and affect.

Currently there is no consensual terminology in the research and educational community on what constitute non-cognitive factors (Duckworth & Yeager, 2015). While a consensual terminology would be beneficial, in actuality different research and practical contexts, concerns, priorities and goals dictate different understandings and definitions. We also acknowledge Duckworth and Yeager's observation that in many instances it would not be easy to completely conceptually separate cognitive and non-cognitive domains, since "every facet of psychological functioning, from perception to personality, is inherently 'cognitive' insofar as processing of information is involved" (Duckworth & Yeager, 2015, p. 238). Therefore, for the purposes of the research and associated practical applications featured in this chapter, we broadly define non-cognitive factors as acquirable personal qualities, attitudes and beliefs other than *academic* cognitive abilities.

In this chapter we examine how non-cognitive concepts and associated measures and assessments can be implemented in school contexts through addressing a common area of concern among educators – student engagement. Student engagement is often seen as a precursor to academic success, including high school completion (Hazel, Vazirabadi, Albanes, & Gallagher, 2014; Reschly & Christenson, 2012). Student engagement at school (social, affective and academic) is also a prerequisite for equitable educational opportunities for all students. While students from traditionally disadvantaged backgrounds may be at a high risk of disengagement, socially and emotionally disadvantaged and disengaged students can come from a much broader milieu. Where student engagement fails due to various reasons, opportunity for education equity declines.

Systematic attention to the social and emotional issues surrounding education can contribute to the paradigmatic shift towards reframing schools in ways that are more inclusive. Although educators cannot directly influence students' socio-economic status and family dynamics, school contexts can effectively counteract adverse factors in students' lives. Renshaw and Eklund (2015), for example, demonstrated based on a sample of 902 California public high schools, that the moderation effect of positive school climate perceptions on self-reported GPA was strongest for homeless youth and youth from one-parent homes, suggesting a protective effect of school climate. Finn and Zimmer (2013) call for a universal approach to student engagement and suggest that, "…efforts to prevent disengagement should be targeted toward the elementary and middle grades as well as high school" (p. 124).

The Programme for International Student Assessment (PISA) results indicate that drive, motivation and confidence in oneself are essential if students are to fulfill their potential (Organization for Economic Cooperation and Development [OECD], 2014). Focusing on student engagement (including nurturing a sense of belonging, relevance and fairness) is one of the key avenues for educators and educational leaders to change the social and cultural context of education through developing

relationships and caring environments to ensure better academic and social outcomes for all students.

The available engagement models identify various engagement domains, including observable engagement (academic and behavioral engagement) and internal engagement (emotional and affective engagement, belonging and aspirations) (Hazel et al., 2014). Measuring and systematically monitoring both observable and internal types of engagement are equally important. However, while many aspects of observable engagement have been traditionally captured in schools by monitoring attendance, discipline, academic interest and classroom participation, internal engagement, especially of affective and emotional type, often remains unaccounted for, unnoticed or misinterpreted. Since internal engagement is conceptualized as an underlying facilitator of observable, end state engagement, it is important to measure and monitor these facilitative processes to help prevent observable alienation early and suggest targeted interventions that address identified student needs (Burger, Nadirova, & Keefer, 2012).

Non-cognitive assessment that captures internal, facilitative engagement factors is key for the "operationalization" of strategies and interventions directed at increased student engagement and should become an integral constituent of evidence-based decision-making in schools and school districts. "Teachers and school principals need to be able to identify students who show signs of lack of engagement with school and work with them individually before disengagement takes firm root" (OECD, 2014, p. 22). Practice-wise, non-cognitive assessments can be valuable diagnostic tools for detecting general disengagement "symptoms" or patterns and then work *individually* with potentially at risk students to deconstruct these patterns and delve into the diverse root causes. Individual non-cognitive student assessment outcomes also can be aggregated by various student groups (e.g., classrooms, grades and schools) and linked to various academic achievement results to identify general trends and gaps and chart improvement goals and strategies. As Duckworth and Yeager (2015) observed, by applying non-cognitive measurement, one can measure, with precision and accuracy, the many positive personal qualities other than cognitive ability that contribute to student well-being and achievement. "…Self-report questionnaires are arguably better suited than any other measure for assessing internal psychological states, like feelings of belonging" (p. 240).

STUDENT ORIENTATION TO SCHOOL QUESTIONNAIRE (SOS-Q)

In the following sections we demonstrate how non-cognitive assessment can be incorporated in routine school practices as well as support ongoing research by featuring recent research and practical activities around a non-cognitive assessment instrument – the Student Orientation to School Questionnaire (SOS-Q), which formed the operational base for several action research projects in Rocky View School Division (Alberta, Canada). The SOS-Q has been carefully validated and meets the necessities of classroom practical contexts, including reasonably short length (which

does not jeopardize the instrument's comprehensiveness), time requirements from students and teachers and clear language. The underlying premise of this student-centered instrument, which was developed by educational researchers collaboratively with educators and students, is that students are engaged in school when they feel that they belong, can succeed and find it meaningful (Board on Children, Youth and Families [BOCYF], 2003). The SOS-Q targets identifying at risk students in upper-elementary and high school grades and assisting with interventions based on distinct student profiles (Nadirova, Burger, Clarke, & Mykula, 2007).

The junior-senior high SOS-Q version consists of 55 items and the following seven constructs:

1. Safe and Caring School – student perception of how supportive the school environment is;
2. Peers – perceived ability to get along with other students and friends' supports;
3. External Resilience – ability to cope with external challenges and adversities;
4. Internal Resilience – ability to resist anxiety and maintain emotional balance;
5. Self-Confidence – conviction of capability to be successful at school and beyond;
6. Utility of School – perceived usefulness of school;
7. Extracurricular Activities – participation and perceived value.

In addition, the junior-senior high version of the SOS-Q provides an option of collecting self-reported information on students' experience of balancing school studies with employment outside of school. The upper-elementary version of the instrument is less extensive (42 items) and incorporates only the first five constructs. Detailed information on the SOS-Q instrument, including item composition, is available in Burger and Nadirova (2014).

The diagnostic potential of the SOS-Q instrument (e.g., identification of distinct student groups characterized by notable variations in their orientation to school) has been demonstrated using various student samples incorporating different grades. Internal measurement properties (factor structure and reliability) were tested in past studies involving four pilots. Burger et al. (2012), for example, confirmed factor structure of the instrument in a past study based on a large sample of 1,356 grade 7 and 9 students using exploratory and confirmatory factor analysis. Scores on all SOS-Q subscales measuring the seven SOS constructs had acceptable internal consistency: Cronbach's α on five subscales were in the 0.84–0.94 range, and Cronbach's α for the two remaining subscales were 0.72 and 0.75.

CONCEPTUAL COMPOSITION OF THE SOS-Q

This section provides brief highlights of the conceptual constructs corresponding to the SOS-Q measurement subscales. For more detailed discussion of the constructs, underlying concepts and their interrelationships see Nadirova and Burger, 2014 or refer to Burger et al., 2012 for the discussion of the conceptual links to a broader

context of the psychological notions of competence, autonomy and relatedness (Connell & Wellborn, 1991).

Safe and Caring School

The SOS-Q intends to capture the degree of students' identification with the social aspects of school, the sense of belonging, and self-appraised fit in school environment, including feeling safe, understood, heard, and supported. The SOS-Q Safe and Caring School construct reflects students' perceptions of safety and responsiveness of school environments to their needs in a general caring sense as well as socialization with teachers around the notions of communication, respect, fairness and understanding. Since "for many youngsters, the primary adult they speak to during the week is a teacher" (Schargel, 2004, p. 22), the relationship with teachers and other adults in school is of primary importance. Croninger and Lee (2001) contend that teachers provide an especially important source of social capital for students in considering whether to stay in school.

Relationship with Peers

Peers play a central role in schools' social milieus and for adolescents the relationship with friends often becomes more important than relationships with family (Hair, Jager, & Garrett, 2001; Newmann, 1992). Therefore, including the peer-related measure in a non-cognitive assessment targeting student engagement is imperative to capture emotional connection to school. The SOS-Q focuses on two major facets of peer relationship: ability to get along with other students in general and experiencing friends' support in particular.

External and Internal Resilience

The SOS-Q incorporates various aspects of resilience. School social contexts, including caring relationships and opportunity to participate and contribute are among key protective environmental factors positively influencing student resilience (Benard, 2000; Richardson, 2008; Stewart, Sun, Patterson, Lemerle, & Hardie, 2004). Resilience is a key personal strength that enables a young person to navigate the environmental risks and become happier, more successful, and more balanced in life. Resilience is defined as "the phenomenon of overcoming stress or adversity" (Rutter, 1999, p. 119), "a dynamic process encompassing positive adaptation within the context of significant adversity" (Luthar, Cicchetti, & Becker, 2000, p. 543), and the ability to persevere and adapt when things go awry (Reivich & Shatté, 2003). "It refers to the characteristics of children that allow them to thrive despite exposure to adversity and deficiencies in the settings of their daily lives" (Stewart et al., 2004, p. 26). In line with these conceptualizations, the SOS-Q relates resilience

to the way students respond mentally, emotionally, and behaviorally to (adverse) situations and events. Following several developmental and piloting iterations, two resilience constructs were built in the SOS-Q to distinguish between internal and external resilience. Internal resilience conveys the ability to withstand anxiety and sustain internal emotional and mental balance while external resilience focuses on the ability to recover quickly from external disruptive changes or hardships without being overwhelmed or acting in dysfunctional ways, as well as the ability to cope and adapt successfully in the face of challenges, risk, or adversity (Burger & Nadirova, 2014). Resilience is an intrinsic human capacity to transform that can be facilitated and developed, including building associated personal strengths, social competence, a sense of autonomy, identity and purpose, and belief in a bright future (Benard, 2000).

Self-Confidence

Students' general positive beliefs about their skills, competencies, and ability to succeed constitute self-confidence. SOS-Q defines self-confidence as students' conviction that they are capable and well positioned to be successful at school and beyond (Burger & Nadirova, 2014). We theorized that students' assurance about their capability to be successful at school and in life in general plays an important role in fitting well in school, feeling adjusted, motivated and bonded to school. It is important to distinguish between a general construct of self-confidence incorporated in the SOS-Q and the related concept of self-efficacy, which, unlike a broader concept of self-confidence is domain, task or situation-specific (Druckman & Bjork, 1994; Pajares, 1996). Bandura (1977, 1986) refers to self-efficacy as people's judgments of their capabilities to accomplish specific tasks or activities successfully (e.g., various academic tasks). Thus, self-efficacy can be conceptualized as "situationally specific self-confidence" (Druckman & Bjork, 1994, p. 174). It follows that the concepts of self-confidence and self-efficacy can be causally interrelated. Since the purpose of the SOS-Q is to make the instrument applicable to all students and a broad range of situations, it focuses on defining and measuring self-confidence as a general construct. The SOS-Q conceptualizes self-confidence as a dynamic, developmental feature rather than an immutable attribute, meaning that self-confidence can be developed, stimulated, and built up through teachers' and school staff actions to generate and support positive student experiences.

Utility of School

The junior-senior high school version of the SOS-Q incorporates the concept of Utility of School, as perceived by students. Closely formulated is the concept of aspirations, which "are students' interest and investment in their education, based on their appraisals of the worthwhileness of an education and its utility to their future" (Hazel et al., 2014, p. 807). "The perceived utility of school and particular

courses may be important in sustaining students' participation in school—sometimes despite frustration and failure" (Finn & Zimmer, 2012, p. 113). Unlike specifically conceived studies focusing on particular school subjects or student career aspirations, the SOS-Q captures a general sense of usefulness of school experience relative to broadly formulated current and future opportunities and outcomes, including helping in later life, helping with career plans, and providing opportunities to learn interesting things. In this respect the SOS-Q Utility of School construct is similar to the conceptual underpinnings of Voelkl's Students' Identification with School scale (Voelkl, 1996). Students scoring high on the SOS-Q Utility of School subscale would tend to see value in deferred gratification, whereby their efforts in school today will be rewarded with anticipated future benefits.

Extracurricular Engagement

Participation in and perceived value of Extracurricular Activities is a conceptual construct that is included in the junior-senior-high version of the SOS-Q, since these activities could offer vital complementary learning (e.g., skill and competency building) along with developing social networks, emotional supports, and positive role modeling. Specific proven benefits from participation in school extracurricular activities and community programs include reduced rates of school failure, early dropout, and problem behaviors (Mahoney, 2000; Mahoney, Larson, Eccles, & Lord, 2005). Since schools may have only limited influence on out-of-school engagements, the SOS-Q refers to predominantly school-based extracurricular activities and offers generally formulated statements that do not feature specific types of activities that may vary from school to school.

ANALYSIS OF THE RELATIONSHIP BETWEEN NON-COGNITIVE FACTORS AND ACADEMIC ACHIEVEMENT

The imperative role of non-cognitive assessments is helping respond to student social and emotional needs to promote student learning. Therefore, the link to educational attainment is of primary interest to educators. While it was shown before (Nadirova & Burger, 2014) that the relationship between orientation to school measured via the SOS-Q and academic outcomes was in the hypothesized direction (students displaying more positive orientation to school performed better), it was not controlled for the important attendant variables.

In this chapter we show the results of a multivariate analysis of the link between student orientation to school and achievement using a recently obtained substantive student sample. Unlike previous research, classroom achievement data generated by teachers were used to examine the above-mentioned relationship to facilitate comparisons with previous results obtained using large-scale standardized tests (which in Alberta are restricted only to grades 3, 6, 9 and 12) (Nadirova & Burger, 2014). Our purpose was to determine whether the effect of student orientation to

school persists in a broader context, after accounting for several other key student-related and socio-economic status (SES) characteristics. Additionally, we examine how patterns in student disposition toward school vary in distinct student groups.

The objectives of the analysis were to:

1. Examine direction and strength of the relationship between student achievement (predicted variable) and SOS-Q constructs (predictors), controlling for the attendant independent variables including students' special needs, English language learning, gender, grade and SES;
2. Investigate differences in the SOS patterns (profiles) in various student groups;
3. Discuss emerging intervention practices applied by schools to improve their student engagement using the SOS-Q evidence.

Data

The data analyses discussed in this section are based on the SOS-Q survey data collected by school administrators in late fall 2013 – early spring 2014 from 1084 grades 7, 8 and 9 students (569 male and 515 female) in eight schools in a Canadian suburban/rural school district. (The survey was administered to all students in respective grades). As well, subsequent sections refer to some upper-elementary SOS-Q data to illustrate the results of practical applications of the SOS-Q in schools.

The items comprising SOS-Q constructs were rated on a 5-point Likert-type scale, with response options ranging from strongly agree to strongly disagree. Additionally, self-reported data on student employment outside of school were collected (hours worked per week).

The results of analyses associated with student achievement data are based on a smaller sub-sample of 924 students (484 male and 440 female) who had matched classroom achievement data available in both English Language Arts (ELA) and Mathematics. Student year-end (2014) classroom achievement data were measured as percentage points (maximum 100%).

Supplementary (control) variables included student gender, special needs, English language learning and 2011 census socio-economic data for individual students based on their residential postal codes (average family income).

Analysis

The relationship between student achievement (predicted variable) and the SOS-Q constructs and other predictor variables was tested using SPSS multiple linear regression model (sequential entry). First, the seven student orientation to school variables (i.e., subscale means computed based on the seven SOS constructs) were entered into the model as predictors of student achievement, then control variables were added to the model.

In addition, the patterns of student orientation to school were compared across distinct student groups. The differences between males and females, older and younger students and "mainstream" majority versus students coded as special needs or English language learners were tested using independent samples t-test and one-way ANOVA.

RESULTS

Student Orientation to School and Academic Achievement

We started the analysis of student orientation to school and academic achievement by examining the differences in classroom achievement among the students, who were classified into four distinct groups (clusters) according to their orientation to school using k-means cluster analysis. Four distinct groups of students emerged as a result of cluster analysis, including:

- "Very Positive" cluster of students who scored consistently one standard deviation above the mean or higher on all seven SOS-Q subscales;
- "High-Medium" cluster of students who scored around the mean score or about 0.5 standard deviation above the mean on most of the SOS-Q subscales;
- "Low-Medium" cluster of students who scored around the mean score or 0.5 standard deviation below the mean score on most of the SOS-Q sub-scales; and
- "Very Negative" cluster of students, who scored one standard deviation below the mean or lower on the SOS-Q subscales.

The graph on Figure 1 depicts classroom achievement results in English Language Arts (ELA) and Mathematics according to the above-described four student clusters. There was evidence of consistent, statistically significant association between student orientation to school and classroom achievement, especially in Mathematics: students from the Very Positive cluster had higher achievement scores than students from the Medium and Very Negative clusters, and students from the Medium clusters scored higher than students from the Very Negative cluster. These results support the proposition that socio-emotional factors may play an important role in student academic outcomes and are in line with others (Finn & Zimmer, 2013) and our previous findings based on different measures of student achievement using large-scale standardized tests (Nadirova & Burger, 2014).

Regression Models

The relationship between the SOS-Q constructs and academic achievement was further tested using a multiple linear regression model, controlling for a number of variables that also were previously found to be associated with student achievement, including student gender, grade, special needs, English language learner, working outside of school and socio-economic background. Results of multiple regression

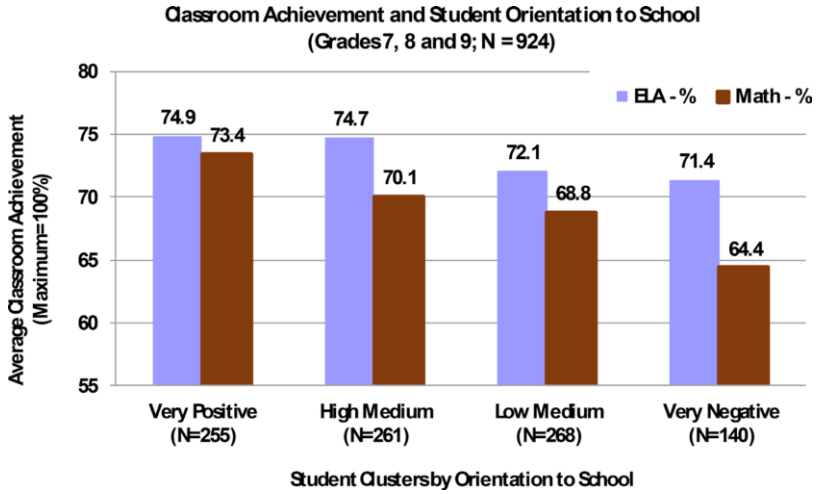

Figure 1. Classroom Achievement and Student Orientation to School (Grades 7, 8 and 9)
One-way ANOVA, ELA: F = 4.987; df = 3, 920; p<.01 (two-tailed); N = 924;
One-way ANOVA, Mathematics: F = 11.068; df = 3, 920; p<.001 (two-tailed); N = 924

analysis presented in Table 1 are based on Mathematics achievement data used as a dependent variable. Incorporation of the socio-economic status (SES) variable – average family income (2011 census data based on individual student postal codes), into the analysis resulted in reduction of available data to 890 cases, because these data were not available for every student. While realizing the limitations of using aggregate geographic proxies as a substitute for individual SES data (including biases associated with data aggregation, misclassification, etc.), we decided to include an aggregate measure of average family income in the analysis given lack of SES data collected from individual students. Family income has been a proven predictor of educational attainment and can modify the association between the SOS-Q variables and student academic achievement when included in the regression model. We intended to find out whether the SOS-Q constructs will hold as predictors of achievement when controlled for average family income. (Furthermore, some possible biases can be reduced. For example, misclassification related to address inaccuracy and assignment of wrong postal codes could be marginal in regularly updated school student data).

The predictor variables were entered into the regression model in several steps to assess the respective effects of each entered group of variables. SOS-Q variables were entered first into the model, starting with Self-Confidence and Extracurricular Activities, since previous research demonstrated that these two variables were the major predictors of academic achievement controlling for other SOS-Q constructs (Nadirova & Burger, 2014), then other SOS-Q predictors were entered into the

Table 1. Regression of academic achievement in mathematics on student orientation to school controlling for student-related and socio-economic variables

SOS variables	*B*	*Standard error*	*Beta*
Self-Confidence	6.508***	1.161	.247
Extracurricular Activities	1.483*	.690	.070
External Resilience	1.597	1.299	.053
Safe and Caring School	1.297	1.092	.050
Internal Resilience	.360	.571	.021
Utility of School	–.834	.930	–.038
Peers	–3.718***	.819	–.156
English Language Learner (ELL = 1; non-ELL = 0)	1.525	2.098	–
Special needs (special needs =1; no special needs = 0)	–7.475***	1.435	–
Gender (female = 1; male = 0)	2.525*	.994	–
Grade (Grade 8 = 1; Grade 7 – reference)	2.712*	1.311	–
Grade (Grade 9 = 1; Grade 7 – reference)	–3.498**	1.101	–
Working Outside of School (working =1; not working = 0)	–3.388*	1.344	–
Average Family Income (thousand)	.037***	.005	.239
Constant	40.318		
R^2	.213		
Adjusted R^2	.201		

Note. N = 890
** p < 0.05; ** p < 0.01; *** p < .001*

model. Altogether the seven SOS-Q constructs accounted for 10% of variance in student achievement in mathematics in the analyzed data sample ($R^2 = 0.098$). Congruently with previous research findings based on different student samples, when accounted for the effects of the other five SOS-Q constructs, Self-Confidence and Extracurricular Activities emerged as statistically significant positive predictors of achievement explaining the bulk of the above-mentioned variance. Emergence of the (relationship with) Peers construct as a third significant, but negative predictor of academic achievement is not totally surprising, given that high school peers may be a source of positive or negative influence in keeping with the observation that, "…research suggests that students with more academically engaged friends perform better academically than those whose friends are disengaged" (Juvonen, Espinoza, & Knifsend, 2013, p. 392). In our previous research based on a different

junior high student sample from a different school district the Peer construct did not emerge as a significant predictor of achievement, but was found to have effect on the External Resilience construct, which, in turn, significantly affected Self-Confidence (Nadirova & Burger, 2014). We can conclude based on the available research findings, that while Self-Confidence emerges as a "stable" predictor of educational attainment, other constructs can be more contextually dependent, including the Peers variable and need further investigation using different data samples.

As demonstrated by a previous explorative study, which involved path analysis (Nadirova & Burger, 2014), some SOS-Q constructs, many of which are inter-correlated, could be associated with student achievement not directly, but through mediated links. For example, while Self-Confidence persistently emerged as the strongest, direct predictor of academic achievement, several other SOS-Q constructs, including External Resilience and Safe and Caring School were found to be positively related to Self-Confidence and thereby, were indirectly associated with student academic achievement.

Table 1 shows the final regression model, after variables on English language learners and special needs students were entered into the model, followed by the variables reflecting student gender, grade, working or not working outside of school and finally, average family income.

The expanded regression model revealed other significant predictors of student achievement, including gender (females were more likely to outperform males), grade (older, grade 9 students more likely to be lower achievers than their grade 7 counterparts), special needs students tending to have significantly lower achievement than those with no special needs, and higher SES (average family income) being positively associated with achievement. Being an English language learner did not indicate a statistically significant difference in achievement. This result may be attributed to a very small proportion of these students in the analyzed sample – between 5 and 6 percent. Surprisingly, working outside of school, which (in moderation) was expected to have a positive effect on achievement, showed a significant negative effect. (The majority of respondents did not work, and those who worked typically did not exceed 5–6 hours a week). A possible explanation of this finding is that junior-high students may be still too young to successfully manage school and work. In all, the above-described attendant independent variables accounted for an additional 11% in classroom achievement variance, for the total of 21% together with the student orientation to school (SOS) variables (total $R^2 = 0.213$).

After accounting for all mentioned associations, Self-Confidence and Extracurricular Activities constructs continued showing significant, positive relationship with academic achievement, Self-Confidence being the strongest predictor. Judged by unstandardized regression coefficient (B), as Self-Confidence score increases by one unit on a 5-unit scale, classroom achievement would increase by 6.5 units on a 100-unit scale or by 6.5%. This may be indicative of a considerable difference in students' academic standing, including the difference between

acceptable and excellent grades or between acceptable and failing grades. While Self-Confidence has been consistently emerging as a strong, positive predictor of academic achievement in different student samples, the magnitude of effects on academic achievement may vary depending on specific student populations and possibly on specific achievement measures.

SOS PATTERNS IN VARIOUS STUDENT GROUPS

Preliminary findings on student orientation to school patterns in different groups of students are charted in Figures 2 through 4, which show differences in the SOS-Q subscale mean scores. Figure 2 depicts gender differences. While according to the multiple regression model (Table 1) females generally were more likely to outperform males in Mathematics, they scored significantly lower than males on the Internal Resilience SOS-Q sub-scale, which is indicative of being less assured about their ability to resist anxiety.

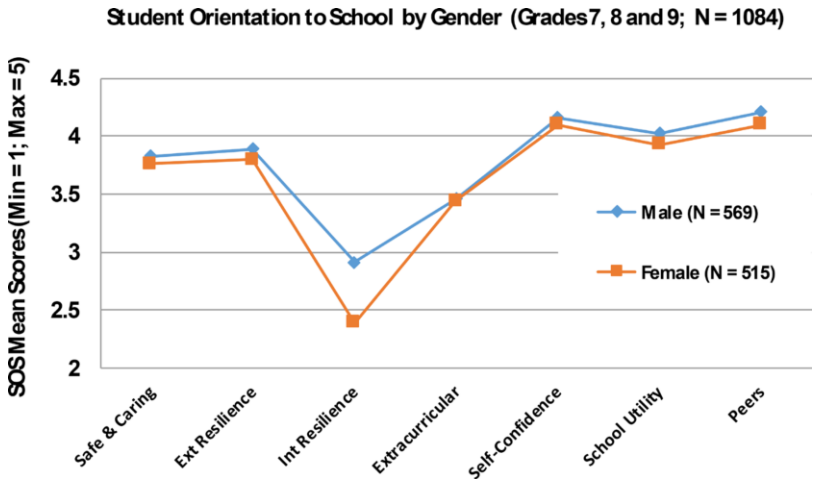

Figure 2. Student orientation to school by gender (Grades 7, 8 and 9) Internal Resilience, independent samples t-test: t = 9.693; df = 1082; p < .001(two-tailed); N = 1084

As illustrated by Figure 3, older, grade 8 and grade 9 students were consistently more negative than younger, grade 7 students on most SOS-Q constructs, including Safe and Caring School, External Resilience, Internal Resilience, Extracurricular Activities, Self-Confidence and (perceived) Utility of School. However, no statistically significant differences were detected in SOS mean scores in (relationship with) Peers.

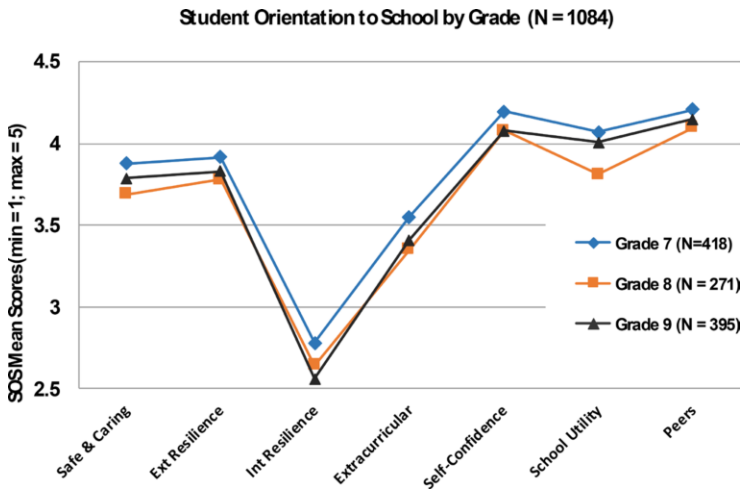

Figure 3. Student orientation to school by grade (Grades 7, 8 and 9) One-way ANOVA (df = 2, 1081; two-tailed; N = 1084): Safe & Caring, F = 8.364, p < .001; External Resilience, F = 6.154, p < .01; Internal Resilience, F = 5.868, p < .01; Extracurricular Activities, F = 6.534, p < .01; Self-Confidence, F = 5.578, p < .01; Utility of School, F = 10.573, p < .001; Peers – n.s

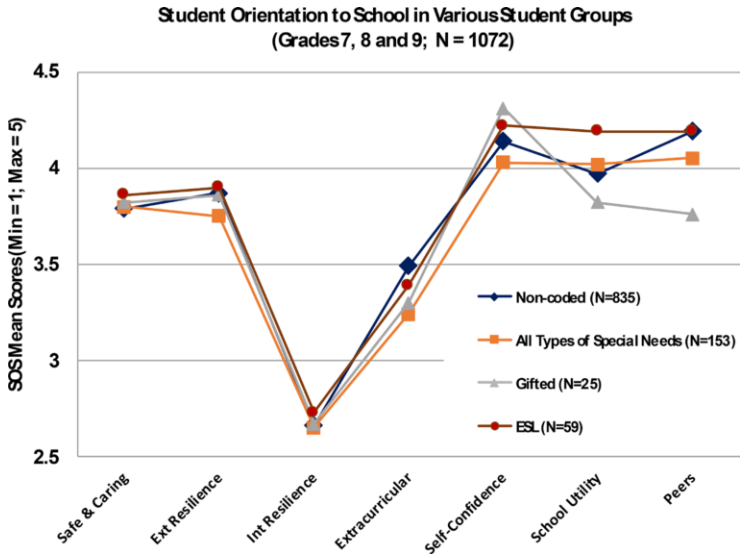

Figure 4. Student orientation to school in various student groups Note: Analyses of means are not reported due to large variations in student numbers in different groups of students

Figure 4 depicts differences in student orientation to school among students with various special needs (severe, mild or moderate), English language learners, gifted students and "mainstream" students with no special codes attributed to them. Students with various special needs were somewhat less affirmative towards school than other groups of students on some of the SOS-Q constructs. On a positive note, they scored very close to the non-coded students on the Safe and Caring School and Internal Resilience constructs.

English language learners were characterized by relatively high appreciation of Utility of School compared to other groups of students. A small group of gifted students revealed an interesting pattern of the highest Self-Confidence (assurance in their abilities and success), but the least positive attitudes toward Peers, Utility of School and Extracurricular Activities. Due to a small number of ELL and gifted students in the current sample, the emerged patterns need further verification and validation based on samples that contain higher proportions of these particular groups of students.

SOS PATTERNS IN VARIOUS SCHOOLS

Figure 5 shows examples of variations in junior high student orientation to school in different schools. Graphed data reveal distinct school-related SOS patterns, with some schools displaying consistently high scores on most SOS-Q constructs (around 4.00) and others having notable variations across the SOS-Q subscale

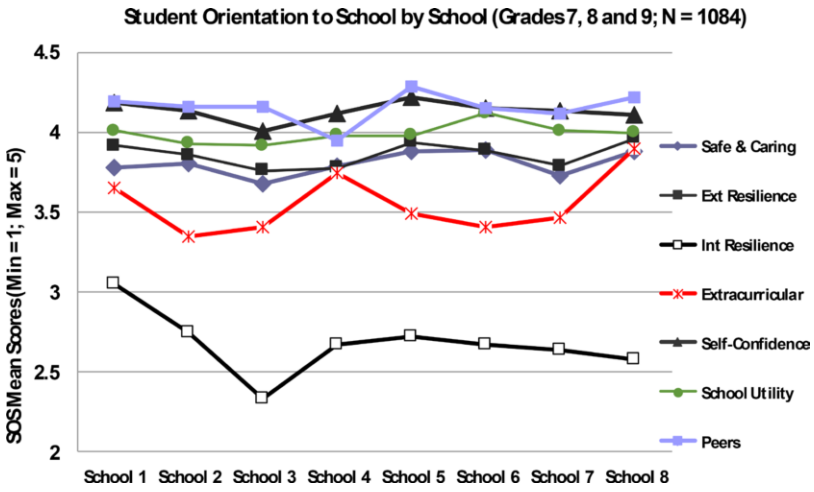

Figure 5. Student orientation to school by school (Grades 7, 8 and 9)
One-way ANOVA (df = 7, 1076; two-tailed; N = 1084): Safe & Caring, F = 2.252, p < .05; External Resilience – n.s.; Internal Resilience, F = 5.530, p < .001; Extracurricular Activities, F = 4.596, p<.001; Self-Confidence – n.s.; Utility of School – n.s.; Peers – n.s

spectrum. Consistent with other SOS-Q samples from different school districts and schools (see, for example, Burger et al., 2012), junior-high students in all schools scored the lowest on the Internal Resilience subscale, but there were significant variations among schools on student Internal Resilience. Student appreciation and participation in Extracurricular Activities is another variable that yielded relatively low and varied scores, indicating that some schools may gain from work on this particular construct, given its positive association with academic achievement. The SOS constructs which had relatively high mean SOS scores at a school level also warrant attention, since there may be substantial variation in different student groups (as demonstrated by classifying students according to Very Positive, Medium and Very Negative clusters). For example, while all schools scored quite high on student Self-Confidence, further increase of this score by targeting specific student groups who display low self-confidence may be a viable step towards positively affecting academic achievement. In all, the variations in SOS-Q patterns across different schools warrant attention, since the reasons for these variations may be attributed to different socio-economic composition, school cultures or other factors or combinations of factors, which would require different strategies directed at student orientation to school.

In summary, multiple linear regression reveals that Self-Confidence and Extracurricular Activities consistently predict student achievement controlling for other SOS-Q constructs and in the presence of key control variables. Further investigation of interrelationships among the SOS-Q variables and various measures of achievement will help identify possible complex mediated effects. Additionally, various student groups as well as schools in general were found to display different SOS patterns. Thus, both association of student orientation to school with academic achievement and the variables affecting student orientation to school need to be examined in order to better understand and facilitate student engagement for school improvement.

The intertwined theoretical and practical aspects of research around the SOS-Q and other non-cognitive assessments have direct significance for understanding student engagement to meet an urgent demand of making schools more educationally and socially inclusive and successful while inviting students to be partners in enhancing the culture of the school and change for improvement (Hargreaves & Shirley, 2009). Academic research related to the SOS-Q seamlessly translates into schools' action research and practice. In the following section we highlight how school administrators and staff have used SOS-Q evidence to support strategies directed at individual student diagnostics and improving student engagement.

PRACTICAL APPLICATIONS IN SCHOOLS

Rocky View Schools implemented use of the SOS-Q in 2010–2012 as a pilot project supported with a small Alberta Healthy School Communities grant. Four schools responded to a call for pilot schools that grew to nine schools based on the

positive experiences of the initial schools with application and usefulness of the SOS-Q data for identifying students at risk of disengagement. An evaluation of the initial 2010–2012 pilot supported the acquisition of a larger Alberta Healthy School Communities grant to scale up implementation of the SOS-Q in the 2013–2015 school years. Eighteen schools administered the SOS-Q in 2013–2014. By the end of the 2014–2015 school year 25 Rocky View Schools have used the SOS-Q within the research context that structures our current use of the instrument, and eight of these schools have used the SOS-Q two or three separate times in order to have trend data.

Different groups of students experience disengagement and inequalities in a variety of unique ways depending on their SES, family circumstances, ability (e.g., special needs or gifted), language, etc. Introducing the SOS-Q into schools' data collections and interpreting unique student profiles helps administrators and teachers grasp and understand the spectrum of different student's realities and associated needs.

Using SOS-Q for Diagnostics and Interventions with Individual Students and Student Cohorts

Table 2 illustrates the data model introduced to analyze and report individual and cohort patterns in student orientation to school for specific SOS-Q constructs as well as the total SOS-Q score. The table shows SOS-Q results on a sample of 23 junior-high students where each row of data presents results for an individual student. The table does not contain student identifiers for a shown sub-sample, but individuals are typically identified to permit personalized follow-up; a design feature built into the early stage of SOS-Q development. This simple analytic method provides a quick visual of the individual and cohort results on the SOS-Q including what areas of student affect are most in need of analysis and attention (column data) and which individuals may be most at risk of disengaging from school and why (data in rows).

Raw score data on each individual student in Table 2 were averaged for each SOS-Q subscale and for a total of all questionnaire items. The average scores were then converted to standard z-scores based on the Canadian national norms for the SOS-Q to indicate how many standard deviations (SD) below or above the national mean the students scored (mean z-score is at zero level). Individual student standard scores where then color coded for each SOS-Q construct and total score. Z-scores below the mean (negative z-scores in Table 2) were color-coded as red (2.0 SD below zero or lower); orange (1.0–1.9 SD below zero); and yellow (0.1–0.9 SD below zero). Z-scores at or above the mean were coded as green (0.0–0.9 SD above zero) and blue (1.0 SD above zero or higher). This analytic method provides a quick visual of the cohort results on the SOS-Q including what areas of student affect are most in need of analysis and attention (column data) and which individuals may be most at risk of disengaging from school (data in rows). Typically we observe approximately 10% of a student cohort showing total SOS-Q scores in the red zone suggesting they may be most at risk of disengagement from school and hence most in need of dialogue on how their experience of school may be made more positive. For

Table 2. Individual and cohort examination of student orientation to school using SOS-Q results

Std	*Safe/ Caring*	*Z*	*Ext. Resil.*	*Z*	*Self-Conf*	*Z*	*Peers*	*Z*	*Int. Resil.*	*Z*	*Extra-Curric Activ.*	*Z*	*Utility Sch.*	*Z*	*Total Avg*	*Avg Z*
1	1.0	–3.9	1.0	–4.6	1.0	–5.1	1.0	–4.9	5.0	2.1	2.5	–1.3	1.0	–4.1	1.5	–5.4
2	2.3	–2.0	1.3	–4.0	1.0	–5.1	1.25	–4.5	1.0	–2.5	2.1	–2.0	1.0	–4.1	1.6	–5.1
3	1.9	–2.6	1.8	–3.2	1.2	–4.8	1.3	–4.5	1.5	–2.0	3.0	–0.3	2.5	–2.1	2.0	–4.3
4	2.2	–2.2	3.36	–0.6	3.5	–1.0	3.6	–0.7	3.5	0.3	3.25	0.2	2.33	–2.4	3.11	–0.9
5	4	0.5	2.91	–1.4	3.83	–0.5	3.2	–1.4	2.5	–0.8	2.75	–0.8	2.83	–1.7	3.15	–0.9
6	3.13	–0.8	3.18	–0.9	2.2	–3.1	3.4	–1.0	4.75	1.8	2.88	–0.5	3	–1.5	3.22	–0.9
7	2.33	–2.0	2.45	–2.2	4.67	0.9	2.8	–2.0	3	–0.3	4.12	1.9	3.33	–1.1	3.24	–0.7
8	3.4	–0.4	4.55	1.4	4.17	0.0	3.6	–0.7	2	–1.4	2.25	–1.7	3	–1.5	3.28	–0.6
9	3.47	–0.3	2.9	–1.4	3.33	–1.3	3.8	–0.4	3.5	0.3	2.5	–1.3	3.83	–0.4	3.33	–0.7
10	3.4	–0.4	3.18	–0.9	3.67	–0.8	3.4	–1.0	3.33	0.1	3.12	0.0	3.5	–0.8	3.37	–0.6
11	3.4	–0.4	3.64	–0.2	3.5	–1.0	3.2	–1.4	3.25	0.0	3	–0.3	4	–0.1	3.43	–0.5
12	3.8	0.2	2.91	–1.4	3.83	–0.5	3	–1.7	3.75	0.6	2.88	–0.5	4.17	0.1	3.48	–0.5
13	4.8	1.7	3.82	0.1	4.67	0.9	4.6	0.9	2.75	–0.5	3.88	1.5	5	1.2	4.22	0.8
14	4.15	0.7	3.82	0.1	4.83	1.1	4.6	0.9	4.75	1.8	4.12	1.9	3.33	–1.1	4.23	0.8
15	4.6	1.4	4.09	0.6	4.67	0.9	4.6	0.9	3.25	0.0	3.38	0.5	5	1.2	4.23	0.8
16	4.86	1.8	4.91	2.0	4.5	0.6	5	1.5	3.33	0.1	2.88	–0.5	5	1.2	4.35	0.9
17	4.73	1.6	4.55	1.4	4.83	1.1	4.75	1.1	3.25	0.0	3	–0.3	5	1.2	4.30	0.9
18	4.8	1.7	4	0.4	5	1.4	4.8	1.2	3	–0.3	3.5	0.7	5	1.2	4.30	0.9
19	4.67	1.5	4.64	1.5	4.67	0.9	4.25	0.3	3.25	0.0	3.88	1.5	5	1.2	4.34	1.0
20	4.53	1.3	4.27	0.9	4.67	0.9	4.6	0.9	3.5	0.3	4.25	2.2	4.67	0.8	4.36	1.0
21	4.4	1.1	4.73	1.7	4.67	0.9	5	1.5	3.75	0.6	3.75	1.2	4.83	1.0	4.45	1.1
22	4.36	1.0	4.36	1.0	4.17	0.0	4.8	1.2	5	2.1	4.75	3.2	4.5	0.5	4.56	1.3
23	4.4	1.1	4.55	1.4	5	1.4	4.4	0.6	4.75	1.8	4.5	2.7	5	1.2	4.66	1.4

example, we interviewed one student who was coded as a gifted student and whose total SOS-Q score was above average but who had red z-scores for Utility of School, Peers and Extra-Curricular Activities. During the conversation the student verified that he found his classes unrelated to his career plans, his peers did not understand him and the extra-curricular activities in the school were for the athletically inclined. The Principal was surprised to learn one of the top academic students in the school was disengaged on three of the SOS-Q constructs.

Further evidence of the value of non-cognitive data was provided by another middle school principal who commented in an email that the availability of SOS-Q data on individual students provides a unique and valuable source of insight when students are referred to the school office for behavioral or academic matters (T. Elbel, personal communication, January 16, 2015). This principal wrote:

> SOS-Q helps provide a platform to structure conversations with parents that go beyond the regular "grades and friendship" conversation. Internal resilience is difficult to measure and observe, SOS-Q results provide this measure to some extent. When we see students in the hallway and classrooms interacting with each other and the adults in the school, SOS-Q provides an internal, perceptual lens to the student. Sometimes these lenses are congruent, other times they bring important incongruent perspectives to the fore.

As illustrated below, educators also may use graphed standardized or unstandardized SOS-Q scores for individual students or student cohorts (e.g., grades) to detect emerging issues and measure progress on interventions.

An elementary K-5 school has focused on their Grade 4 and 5 student responses to the SOS-Q and targeted students who demonstrated varying degrees of disengagement in the latter half of the 2013–2014 school year. The SOS-Q was administered to a cohort of 34 students in April 2014 near the end of the Grade 4 year and again in November 2014 when the students were in Grade 5 to assess the impact of the support strategies that had been applied. Overall class results demonstrated gains (see Figure 6) whereas results for the school district in general (congruent with research literature on student engagement) typically show declines in student engagement from one grade level to the next.

Of 34 students in this cohort 20 demonstrated gains on the SOS-Q and 11 of the 20 had large gains (0.40 – 1.07 standard deviations). Ten demonstrated declines with two students showing large declines (0.76 – 0.83 standard deviations) and four had stable pre-post test results.

The classroom teachers shared their observations to unpack what the pre- and post test results implied relative to their interactions and observations of their students. The following are two examples of specific SOS-Q informed intervention strategies that were applied to two students (Student A and Student B) from the discussed student cohort.

Student A demonstrated a large decline in her pre- and post-test SOS-Q results (see Figure 7 displaying individual SOS-Q results for Student A). In the spring

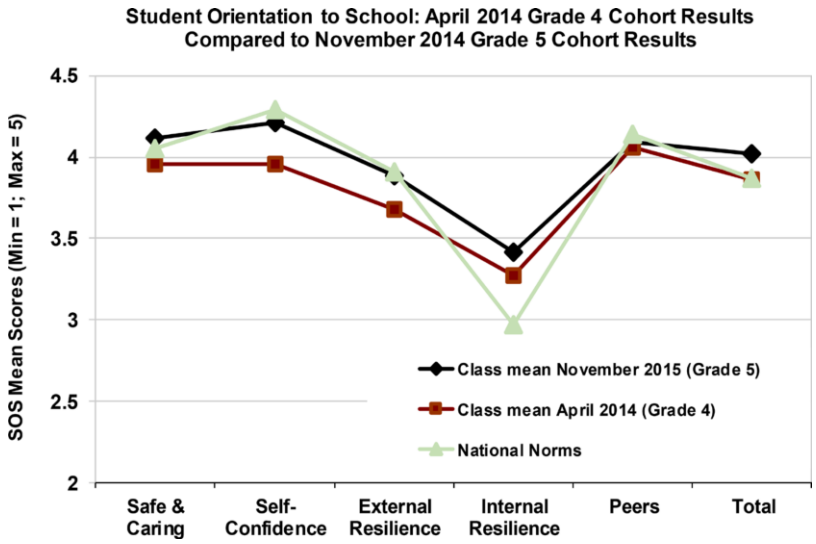

Figure 6. April 2014 Grade 4 Cohort SOS-Q Student Results Compared to Grade 5 Results

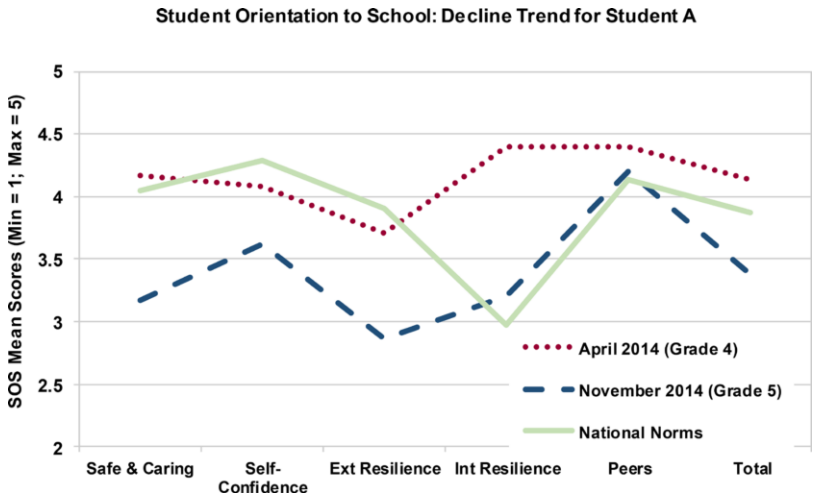

Figure 7. SOS-Q Results on Individual Student A

of 2014 the classroom teachers were concerned that this student was off task too often due to a peer relationship that had gained such prominence that the student was heavily focused on nurturing the friendship at the expense of her academic focus. Consequently the two friends were separated into different class groupings

in the fall of 2014. The November SOS-Q data alerted the teachers to the impact that separating the students was having on multiple orientation to school indicators. The classroom teachers concluded, "These results not only shed light on the lack of resiliency both external and internal and the need for both (students) to develop skills to understand what a healthy relationship is and how to handle the ups and downs of friendship" (Burger, Nadirova, Petit, Stengler, & Valerio, 2015). Follow-up with Student A has included strategies to build resilience, expand peer networks and reinforce the student's self-confidence as a learner.

In another case, Student B demonstrated improving SOS-Q results building on increasingly positive teacher-student relationships (see Figure 8). This student was from a low income family and had overall high SOS-Q results, well above the national norms. The classroom teachers commented, "(Student B) does not complain about her life and meets disappointment in school in a positive way. She gets along well with others, smiling and trying her best in all she undertakes. These traits are reflected in her SOS-Q profile of high resilience and an overall very positive profile" (Burger et al., 2015).

A lead teacher in a Rocky View high school reported using the SOS-Q standardized data to look at areas of student wellness that needed attention. "We used the individual student graphs provided from the SOS-Q data, for each student… to help us identify students with multiple learning and wellness needs… This information also helped us to program for students' learning more effectively, as it was a tool we could use to inform staff about potential needs of students in their classes" (Sly, 2014, p. 57). This teacher observed that the SOS-Q "…provided additional valuable insight into students' needs and gave staff entry points for future

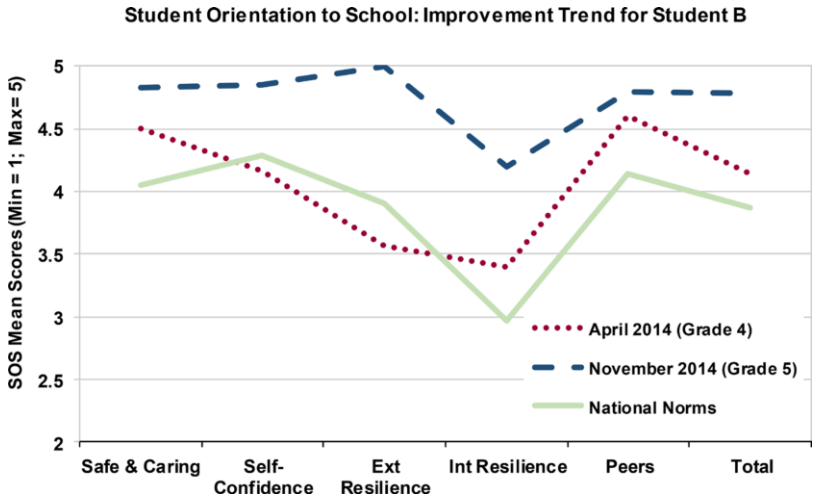

Figure 8. SOS-Q Results on Individual Student B

discussions with students about their success in a given course, as well as overall. In addition, these data helped staff understand how multiple factors can play into students' success and well-being" (p. 58).

The staff in this school used the SOS-Q with strong support from the school administration as a stimulus in building a whole school culture premised on caring and response to students' needs. The lead teacher concluded, "I believe that because teachers, educational assistants, and administrators were all involved in these projects, we maximized our efforts to make as many connections with students for learning, engagement, and wellness as possible" (Sly, 2014, p. 82).

Using SOS-Q for Informing School Intervention Programs

SOS-Q data has had an incredibly strong response among the Rocky View Schools administrators and staff. For example, in response to the pre-post SOS-Q data analysis, the teachers in one of the elementary schools are implementing the GLOW (Girls Leading Others Wisely) program. As commented by these teachers (Petit & Stengler, 2015),

> Our SOS-Q results indicated several areas that would benefit from targeted skill development including peer relationships and resiliency. Our goal is to provide a curriculum-based school program for all grade 5 girls that will develop these skills and promote positive social emotional well-being and strengthen peer relationships thereby contributing to a healthy school community. Being a rural school, our students do not have access to outside agency programs to support the development of these important life skills as our girls transition to the high school.

A French immersion middle school is developing mechanisms to combine SOS-Q data with other gathered information and is developing multiple specialized strategies targeting disengaged students. This school has been using the SOS-Q for 3 years. As reported by the school principal (Ziegler, 2015),

> We have found the (SOS-Q) data useful in identifying our at-risk students. We are currently developing a plan for following up with at risk youth. Specifically, the staff will adapt the Success in Schools (SIS) plan format developed by the Alberta Ministry of Education (http://education.alberta.ca/admin/supportingstudent/collaboration/ppf.aspx) to work with students identified as at risk on the SOS-Q. The advantage of using and adapting the SIS format is:
>
> a. it uses the student's voice to articulate what he/she needs to succeed
> b. it engages parents
> c. it identifies a plan of supports to move forward
> d. the plan can be reviewed after several months or in the following school year to look for progress.

> We will adapt the SIS form to reflect the SOS-Q categories for the plan portion (safe and caring, resiliency, peers etc.), and will then involve the Grade 6 teachers and the school-based Child Development Advisor (CDA) to work with students who appear "in the red zone" on the SOS-Q results. The teachers then will meet with a student in the red zone, and develop the adapted SIS plan based on the SOS-Q data and categories. The teacher, student, parent, administrator and CDA will meet to review and further develop the plan including a follow up date/time to review progress.

A middle school located in a largely blue collar community has used the SOS-Q three times and is accumulating extensive data that they use to support students who appear to be disengaging from school. According to the school principal (Valerio, 2015),

> Our school has established a comprehensive school health and wellness committee that has been in operation for 3 years and consists of teachers, staff, parents and students. This committee advocates for health and wellness initiatives in the school. They also take a lead role in planning and supporting the implementation of programs and activities related to health and wellness. … It is important to support the affective domain of our students…for optimal health and wellness as well as academic performance. We have used many tools to support our work in this area with students and we are expanding this work for further growth and student success.

The principal plans to apply SOS-Q data for evaluating the results of using these tools, including using the Heart Math Emwave software (a bio-feedback program) with many students who need support for self-regulation.

One Rocky View high school has responded with the following observations and planned interventions based on using the SOS-Q (Pepper, 2015).

> Results from the Student Orientation to School Questionnaire (SOS-Q) completed by grade 9s at (our) high school in 2014 indicated that a variety of students were at risk of disengaging from school due to academic and social alienation and a lack of confidence and control. In response to this identified need, one intervention we propose is the development of the Cochrane Healing Arts Time (CHAT) Room. Guided by a caring professional, the CHAT room will lead students experiencing anxiety, physical, sensory, cognitive, speech, learning, social and academic stressors through a process of self-exploration and resolution. This process will help students learn to express themselves (using arts) and ultimately enable them to be more productive and successful within an educational setting.

The above examples provide practical, student-centric responses by school staff to students' SOS-Q profiles that point to risk of disengagement from school. Additional strategies being implemented include enhanced mentoring, and lunch hour student clubs designed to reinforce peer and staff relationships.

DISCUSSION

Nearly 15 years ago Stiggins (2001, pp. 340–341) presented the view that classroom assessment should include measures of student affect and observed that affect and achievement are inseparable concepts within classrooms, and also observed that educators tended to treat measurement of student affect lightly. Yet through four years of piloting the SOS-Q applications, at first in four that grew to 25 schools, we have found keen interest in measuring student affect and other facilitators of student engagement. Measuring student affect is not a silver or magic bullet guaranteed to improve student achievement. In fact, the process involves considerable work and commitment to follow-up obtained results. However, perhaps the interest we have observed in one particular school district is reflective of a growing recognition in the education community of the importance of non-cognitive aspects of school environments and students' experiences in supporting well-rounded student development – academic, social, emotional and personal (Weissberg, Durlak, Domitrovich, & Gullotta, 2015).

The quantitative data analyzed in this chapter have demonstrated the predictive validity of the SOS-Q that extends the previous research we have reported on the construct validity and the relationships with student achievement. Proving positive associations with student educational attainment compels focusing on and accounting for the non-cognitive component in school programming and communication with students and families.

We are accumulating emergent qualitative evidence of non-cognitive assessments informing student's programming and communication needs. We have encountered many instances of teachers and administrators confirming the face validity of SOS-Q results for individual students, often in ways that confirm other means of knowing students through observation and personal communications. Sometimes there are surprises such as the gifted but internally disengaged student mentioned above, or unforeseen support and interest from parents, which could eventually become a vehicle for intensifying parental engagement in school. For example, when a female gifted student told her mother the Assistant Principal discussed her SOS-Q results with her, the mother called the school (before the AP had an opportunity to call the home). After learning the details of the conversation, the mother said, "Finally, someone is getting my daughter."

We can tell stories of students referred to the Truancy Officer for high absences, who were administered the SOS-Q and then the results were reviewed with parents so that a workable support plan could be put into place that addressed issues of weak internal resilience and peer relationships. In another case a middle school student was acting out his frustrations by starting fights with fellow students. The SOS-Q helped open a meaningful dialogue with the father and the student and provided a basis for a plan to positively re-connect the student to the school.

Perhaps the successes being achieved with individual students and the application of appropriate research ethics and protocols helps explain why parent responses

have been so positive, without a single parental complaint about the schools use of the SOS-Q with over 6000 students to date. This growing data base will provide rich opportunities for additional action research on student affect and school engagement.

Development of the SOS-Q program manual (Burger & Nadirova, 2014) with extensive input from teachers, administrators, child development advisors and school psychologists have also been part of the success story conveyed in this chapter. This manual, available on the Rocky View website, is a living document routinely updated to capture new and evolving ideas about strategies to support students who may be disengaging from school.

In addition to the creative student support strategies Rocky View staff are implementing, the successes and challenges of incorporating non-cognitive assessments into the decision-making processes related to student needs holds important implications for the design and implementation of the evolving, district-wide Student Information System, including the importance of developing capacity to link and interpret data. Collection of the SOS-Q data in Rocky View Schools commenced with using paper-and-pencil versions of the instrument, with the questionnaire forms being hand or machine scored. SOS-Q results were randomly verified and a scoring accuracy rate better than 99.9% was confirmed. On-line SOS-Q applications now are being developed with automatic scoring and report generation to scale the SOS-Q to all Rocky View schools in 2016–2017 as part of the Division's strategic Education Plan.

Next steps include working with other school districts to expand the research base underlying the SOS-Q and to perhaps develop other supplemental instruments for use with young students in K-3. We are planning to make the SOS-Q available to schools and school districts outside of Rocky View School Division.

CONCLUSIONS

We began this research with the notion of the emerging need in education communities to recognize and develop student attributes other than cognitive ability. We also put forward the proposition that equitable educational opportunities for all students and inclusive school cultures are premised on high student engagement, which incorporates many non-cognitive concepts, such as self-confidence, resilience, aspirations and others. We agree with the contention that, "…engagement not only drives learning but also predicts school success" (Reschly & Christenson, 2012, p. 4), and also supported it with the results of data analyses. We also emphasized the importance of capturing the key internal, not observable aspects of student engagement, which can be done through incorporating non-cognitive assessments as an integral part of systematically collected school and school district data. We have presented data from participating schools that demonstrated important links between aspects of student orientation to school (SOS), such as self-confidence and extra-curricular constructs that hold significant predictive validity with student academic achievement. These results reinforce the conclusion that, "…students can

accurately report on their school experiences, and in fact, their reports are likely more accurate, or at a minimum an important addition to, the information obtained from other sources…." (Reschly & Christenson, 2012, p. 13). Additionally, we have shared practical experience that demonstrates how distinct student orientation to school patterns emerging in various student groups and in individual students are being detected and used to build more caring and inclusive school communities.

Introducing non-cognitive assessments into evidence-based decision-making and as predictors of school improvement outcomes, including enhanced achievement and high school completion, argue strongly for including non-cognitive measures in schools data compendiums and as components of strategic planning in schools and school systems. Duckworth and Yeager (2015) in their analysis of non-cognitive measurement conclude, "Given the advantages, limitations and medium-term potential of such measures, our hope is that the broader educational community proceeds forward with both alacrity and caution, and with equal parts optimism and humility" p. 246). We agree and contend that it is time to shift the emphasis to action research to support implementation of non-cognitive measures as core data to inform how teachers and administrators can better support students' affective experience of and connection to school.

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13. IMPLICIT BROKEN STRUCTURE

The Multidimensionality of Non-Cognitive Factors in Higher Education

INTRODUCTION

Educational policy in the United States has long been based on a system that values cognitive skills (i.e., memory and analytic abilities) in assessing and determining intelligence, while at the same time devaluing those individuals with other talents such as creative and practical noncognitive abilities (Sternberg, 2010). This has led to a closed educational system which has been primarily based on Charles Spearman's theory of intelligence (e.g., g-factor) from which all standardized testing is based (Sternberg). Furthermore, educational policy planning in the U.S. has traditionally undervalued the use of noncognitive factors in assessing intelligence (Heckman, 2008). Recent research, however, has determined the value of using noncognitive factors for teaching diverse types of abilities (Sternberg, 2005); for evaluation within developmental education (Boylan, 2009); and, for standardized testing (Schmitt et al., 2009; Sternberg, 2009). Gottfredson and Saklofske (2009) noted the trend in research is to find ways to partner cognitive and noncognitive viewpoints to better understand cognitive competencies. Heckman (2008) reported that the evidence gained from the recent ability to measure noncognitive skills is beginning to confirm that college students can improve cognitive skills training by primarily focusing on their noncognitive skills, such as social-emotional regulation, personality, motivation, and a willingness to communicate with others.

In order to further investigate this issue, the central purpose for this phenomenological study was to investigate the multidimensional ways that noncognitive factors influenced academic preparedness. Several noncognitive areas such as educational factors, personal factors, affective factors, and noncognitive skill factors were explored. The resulting textual narratives and structural themes that emerged coming from our participants' lived experiences led to the development of four cognitive/noncognitive distinctions, and ultimately into an overall creative synthesis of four types of academic preparedness and underpreparedness: Cognitively Prepared/Noncognitively Prepared; Cognitively Prepared/Noncognitively Underprepared; Cognitively Underprepared/Noncognitively Prepared; and, Cognitively Underprepared/Noncognitively Underprepared (Finkelstein & Thom, 2014).

M. S. Khine & S. Areepattamannil (Eds.), Non-cognitive Skills and Factors in Educational Attainment, 293–313.

LITERATURE REVIEW

The previously mentioned four cognitive/noncognitive distinctions were mainly derived from studying the implications of noncognitive factors. Researchers have discovered the need for assessing academically underprepared students using cognitive factors combined with noncognitive factors (Thom, 2013). However, they primarily investigated only one or two noncognitive areas for their research. For example, Sternberg (2009) focused on noncognitive skill factors; Boylan (2008) focused on affective factors and personal factors; and, Fewell and Deutscher (2004) focused on early educational factors.

Seminal Research on Noncognitive Factors

Recent research on noncognitive factors have all been preceded by Vygotsky (1978), who believed in the interlocking of both cognitive and noncognitive abilities. He further suggested that noncognitive abilities (i.e., auxiliary tools) such as self-regulation and metacognitive skills were brought about through social/cultural influences and language (Van Der Veer, 2007). However, it wasn't until the 1960s and 1970s that Vygotsky's social/cultural theory was recognized by psychologists looking for an alternative to Piaget's cognitive theories (Van Der Veer). Additionally, neuropsychology research beginning in the 1970s eventually led to the development of multiple intelligences (MI) theory (Gardner, 2006). Other researchers focused on highlighting the hidden talents of both lower socioeconomic students and higher socioeconomic students based on successful intelligence theory (Sternberg, 2010). It was these early studies on noncognitive factors that led to the recent proliferation of research on the influence of noncognitive factors.

More current research on noncognitive factors has been instrumental in discovering the important influence of noncognitive factors on academic success. Heckman (2008) conducted a social-economic study and found that educational outcomes were reliant on both cognitive skills as well as noncognitive skills. He further noted that noncognitive skills such as motivation and self-regulation were just as important as cognitive skills. Other empirical evidence indicated that more improvement would occur in the cognitive training of adults and adolescence when noncognitive skills were the focus, rather than with cognitive training alone (Cunha & Heckman, 2008).

Vukman and Licardo (2010) confirmed that self-regulation was a product of social environment, as well as a natural prefrontal cortex maturation process. They advocated using the noncognitive factor of self-regulation in finding solutions to obstacles. Monitoring self progress, note taking, and setting goals were self-regulation techniques recommended by Berger (2011) for focused interventions to help learners become proactive learners by making them aware of their strengths and limitations. According to Sitzmann and Ely (2011), the most indispensable asset

an adult has for effective functioning in the workforce, personal lives, and higher education is their self-regulation.

Academic underpreparedness. While self-regulation and metacognition may be important noncognitive factors affecting academic underpreparedness, other noncognitive factors in several areas may have a combined affect on learning. For example, Boylan focused his research on affective factors (i.e., motivation and self-efficacy), personal factors (e.g., at-risk factors), and cognitive factors (i.e., math and English) to understand academic underpreparedness for targeted interventions. Sternberg (2007) focused his research on noncognitive skill factors (i.e., creative skills and practical skills) along with cognitive skills to discover gifted students in both lower and upper socioeconomic levels for college entrance testing. Fewell and Deutscher (2004) studied early educational factors focusing on maternal responsivity. The current study focuses not on one noncognitive factor but four areas of noncognitive factors such as affective factors, personal factors, educational factors, and noncognitive skill factors to better understand the combined affect on academic underpreparedness.

Understanding academic preparedness and underpreparedness may come from understanding the construct of intelligence. According to Shavinina (2008), understanding human intelligence is not possible using current intelligence theory. Current intelligence theory has a foundation on fixed intelligence and uses what is referred to as general intelligence known as g-factor, which according to Gardner (2006) is the latent variable used in standardized testing.

Significance of Traditional and Other Intelligence Theories

Binet, who was credited with devising the questionnaire that led towards the intelligence quotient (i.e., IQ) test, was adamantly against using his questionnaire as a construct of fixed intelligence (Van Der Veer, 2007). However, the construct of fixed intelligence has prevailed. Jackson (2007) reported that this construct was used as the basis for the Army Alpha test. In 1917 the Binet-based questionnaire was used to create the first standardized test at the national level. This fixed intelligence theory became known as g-factor intelligence theory, or as Guvercin and Arda (2008) suggested, a heredity transfer of intelligence. Gardner (2006) reported the IQ test was later to become known as the Scholastic Aptitude Test (i.e. SAT), which was introduced in 1926 by the College Board (Sternberg, 2010). To this day, most colleges use some form of standardized testing such as the SAT or American College Test (i.e., ACT) (Boylan, 2009). Thom (2013) noted that even the computer placement assessment and support system (i.e., COMPASS) used by most community colleges has a foundation similar to SAT and ACT tests.

G-factor intelligence. Standardized testing (e.g., SAT, ACT, or COMPASS) using IQ as the foundation has g-factor as the underlying construct (Weel, 2008). Van

Der Veer (2007) noted during the development of g-factor intelligence theory that cognitive abilities were considered to be stable and unchanging. These abilities were described as psychological constructs in terms of traits of emotional and intelligence stability (Gottfredson & Saklofske, 2009). However, Sternberg (2010) reported this has led to an educational system in which only analytical and memory skills were valued depriving society of individuals who have noncognitive skills such as creative and practical skills.

Boylan (2009) reported most colleges use SAT or ACT to measure academic preparedness. Syverson (2007) showed that SAT and ACT scores can accurately assess academic preparedness of prospective college students. However, under scrutiny, Geiser (2009) noted that these tests were not accurate when assessing academically underprepared college students. In essence, educational systems in the U.S. have an incomplete understanding of the important influence of noncognitive factors when concerning academically underprepared adults (Thom, 2013).

Imitation as dynamic intelligence. Shortly after the development of fixed intelligence theory Vygotsky proposed a counter theory of dynamic intelligence (Van Der Veer, 2007). Fixed intelligence theory was based on the assumption that cognitive intelligence was inherited at birth, aided by maturation, and could not be contaminated by environment or even instruction (Van Der Veer). However, Vygotsky (1978) suggested that intellectual growth occurs first from emotional regulation (i.e., self-regulation) combined with communicative speech, and then expanded by the individual's ability to plan (i.e., metacognition). He felt that the ability of a young individual to imitate a more knowledgeable elder led to intellectual development through reenactments of environmental situations. He further argued that auxiliary tools (i.e., the child's ability to self-regulate leading toward their developing metacognitive skills) were a construct of dynamic intelligence developed first through imitation and the *zone of proximal development*. He defined this as the gap between actual development and potential development, determined through problem-solving exercises with assistance by a more capable elder or peer. This suggests that instruction should not follow the mental development of individuals but run ahead of their mental development (Van Der Veer, 2007). Van Der Veer further noted that only instruction that stimulates independent performance above the individuals' actual developmental stage is fruitful toward higher mental development.

Successful intelligence. Sternberg (2008) believed including creative and practical abilities (i.e., noncognitive abilities) in standardized tests could increase assessment accuracy without lowering academic standards. His research indicated that teaching in a way to match natural abilities may lead to better academic performance by college students. His *Successful Intelligence Theory* is based on the notion that all individuals can have weaknesses and strengths in three areas (analytical, practical, and creative), and they compensate their weaknesses with their strengths

as a form of successful intelligence. Sternberg et al. (2010) believed that diverse sociodemographic groups such as those based on gender and ethnicity may need to overcome challenging environments, leading to the development of practical and creative skills. To test his theory, Sternberg (2010) conducted the Kaleidoscope and Rainbow research studies. He found that he could increase college diversity of gender and ethnic groups while also increasing academic standards.

Multiple intelligence theory. Multiple intelligences is based on the idea that individuals can have many intelligences (Gardner, 2006). Gardner felt that standardized testing only gives a partial view of an individual's intellectual abilities. He described the social/cultural environment of an individual as the basis for a bio-psychological potential. Gardner (2007) indicated social influences reorganize the structure of the brain into many autonomous abilities and each of these abilities become different forms of intelligence. In reference to education, he warned to not curtail connections made by the young mind as these connections may join diverse neural networks of intelligences. According to Helding (2009), MI theory in arts education and education in general may represent an historical paradigm shift. She lists the seven original intelligences as: (1) linguistic, (2) logical-mathematical, (3) spatial, (4) bodily-kinesthetic, (5) interpersonal, (6) intrapersonal, and (7) musical.

METHODS

The data in this study was collected using in-depth, semi-structured interviews that were individually conducted with 16 college students from a four year college in the Southwest. The audio recorded interviews were subsequently transcribed verbatim. All participants were assigned pseudonyms to maintain confidentiality and anonymity. The participants were from a variety of ethnic groups including Hispanic, White, Native American, and African American. All participants were over the age of 18 were currently enrolled in a below college level course.

Participants were asked about their lived experiences related to noncognitive factors including personal factors (relationship to parents, parental unemployment, parental literacy); affective factors, (attitude towards learning, willingness to make an extra effort, willingness to seek help); noncognitive skill factors (creativity and practical skills); and, early educational factors (educational experiences from pre-K through high school). Open-ended interview questions were developed with the purpose of understanding how the students' experiences with noncognitive factors influenced their academic preparedness.

The data analysis included reading the interview transcripts several time to achieve what Giorgi (1985) called a "sense of the whole" (p.10). As categories emerged from the data, they were established as storage units for similar participants' significant statements. Out of these statements emerged textual categories with invariant constitutes to provide what Moustakas (1994) called narrative descriptions. Using textual categories, structural themes, and integrated aspects of interpretive

phenomenological analysis, a cohesive analysis of academic underpreparedness evolved using four cognitive/noncognitive distinctions of preparedness and underpreparedness. Finally, through iterative readings of textual categories and structural themes, a creative synthesis adapted to the study was an attempt to make visible what was previously invisible.

The analysis included five preconfigured categories: college experiences; early educational factors; personal factors; affective factors; and, noncognitive skill factors. A further analysis of textual categories, structural themes, and integrated aspects of interpretive phenomenological resulted in a creative synthesis of academic underpreparedness using four cognitive/noncognitive distinctions of preparedness and underpreparedness. These themes are discussed in the following section. Structural themes are described within the discussion of each major category.

AREAS OF NONCOGNITIVE FACTORS

While most studies on noncognitive factors focus on one factor or one area of factors, this study expanded the scope of inquiry to combine four areas of noncognitive factors as a multi-area factor. This multi-area factor as discussed below included educational factors, personal factors, affective factors, and noncognitive skill factors. An examination of these areas ultimately provided a multidimensional view of the ways noncognitive factors influence academic preparedness.

Educational Factors

Educational factors include educational experiences from pre-kindergarten through high school (Fewell & Deutscher, 2004; Mathews, 2010). To understand how this area influenced academic preparedness participants were asked to give their perceptions on their experiences related to early educational factors before and during K-12. Participants; textual and structural narratives revealed that most were read to as children but not by their parents. This was consistently reported by participants, regardless of whether they were raised in broken families or two-parent families. Most revealing was that participants were not pushed by their parents to succeed academically nor did they have chores imposed on them. For example, Rachel told us, "I wish they would have stressed to me more of the uh, taking it more of accountability and responsibility…rather than to end up dropping out." Serena added, "…we weren't guided very well and were making a lot of mistakes." The limited few participants who did receive some form of structural discipline or were pushed to succeed academically by their parents often had some form of cognitive or noncognitive preparedness. For instance, John noted, "We were always active at home and there were a lot of chores." In another example, Henry noted, "…my father control my education… always directing me."

Participants also revealed that the K-12 school system did not push many of them to succeed toward academic excellence. They were allowed to put minimal

effort into their academics and pass into higher grade levels. Serena noted, "they just seem a little bored…maybe they're just tired of teaching, I don't know. Laura added, "I don't think that any of us realized how important it was…the teachers really didn't want to take the time." Jackie reported, "teachers, they're just passing students, even if they don't understand the – what they're trying to teach." In summary, participants' pre-kindergarten experience was inconclusive concerning academic preparedness. However by taking a fresh look at participants' direct-quote data, this noncognitive area of educational factors, as a whole, was found to be a negative influence on participants' academic preparedness.

Personal Factors

Griffin (2008) defined personal factors as personal at-risk issues as well as family at-risk issues, such as parental unemployment, illiteracy, and absentee parents. Boylan (2009) cited childcare issues and language barriers as personal factors that may influence study habits. To understand how this area of noncognitive factors influenced academic preparedness, participants were asked to describe any personal issues that may have helped or hindered their ability to obtain a college degree. The data on this factor revealed that most participants had family at-risk issues, as well as some personal at-risk issues. However, family issues were predominant. For instance, most broken homes had much strife between parents. Jackie acknowledged, "it was difficult trying to grow up because…my father was abusive and stuff, and, um, it was just difficult growing up." Josephine replied, "I was going through a tough time, because my mom was going through a divorce." Additionally, some of the participants who were raised in two-parent families also reported family conflict. Delores revealed,"…my mom stayed at home with us kids, but it was a lot of – there was a lot of chaos going on all the time." This one aspect of strife within personal factors was a significant negative influence on most participants' academic preparedness throughout k-12 and going into college.

Affective Factors

Boylan (2009) described affective factors as motivation attributes such as the students' approach toward learning, their willingness to ask for help, and an all around determination to put an extra effort into their learning. To discover the ways this area of noncognitive factors influenced academic preparedness participants were asked to describe how they would overcome the challenges they may face in obtaining a college degree. The data obtained from participants' direct quotes revealed that the study participants had a great deal of motivation and determination to overcome their circumstances in order to obtain their degree. James replied, "…overcome any obstacle that's set in my path and if I can't, and I have to ask for help, I mean I will." David also mentioned, "…there's a certain, certain level of self-control, I guess, that I have over myself for, uh, pushing past the procrastination and getting that work

done, or whatever." However, this determination and motivation they expressed was dependent on student support services, such as tutoring, and mainly student financial support services provided by the college. For instance, Rachel noted, "Um, I'm on financial aid so without those, without the ability with financial aid I would have never been able to go." In other words, college support services were converging with affective factors to have a positive influence on academic preparedness.

Noncognitive Skill Factors

Sternberg (2008) revealed through several of his own research studies that noncognitive skill factors, he called creativity and practical skills, were just as important as analytical skills in determining students' academic preparedness. To explore the ways this noncognitive area may have influenced students' academic preparedness participants were asked to describe an educational situation in which a teacher inspired them to think creatively or use practical skills. Most participants could think of at least one teacher who inspired them. Frank recalled, "My sixth grade teacher, he was awesome. He always inspired me to be myself and encouraged me to go further in education." However, most participants were longing for creativity to be included into their curriculum. These participants found academic lectures to be boring and desired their classes to be inspiring such as learning life skills. Rachel reported, "I think that it's important for teachers to inspire their students… to give life skills, so that students will be able to compete in the real world." As well, some participants felt something was missing in education. Apollo expressed, "…I think that's where, um, uh, there's like a bridge – a broken bridge in a sense." While the noncognitive skill factor area was found to be helpful toward academic preparedness, it was also found that it was not used much in education according to the lived experiences of the participants in this study.

FOUR COGNITIVE/NONCOGNITIVE DISTINCTIONS

The challenge of this study was to discover from what appears to be simple the hidden complexity (Brough, 2008). Combining Vygotsky's findings on self-regulation and metacognition, with the multidimensionality of the four noncognitive areas previously mentioned several cognitive/noncognitive distinctions were developed to create an overall creative synthesis: (1) cognitively/noncognitively prepared; (2) cognitively prepared/noncognitively underprepared; (3) cognitively underprepared/noncognitively prepared; and, (4) cognitively/noncognitively underprepared.

The term *cognitively prepared* was based on the students' metacognitive ability to consciously develop some sort of planning strategy, such as planning to enter a university, planning a business, or planning to home-school their children. Efklides (2008) described cognitive as the metacognitive ability to develop a conscious process of planning strategies. According to Dunlosky and Metcalfe (2009), metacognitive abilities are separate from a student's measured intelligence quotient (IQ).

Noncognitively prepared was defined as the students' ability to self-regulate, such as their behavioral ability to control their attention, actions, or thoughts. Sitzmann and Ely (2011) described self-regulation as an emotional or behavioral choice process in which choices are made about how much of personal resources are to be used for the attainment of a goal. According to Vukman and Licardo (2010), guidance coming from student's social environment as well as a maturing prefrontal cortex may result in the student developing their self-regulation.

By operationalizing the terms *cognitively prepared* and *noncognitively prepared*, a culmination of participant's direct quotes was instrumental in developing what Moustakas (1994) called a creative synthesis, and of what Pringle, Drummond, McLafferty, and Hendry (2011) called evidenced-based data. In line with this rationale, much of the narration in this part of the study consists of participants' direct quotes. Also, the assumption is made that self-regulation and metacognition are central to academic preparedness.

Cognitively Prepared/Noncognitively Prepared

Only one student out of the 16 in the study was found to be both cognitively and noncognitively prepared. This implies that the student was prepared for college in both cognitive and noncognitive areas. This student was attending college to support his daughter in her education, and the school system allowed him to attend below college level courses with his daughter. This student, John, reported that he home-schooled his daughter. He mentioned, "…her not being ever in a classroom was a little scary for her, and I said, 'Don't worry, I'll go with you'…" About having chores, he explained," We were always active at home and there were a lot of chores."

John often tutored many of the students at the college and home-schooled his daughter. For these reasons, he was deemed metacognitively prepared. He reported few negative experiences from his early schooling, home environment, or negative personal issues in his early life as a child or in his later life as an adult. He was an excellent example of having both self-regulation (i.e., control of his thoughts, attention, and actions) and metacognitive skills (i.e., the ability to plan such as planning to enter a university, planning to start a business, or home-schooling his child). John seemed to have an advantage on most participants by having a structured stable and loving two-parent home environment. This is consistent with Heckman (2008), who suggested that the quality of home environment is more influential in determining academic disadvantage or advantage than from financial resources alone.

Cognitively Prepared/Noncognitively Underprepared

Two other participants in the study, Tanya and Frank were both considered cognitively prepared, meaning they had good metacognition. However, they were both lacking in self-regulation. Tanya had family issues, and later personal issues.

Frank had no childhood family issues but later experienced negative personal issues as an adult.

Tanya reported she took proficiency test in testing out of high school and received her diploma at 16 years of age. She stated, "I took a proficiency exam…I would have got when 16…I tested out, yes." A few years later, she received an associate's degree. However, even though she did not return to college for 14 years and she had to take a below college level math class as a refresher, It was as a result of her earlier proficiency exam, her early university experience, and her recent membership in an academic honor society that she was considered cognitively prepared. In her own words, Tanya reported, "Um, I actually belonged to an Honor Society… I enjoyed helping people on campus." At the same time, however, Tanya was also noncognitively underprepared due to her family and personal issues putting her at-risk. For example, she had to deal with an alcoholic ex-husband and she had scheduling issues in school as the result of her children who have special needs. She explained, "So having to be divorced…an ex-spouse has probably actually been a bigger factor than being disabled or being, uh, a mom with kids that do have special needs. So I have a lot of challenges there."

When asked how she got along with her parents, Tanya revealed, "we actually worked together; and I enjoyed working with them more than I did going to school quite honestly… My dad had issues where he wasn't around a lot and, uh, suffered from alcoholism." She also noted, "I knew how to make money. I was working with my parents… I had the regular separation from my parents and the kind of rebellion… I was actually staying with my sister, um, during high school." Although Tanya had a shaky relationship with her parents, she apparently did have some family structure imposed such as chores in her parent's business. She also enjoyed this activity. This was similar to John's experience of working and doing chores with his mother. Both John and Tanya were deemed cognitively prepared, and both had worked within their parent's businesses. However, the fact that Tanya had early family issues involving her father's alcoholism, as well as her personal issues as an adult with an ex-husband, who was also alcoholic, put her at-risk. As a result, she was noncognitively underprepared.

Frank was also deemed cognitively prepared. He noted, "My mom has her Associate's in Public Administration and my dad was an accountant for over 17 years, so they were both professionals… I'm also president of a student organization here on campus… I don't' want to start drinking again… I made some wrong choices in my life." Frank was considered cognitively prepared because he was able to enter into a large university straight from high school. This was evident even though he developed an alcohol problem and dropped out of the university. When he returned after 20 years he had to take below college level courses. However, he had no problem with his courses when he came back to education and he became the president of a student organization. Conversely, He was deemed noncognitively prepared because of his alcohol drinking issue, which makes him an at-risk student.

Cognitively Underprepared/Noncognitively Prepared

This distinction is defined as metacognitively underprepared with self-regulation preparedness. By overlapping textual descriptions with structural themes, the discovery was that some participants who were noncognitively underprepared as children in K-12 were actually noncognitively prepared as adults in college.

For example, Henry came from a loving two-parent family. He would have been in the cognitively/noncognitively prepared category. However, he came from another country and did not speak fluent English, which left him cognitively underprepared in this country. In fact, he reported doing well in math, chemistry, and physics. He reported, "… Like math, physics and chemistry, I'm really good at that, but the good thing here is like they prepare you for talking." He further mentioned, "… I've got a good relationship with my father…and my mother I consider her like my best friend…" Although Henry was deemed cognitively underprepared because of his low ability to speak English, he was noncognitively prepared because of his strong family support.

Jane also came from a two-parent family. She was deemed cognitively underprepared because she quit high school did not return to education for over 20 years. This was due to a family health issue, which required her to play a second mother to her siblings. She stated, "I dropped out…there was a lot of family issues…I kind of played the role of a second mother in it…because either my mom was sick or she was giving birth." However, she was deemed noncognitively prepared because later in her life, her family wanted her to finish her education. She stated, "…My kids would say, well, what's holding you? Why aren't you finishing up? I said I don't know." The family issues that she had experienced in her youth had disappeared. Although she was out of education for over 20 years, which made her cognitively underprepared, she now had her family support to go to college. Her decision to help her ailing family as well as her current family support made her noncognitively prepared. She was definitely able to control her behavioral choices such as control of her thoughts, attention, and actions.

While Phil also came from a loving two-parent family, he was deemed cognitively underprepared because of a learning disability. However, his learning disability did not stop him from going to a university directly from high school. The high school he attended was able to deal with his disability and teach him in a way that was conducive to his learning style. Conversely, the university he attended had too many students in class. He eventually had to drop out and go to another college. Phil reported, "My home is a loving home…I am dyslexic…I could talk to teachers. The teachers will tell me what I need to do… way different than LA. In LA, it was – the lady that supposed to help you, she was so busy – so many students." He was deemed cognitively underprepared because he needed a particular method of teaching because of his learning disability. However, he was noncognitively prepared mainly because he has a supportive and loving family, which helped him to make positive behavioral choices.

Lydia came from a broken family and also had a learning disability. She was considered cognitively underprepared because of her learning disability. When asked about her learning disability and family life as a child she explained, "…I have dyslexia…I have extra time on my test…My parents got a divorce when I was five… It's getting better because now I live with my mom so there's no more fighting. She eventually received help with her disability and attended all regular classes during high school. She went directly into college from high school and has her mother's emotional and financial support while currently in college. Lydia further explained, "…I was in all regular classes…My mom told me and my sister that if we go to college, me and her do not have to work…" Because Lydia currently has a stable and supportive environment helping her to make responsible decisions provided by her mom, she was considered noncognitively prepared.

Cognitively Underprepared/Noncognitively Underprepared

The main difference between this cognitive/noncognitive distinction and the other three previous distinctions was that seven of the nine participants were from broken homes. Six of the seven participants in the first three distinctions were from two-parent families.

Using participants' direct quotes from this current distinction, a picture of academic underpreparedness begins to emerge. For instance Serena was from a broken family and she was a returning adult. She entered college courses before she was ready. She was considered cognitively underprepared because she had much difficulty with her college level courses. In one example, she reported, "I got straight into algebra and I hadn't taken a math class in quite some time so, it was a little difficult…"She was deemed noncognitively underprepared because of her lack of family support and consequently her making bad choices. She recalled, "…broken home, we were living with our grandparents… we weren't guided very well and were making a lot of mistakes…I started drinking about 13… spent a lot of years creating my own obstacles…"

In another example, Josephine began college immediately after graduating high school. She was from a broken family but very much attached to her grandfather. When her grandfather died she lost her motivation to learn, which may have been a main contribution to her cognitive underpreparedness. She was also noncognitively underprepared because of lack of family support and the negative effect of alcoholism in her family. She noted, "When my grandfather passed away, and that was a real hardship, that affected my grades…my mom's divorce and my dad is an alcoholic… me and the father of my child broke up…that's a pretty big barrier."

Rachel was another returning adult more than 20 years after dropping out of high school. She also had a learning disability. These issues combined with the fact that she had no family support led to her being deemed cognitively underprepared and noncognitively underprepared. She noted, "…they divorced when I was very

young…I must deal with a learning disability…I do depend on as much tutoring as I can get help with…Um, my K-12 was rocky…because of my home life…"

Delores was a high school dropout returning to education after 25 years of being away. She was from a two-parent family but her family life was chaotic. She found no reason to learn during her k-12 experience. For these reasons, she was considered both cognitively and noncognitively underprepared. She acknowledged,

…I hadn't been at school in twenty-five years; my math skills were not good… I dropped out…I was not happy…there was a lot of chaos going on all the time… K-12 you pretty much sat there, be quiet and it was almost like they were drilling something into you rather than letting you show the willingness of wanting to learn.

These participants were all examples of the negative effects of the two previously mentioned noncognitive areas, personal factors and educational factors. These study participants had virtually no family support or anyone to push them academically. As well, the k-12 educational system may have failed these participants. For instance Laura, who came from a two-parent family, mentioned,"…there was no one at school who really wanted to take the time to help me… and then High School, it didn't really seem that important because there wasn't anybody pushing me… and the teachers did not care to help." As well, Jackie noted,

…my kindergarten through 12th grade experience…it was kind of hard to learn… I remember one teacher in particular, she, um, she would just give us an assignment, and she would then – after, she would just play on her cell phone or just play cards… teachers, they're just passing students, even if they don't understand the – what they're trying to teach.

OVERALL CREATIVE SYNTHESIS

Although having a two-parent family was conducive toward some form of academic preparedness, either cognitively or noncognitively, it was not a guarantee of any form of academic preparedness (Finkelstein & Thom, 2014). For example, the deciding issue was whether there was family strife between the parents such as arguing, or if there was an alcohol issue with at least one parent, or an alcohol issue with the participant. As one example, Lydia wished her parents were not fighting and were still together. She stated, "my mom and my dad not fighting, them still together." In another example, James stated, "… my father was an alcoholic… my mom and him would be fighting, and me and my sister would be there really sad and stuff". As well, Frank also stated, "The main factor for me was alcohol… it did take a hold of me." Alcoholism and family strife were issues that came up consistently even though this specific question was never asked, during initial interview questions or probing questions.

Another synthesis that came from the study participants was that without some form of structure imposed at home, participants were prone to make bad choices. As a result, they did not put forth an effort into their academics. Serena, who

was mentioned in the cognitively underprepared/noncognitively underprepared distinction was from a broken home and spent many of her early years with her grandparents. She admitted that she created many of her own obstacles. She noted, "…we weren't guided very well…living with our grandparents…rough childhood… spent a lot of years creating my own obstacles…started drinking about 13…I didn't care back then." Rachel added, "growing up in my house was very dysfunctional… I never had parents or adults to follow through on my education… that's where my failure started in my education."

Additionally, the school system may not have provided these participants with an atmosphere to strive for academic excellence. For instance, Delores, who was from a two-parent family and was mentioned in the cognitively underprepared/ noncognitively underprepared distinction, noted, "k-12 you pretty much sat there, be quiet and it was almost like they were drilling something into you rather than letting you show the willingness of wanting to learn." Also from the same distinction, Jackie noted, "they're just passing students, even if they don't understand the – what they're trying to teach."

The only participants that had cognitive preparedness were from two-parent families in which participants had chores imposed on them such as working in their family business or helping out around the home, or they had parents who were working professionals. For instance, John, who was the only participant both cognitively prepared/noncognitively prepared, had chores imposed on him. He noted that, "… there were a lot of chores." Tanya, who was also cognitively prepared but noncognitively underprepared, acknowledged she grew up "learning by being in a working environment… I was working with my parents." Frank, the other cognitively prepared/noncognitively underprepared participant, added that, "My mom has her Associate's in Public Administration and my dad was an accountant for over 17 years, so they were both professionals."

Another aspect was that six of the nine participants that were both cognitively and noncognitively underprepared were female. When taking a fresh look into the direct-quote data, it was implied by at least one female that her parents approach toward her academics was that it was not that important. For example, it came out through probing questions that Laura had a college fund saved for her by her two-parent family. When probed further, Laura stated, "I, uh, my parents ended up using the money for personal. They had saved it, and they just – they couldn't – and they ended up using it. And then they just made it seem like it just wasn't that important that I go." Although most participants who were cognitively underprepared/ noncognitively underprepared were female, the potential reason for this result was not conclusive.

The overall creative synthesis was that these participants experienced a failure by both their families and the school system towards their obtaining an outlook of academic excellence, which ultimately led to them making bad decisions such as dropping out of school, not applying themselves to their academics, and alcohol

abuse. This was supported by the earlier allusion to personal factors and educational factors as both negative influences on participants' academic preparedness.

Overall Influence of Noncognitive Factors on Academic Preparedness

The findings of this study suggest that there are many ways that noncognitive factors influence academic preparedness. The failure of participants' families and k-12 school system established within personal factors and educational factors indicated a common negative effect on participants' academic preparedness. While the majority of participants were returning adults, being away from education for at least 10 to 20 years or more, the majority of participants in the cognitively/noncognitively underprepared distinction were 19 years of age or in their early twenties and female. As well, many of these participants, both male and female who came from broken families had a hard time just obtaining shelter. Apollo mentioned that he "…didn't have nowhere to stay, so I was like, homeless…I had to stay in my girlfriend's car." Laura commented, "I had a lot of barriers because to go to summer school I needed somewhere to live, and I was willing to live in the park…you know leave my dog outside parked, you know tied up so that I could go."

Affective factors combined with college support services such as financial aid and tutoring provided these participants with new optimism. Participants collectively demonstrated a determination to obtain a degree. For example, Jane stated, "Well, I'm very determined. Whenever I set my mind…" As well, affective factors combined with financial support services were a positive influence on academic preparedness. As an example, Delores stated, "The tutoring is wonderful… I'm getting tutoring for my algebra, and it's awesome." James mentioned, "… staying strong and when something happens, if I get a bad grade, just make me try harder. And overcome any obstacle that's set in my path and if I can't, and I have to ask for help, I mean I will." Rachel added, "if I wouldn't have the ability of financial aid it would be rough."

Although noncognitive skills are not measurable items in the U.S. public education school system, many participants expressed the importance of including noncognitive skill factors such as using creative and practical skills. At least one participant considered them to be necessary life skills. For instance, Frank stated.

…I believe you need to be well rounded in order to survive in this kind of world we live in today…I would have probably come out, excuse the expression, dumb as a rock, because I might be book smart but I wouldn't have common sense or the ability to interact socially with people…

John added, "…they actually solve problems for you – your own creativity can solve a problem…it's very important how you view things, how you get along, how you see things, knowing that you can either change it or how it was done." Delores stated, "I think being creative is very important. I think it helps the cognitive skills along, whereas if you just have the cognitive without the creation, then it doesn't

come together." Rachel added, "…I think it's very important for, for teachers to, to teach education wise but also to keep in mind that uh it's important to give life skills…"Although the school system does not make use of these noncognitive skills as measured items, participants intuitively felt the importance of having creative and practical skills or as one participant stated life skills. This was consistent with Sternberg, who proposed that noncognitive skills such as practical and creative skills were essential life skills.

However, as viewed through a divergent perspective, at least one participant noted how little this noncognitive skill area was used and was therefore unnecessary for him to spend time learning. For instance, James noted,

I feel like learning math, reading and all of those cognitive skills are something people really need to learn in life because they're used almost every day…practical skills are good, good to learn, but they're not, they're not as important…You chose if you want to know the practical skills.

Because the school system does not make use of these noncognitive skills as an important item to be measured, noncognitive skills factor was found to be non-consequential toward academic preparedness. This was also consistent with Sternberg (2008), who proposed that the educational system is a closed system that values only cognitive analytical skills such as English, math, and memory.

DISCONNECT BETWEEN SOCIAL/CULTURAL EXPERIENCES AND COGNITIVE/NONCOGNITIVE DEVELOPMENT

Sternberg (2007) discovered that disadvantaged individuals who do not develop cognitive skills compensate by developing noncognitive skills such as creative and practical skills as part of their social/cultural experience. He proposed that when these individuals are taught in a way that matches their naturally formed abilities their academic performance improves. Heckman (2008) believes that the educational system does not value noncognitive factors. This implies that academically underprepared participants may experience a mismatch or disconnect between their natural forming abilities derived from social/cultural experiences and their cognitive/noncognitive development obtained from public education teaching norms. This was consistent with Vygotsky (1978), who uncovered many issues related to learning were the result of a disconnection or mismatch between natural forming abilities of individuals and dominant teaching norms in public education.

Vygotsky (1978) theorized that social/cultural experiences provide self-regulation during an individuals' early development leading towards metacognitive skills based on an elder or peer interaction guiding them through their zone of proximal development. According to Cunha and Heckman (2008), during the critical early development before adolescence the brain is more malleable toward cognitive skills development. They further noted that if this critical early developmental period is missed the brain becomes less malleable for cognitive development during

late adolescence. They felt that this may provide an explanation for the dismal cognitive success rates within developmental education. Their recommendation for cost effectiveness in developmental education was to teach by first focusing on the individuals' noncognitive skills as these skills are more malleable within the brain during late adolescence and adulthood.

Noncognitive skill factors such as creative and practical skills may also have a connection to Vygotsky's zone of proximal development. For example, cognitively underprepared/noncognitively underprepared participants expressed their desire to have someone push them, and to have someone to impress. One such participant, Rachel stated, "…I wish I would have had somebody to, to push me or encourage me…I think that it's important for teachers to inspire their students…" Another participant within the same distinction expressed a desire to have someone to impress. James revealed, "…when I met my girlfriend was actually when things started changing for me in school because I…actually had somebody to impress in school because no one really actually did care how I did in school…" In essence, these were participants who wanted to be pushed so that they may grow academically through their zone of proximal development.

IMPLICIT BROKEN STRUCTURE

Noncognitive skill factors, according to Sternberg (2007), are what disadvantaged individuals develop through their social/cultural experiences to survive their challenging environments. However, what happens when the educational system does not teach to the strengths of disadvantaged individuals, such as by nurturing their naturally developed practical and creative abilities? One of the participants from the cognitively underprepared/noncognitively underprepared distinction offered his own theory. Apollo reasoned,

…I think that's where, um, uh, there's like a bridge – a broken bridge in a sense. Like, um, there's a lot of people that are creative thinkers that, um, become bored, you know, go off and because they're so depressed and they'll turn to some kind of drug or something, and kill themselves. Not – probably not physically kill themselves, but mentally kill themselves, you know? Some of them plant themselves so deep they can't come back. So I think creative thinking should be more expressed.

The broken bridge that was intuitively understood by this participant was that creativity and practical skills are essential, however not systematically used in his educational lived experience. This participant may have touched upon a main problem in education. When U.S. educational system policy makers devalue noncognitive factors, it creates an implicit broken structure. Heckman (2008) warned educational policy-makers to not underestimate the value of noncognitive factors. This warning may become even more evident when understanding the multidimensionality of noncognitive factors.

MULTIDIMENSIONALITY OF NONCOGNITIVE FACTORS

The importance of noncognitive factors may become more evident by understanding the multidimensionality of noncognitive factors within an educational context. As explored earlier, four noncognitive areas were used to help understand issues of academic preparedness and underpreparedness. These noncognitive areas may be better understood as one multi-area factor by first taking a look at each part and then looking at the whole.

Educational factors and personal factors together indicated a negative influence on academic preparedness, as well as causing a possible disconnection or mismatch between social/cultural experiences of participants and their cognitive/noncognitive development. Conversely, affective factors and noncognitive skill factors revealed another story. With affective factors, most participants were highly motivated and indicated a high level of perseverance by overcoming the deficit of personal factors and educational factors with the help of financial aid and tutoring. However, since noncognitive skill factors were rarely used they were found to be a non-consequential influence on participant's academic preparedness. In essence, the multi-area factor may be out-of-balance when concerning academically underprepared students.

Additionally, noncognitive skill factors revealed a disparity or a disconnection between the way participants wanted to be taught and the way they were actually taught. Most participants expressed the importance of using creative and practical skills along with their cognitive skills of English and math. They associated these noncognitive skill factors as essential life skills and longed for these skills to be taught in education. For instance, Rachel noted,

Again, um, I think it's very important for, for teachers to, to teach education wise but also to keep in mind that uh it's important to give life skills, so that students will be able to compete in the real world. Um, and I think that that should be important to, for the teachers to remember that a lot of the students that, that are high risk, will have the challenge of having to learn skills and life skills.

This was consistent with Sternberg (2009), who proposed that students who came from a disadvantaged background may not develop their cognitive skills, but was likely to develop creative and practical skills as a normal function of successful intelligence. However, if these skills are not valued or taught in an educational setting, student apathy may result. In this study, most participants only had fun in education when they had creative projects such as creative writing or an instructor who was able to convey academic material in a way that was understandable. Serena noted, "There's some people that just walk into a room and you know it's going to be fun or inspiring…Something that they're actually going to use, it can be very inspiring." Josephine added, "My mathematics teacher inspired me. He was one tough… and he pushed us to learn it." This was consistent with Mathews (2010), who discovered one reason for student apathy is that education is not fun.

In result, the multi-area factor is out of balance. Participants may be able to overcome the deficit of educational factors and personal factors with just affective

factors aided by college support services. However, they may not develop the full set of skills needed to compete in the job market. Noncognitive skill factors may be the essential part of the multi-area factor to fully balance initial deficits and to propel students onto the world stage.

RESEARCH RECOMMENDATIONS

Several recommendations emerged as a result of the study findings. The first recommendation is to provide self-regulation knowledge support so that students can develop their metacognitive skills as a means to improve academic preparedness. Dunlosky and Metcalfe (2009) felt that it was that important to academic preparedness that metacognitive skills are used to compensate for low IQ. A vital indication of academic preparedness is the self-regulation of students' metacognitive skills (Vukman & Licardo, 2009).

The second recommendation is to provide every student at enrollment information about college support services, such as distributing as a brochure with phone numbers to ensure a cohesive and supportive environment. According to Bailey (2009), the distinction made by developmental education is misguided as even academically prepared students need help. This is especially true of gifted underachievers on which they are creativity based on intrinsic motivation (Morisano & Shore, 2010).

The third recommendation is to include noncognitive skills such as creativity and practical skills along with cognitive skills for evaluating academic preparedness. By including noncognitive skills, students who excel at these noncognitive skills may become as valued as students with cognitive skills. A lowering of academic standards does not occur when including noncognitive factors with cognitive factors for the evaluation of students' academic preparedness (Sternberg, 2008). In fact, empirical data has shown noncognitive factors may increase the evaluation accuracy of academic preparedness (Schmitt et al., 2009; Sternberg, 2008, 2009).

The fourth recommendation is to redesign education from a foundation based on fixed intelligence to a design of dynamic intelligence. This may create the recognition that intelligence is not just from genetic inheritance, but also stems from environmental influences. The redesign should include using noncognitive factors for a variety of educational issues such as: (1) for teaching diverse types of abilities (Sternberg, 2005); (2) for evaluation within developmental education (Boylan, 2009), and (3) for standardized testing (Schmitt et al., 2009; Sternberg, 2009).

The overall creative synthesis in this study revealed that most participants experienced a failure by both their families and the school system in providing them with an outlook of academic excellence. A multi-area factor was developed from combining the four noncognitive areas to illustrate how this system was out-of-balance. An implicit broken structure was exposed revealing a deeper understanding of the multidimensionality of noncognitive factors.

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14. THE STUDY OF NON-COGNITIVE ATTRIBUTES IN EDUCATION

Proposing the Mental Toughness Framework

INTRODUCTION

In recent years, there has been a growing interest in non-cognitive aspects of academic performance. Accordingly, a number of models, concepts and ideas have been discussed, disseminated and delivered. Whist all have their value, perhaps the area that has received most attention is that of resilience and character.

Resilience and other 'character orientated' research have had a major impact in the education domain (e.g., Putwain, Nicholson, Connors, & Woods, 2013). Resilience is, at its most basic, the ability to deal effectively with stress. Resilience refers to the ability to adapt effectively in situations of adversity or stress. A number of studies have reported a positive association between resilience and academic outcomes (e.g., Mullis, Rathge, & Mullis 2003; Putwain et al., 2013). Similarly, a number of investigators have examined the concept of buoyancy (Martin & Marsh 2006, 2008, 2009; Putwain & Symes, 2012). Buoyancy is as an adaptive response to challenges and setback.

Finally, arguably the best-known concept related to resilience is grit. Grit is perseverance for long-term goals, particularly in the face of adversity. Grit is important for helping overcome obstacles or challenges, and is a significant predictor of academic attainment (Duckworth, Peterson, Matthews, & Kelly, 2007).

MENTAL TOUGHNESS

More recently, the concept of mental toughness has been utilised within education settings and educational performance. In many respects, mental toughness represents an 'umbrella concept' incorporating many, if not all of the resilience-orientated ideas. Historically, the study of mental toughness was largely within the domain of sports; to understand how sports performers, particularly elite sports performers, deal effectively with challenges, stressors and pressure (e.g., Gucciardi, Gordon, & Dimmock, 2009). However, mental toughness has also been used in research within occupational settings (e.g., Marchant, Polman, Clough, Jackson, Levy, & Nicholls,

M. S. Khine & S. Areepattamannil (Eds.), Non-cognitive Skills and Factors in Educational Attainment, 315–329.

2009; Godlewski & Kline, 2012) and is becoming particularly popular within the education domain.

There are a number of definitions and conceptualisations of mental toughness. Whilst models differ, McGeown et al. (2015) note they share a number of core concepts. These include: self-belief (e.g., Bull et al., 2005; Clough, Earle, & Sewell, 2002; Gucciardi, Gordon, & Dimmock, 2008; Thelwell, Weston, & Greenlees, 2005); motivation (e.g., Bull et al., 2005; Gucciardi, Gordon, & Dimmock, 2008; Thelwell, Weston, & Greenlees, 2005); persistence in achieving goals (e.g., Clough, Earle, & Sewell, 2002; Fourie & Potgieter, 2001; Gucciardi & Gordon, 2008; Loehr, 1982); and the ability to deal with setbacks (e.g., Clough, Earle, & Sewell, 2002; Gucciardi & Gordon, 2008; Loehr, 1982).

One model of mental toughness that perhaps offers a particularly useful approach in education is the four 'C's model developed by Clough, Earle and Sewel (2002).

McGeown et al. (2015) highlight three major advantages of this model over other mental toughness approaches:

1. The model forms the basis for a valid and reliable measure of mental toughness – the MENTAL TOUGHNESSQ48 (Perry et al., 2013) and an adapted version of the MENTAL TOUGHNESSQ48 has recently been used in a study by St Clair-Thompson et al. (2014) to study this concept among adolescents.
2. The use of model subcomponents provides the opportunity to better identify any potential issues and, perhaps more importantly, target interventions.
3. The model offers the potential for integration of psychological and cognitive enhancement techniques. Crust and Clough (2011) argue that the available evidence suggests that experiential education plays a significant role in the development of mental toughness.

The 4 'C' Model in More Detail

Clough & Strycharczyk, 2012 define mental toughness as

> *The quality which determines in large part how people deal effectively with challenge, stressors and pressure…irrespective of prevailing circumstances.* (p. 1)

This definition derives from The 4 'C's model (Clough, Earle, & Sewell, 2002) of mental toughness, which brings together a range of concepts, enabling a simple, yet relatively comprehensive approach.

In the 4 'C's model overall mental toughness is a product of four central pillars: challenge; seeing challenge as an opportunity, confidence; having a high level of self-belief, commitment; having the ability to stick to tasks, and control; having the belief that you control your own destiny. It is important to understand that the model conceptualizes the opposite end of the toughness continuum as sensitivity

not weakness. This is in stark contrast to all other mental toughness delineations. The sensitive individual has a number of strengths, but also a number of challenges.

Research Using the 4'C's Model

There is a growing body of research evidence relating to the MENTAL TOUGHNESSQ48 and a number of these studies are clearly relevant within the world of education.

Coping. Nicholls, Polman, Levy, and Backhouse (2008) reported a significant relationship between mental toughness and coping strategies. Mentally tough individuals were more likely to adopt approach coping strategies, such as thought control and logical analysis and less likely to use avoidance coping strategies, such as mental distraction. Kaisler, Polman, and Nicholls (2009) provided further support for this idea. One of the key 'skills' needed in the educational system is to have an effective and appropriate coping strategy and mentally tough pupils may have an advantage here.

Psychological skills. Crust and Azadi (2010) reported a positive relationship between of psychological strategies and mental toughness. Three strategies were more prevalent: relaxation, self talk and emotional control. Again, better psychological strategies may lead to a better educational experience.

Emotional control and emotional intelligence. A number of theorists have suggested a link between mental toughness and emotional control (e.g. Gucciardi, Gordon, & Dimmock, 2008; Clough, Earle, & Sewell, 2002). Recent work has begun to look at emotional intelligence and its relationship to toughness. Nicholls, Perry, Jones, Sanctuary, Carson, and Clough (in Press) report that mental toughness positively correlated with emotional intelligence and the authors went on to suggest that mental toughness development might be an important component of developing emotional intelligence. Emotional intelligence and emotional control are certainly an advantage, when navigating your way through the labyrinth that is the educational experience.

Mental toughness and cognitive skills. This chapter's focus is on non-cognitive skills in education, but it is important to show briefly how the two skills domains interact. For example, a link exists between mental toughness and memory. Dewhurst, Anderson, Cotter, Crust, and Clough (2012) showed that mentally tough individuals were better able to suppress irrelevant information, when learning new information. Therefore, enhanced memory skills that allow for the better suppression of unwanted information may offer a way of building toughness through a cognitive process intervention.

It is apparent that mental toughness may therefore bestow a number of advantages relating to non-cognitive skills on those progressing through the system. It also clear that there is a 'mental toughness advantage' in relation to performance outcomes.

MENTAL TOUGHNESS RESEARCH IN EDUCATION

The links between toughness and performance strategies have sparked an interest in applying mental toughness directly to education. Although this is relatively new, the findings have been very encouraging.

St Clair-Thompson, Bugler, Robinson, Clough, McGeown, and Perry (2014) carried out three studies examining the relationship between mental toughness and different aspects of educational performance in adolescents aged 11–16. These focussed on academic attainment, school attendance, peer relationships and classroom behaviour. The findings revealed significant associations between several aspects of mental toughness and academic attainment and attendance, mental toughness and counterproductive classroom behaviour, and finally, mental toughness and peer relationships.

Away from secondary education (11–18 years), two recent studies have looked at mental toughness within Higher Education. Crust, Earle, Perry, Earle, Clough, and Clough (2014) investigated the impact of mental toughness on performance in the first year of an undergraduate degree in the UK. There were very strong links between GPA scores and other relevant outcome measures. Stamp, Crust, Swann, Perry, Clough, and Marchant (2014) examined the relationships between mental toughness and psychological wellbeing in university undergraduate students. They found that toughness was an excellent predictor of wellbeing in this population. It is clear that wellbeing may have a major effect on dropout and other performance criteria within university students.

Developing Mental Toughness

When considering mental toughness within education a fundamental question is, 'Can you develop mental toughness'? If not, knowing that the tough have an advantage becomes much less useful. It could help provide better support for the sensitive recipients, but it would be far more helpful if this particular non – cognitive attribute proved trainable.

Research often defines mental toughness as a 'narrow personality trait', with a clear genetic foundation. Horsburgh, Schermer, Veselka, and Vernon (2009) found that both genetics and the features of the environment influence mental toughness. Crust and Clough (2011) argue that the available evidence strongly suggests that experiential education plays a significant role in the development of mental toughness. They propose that individuals must be exposed to (rather than sheltered from) challenging situations, which allow personal resources, such as coping skills to be developed through problem solving.

A number of schools, colleges and universities across the world have introduced mental toughness development programmes. These have used a range of CBT (DEFINE) and PST (DEFINE) techniques. It is felt that a concrete example of this type of work will help provide a better understanding to the reader.

A Case Study – Developing Mental Toughness in a UK School

This section provides a detailed account of a pilot exercise using the '4 C's' mental toughness (MENTAL TOUGHNESS) model to improve students' commitment, control of life, challenge and confidence in abilities.

The Blue Coat School in Oldham is a Church of England convertor academy for students aged 11–18. The school is located on a town-centre site, in a ward that is amongst the 5% most deprived in England. Blue Coat is extremely successful and hugely oversubscribed. Students achieve outstanding results and make excellent progress. The 350-strong sixth form regularly outperforms fee-paying or selective schools and specialist sixth-form colleges. The school received two consecutive 'outstanding' judgments from Ofsted, and rated 'outstanding' in every category in December 2011. In 2013, Blue Coat became a National Support School and a National Teaching School.

Before developing the MENTAL TOUGHNESS curriculum, the school were considering three issues. First, their own 'character education' programme was under review. For a number of years they had been teaching the growth mind-set theory developed by Dweck (1999) and the concept of grit developed by Duckworth et al. (2007). Both of these theories have an important place in education; however, they offer very few practical tools to help improve students' character.

Second, the Children's Society published (2013) a report stating that wellbeing of KS4 students (14–16 years old) had fallen in recent years and young people were experiencing a loss of control in their lives. Observations were showing that over the last few years, there had been a growth in students' perceived levels of anxiety and stress and reported cases of mental health issues had been increasing. Given MENTAL TOUGHNESS is a quality that determines how people deal effectively with challenge, stressors and pressure it seemed an appropriate intervention strategy. In addition, there was significant research to recommend the potential malleability of MENTAL TOUGHNESS (Clough & Strycharczyk, 2014).

Third, they were investigating how we could help students maximise their own potential to improve academic performance. MENTAL TOUGHNESS scores correlate with better outcomes in a host of measures including wellbeing, transition to college and attainment generally (St Clair-Thompson et al., 2014; Crust et al., 2014). In addition, Crust and Azadi (2010) reported that mentally tough individuals were more likely to use psychological strategies, such as relaxation, positive self-talk and emotional control. These types of skills are developable in young people using targeted tools, making this an attractive construct in education.

After deciding that the 4C's MENTAL TOUGHNESS model was the best fit to the school's context, broad programme aims to help students were:

- a happier and more balanced approach to school work and life in general;
- improve confidence and wellbeing;
- improve performance in exam results and attainment levels;
- adopt positive thinking;
- be more resilient;
- develop clear goals.

METHOD

Nine teachers and two learning mentors participated in the pilot. All of the teachers had their MENTAL TOUGHNESS measured by completing the MENTAL TOUGHNESSQ48 and underwent two full days of training in MENTAL TOUGHNESS theory and techniques. After completing the training, a further two days involved designing the Y11 student curriculum.

From the initial sample of 223, 69 students completed the MENTAL TOUGHNESSQ48 (pre and post the mental toughness intervention programme). This sample included 31 males and 38 females aged 15–16 (M = 15.25, SD = .43). Attendance at the mental toughness sessions for all participants used in the analysis was 100%.

The MENTAL TOUGHNESS lessons were six one hour per fortnight over a twelve-week period. Prior to each lesson, there was a year group assembly, which reported student data from the MENTAL TOUGHNESSQ48 and explained the focus of the lesson and or motivational content. At no point was individual data for the pupils shown to any teacher or student. Every two lessons teachers delivering the course participated in a focus group. The focus group explored issues and potential implementation adjustments.

In the week following each lesson, one student from each group (n = 15) was randomly selected to attend a focus group, to collect and collate students' evaluations of the lessons.

THE CURRICULUM

Selecting interventions that work for young people is not straightforward. Many of the interventions originated within the world of sport, business and therapy. There is currently very little, if any, evidence to suggest which psychological skills are most effective in educational settings. When designing the programme we opted for the most common mental preparation strategies: goal setting, imagery, positive self-talk, reframing and relaxation skills. These strategies specifically do not improve MENTAL TOUGHNESS, however, they appear to link explicitly to the 4C's model. For example, there is a clear link between goal setting and commitment.

After an introductory lesson, sessions covered the four components of the 4C's model. For the final lesson, students produced a summary of their main learning points. Below is a brief outline of lesson content.

Lesson 1 – The initial lesson introduced the 4C's Model and explained the Yerkes and Dodson inverted-U model. Students completed a picture frame challenge in groups before relating their thoughts and feelings back to the model.

Lesson 2 – Confidence. To develop confidence skills pupils started with a simple 'bin challenge' – students threw rolled up paper balls into a bin. They then used a visualising technique and a positive thinking ladder to improve their success rate at the same challenge.

Lesson 3 – Control. After a breathing exercise, students completed a number grid focussed activity, whilst music was playing. They then did a similar exercise without music playing and evaluated the improvement. Students encountered the circles of influence and control model; they then coached a partner through a problem using the 'think-feel-act' cycle.

Lesson 4 – Challenge. After exploring the different types of challenge, students used a 2-4-8 planning grid to organise their own revision for their GCSEs. Students experienced a guided imagery script to help them focus in exams.

Lesson 5 – Commitment. Students analysed the types of activity they do stick at and then used a force field analysis tool and positive self-talk to align the completion of a task with their values. Students finished with making a prioritisation list.

Lesson 6 – This involved a summary lesson. Students divided into groups and prepared a presentation with only 15 minutes preparation. For example, one group prepared a presentation explaining how each of the 4C's might apply to different life events, such as becoming a parent for the first time, or becoming redundant.

TEACHER RESULTS

One of the biggest unintended consequences of the programme was the impact on the teachers selected for training and delivery of the MENTAL TOUGHNESS lessons. The analysis of the MENTAL TOUGHNESSQ48 data revealed an upward trend in all aspects of mental toughness and a significant increase in confidence.

Data screening for outliers, missing data, and normality revealed no issues (skewness < 2, kurtosis < 2). Descriptive statistics appear in Table 1. Examination of the minimum and maximum values indicate a range of scores for all components of mental toughness; there were fewer low scores in the post-test sample.

Mental Toughness Development

Paired samples test examined changes in mental toughness between time one and time two. There was a clear upward trend in all aspects of mental. With a

small sample size, statistically significant values require very large effect sizes. However, significant increases were still evident for several variables. *Challenge* progressed from a mean score of 4.64 ($SD = 2.25$) to 5.64 ($SD = 2.01$), $t(10) = -2.47$, $p < .05$. *Confidence in abilities* increased from a mean score of 5.18 ($SD = 1.78$) to 7.00 ($SD = 1.90$), $t(10) = -8.03$, $p < .01$. *Overall confidence* increased from a mean score of 5.36 ($SD = 2.16$) to 6.82 ($SD = 1.83$), $t(10) = -5.88$, $p < .01$, and *overall mental toughness* rose from 5.82 ($SD = 1.83$) to 7.18 ($SD = 1.66$), $t(10) = -3.32$, $p < .01$.

Student Results

Of the initial sample of 223, 69 students completed the MENTAL TOUGHNESSQ48, pre and post mental toughness development intervention programme. This sample included 31 males and 38 females aged 15–16 ($M = 15.25$, $SD = .43$). Attendance at the mental toughness development sessions for all participants used in the analysis was 100%. Screening data for outliers, missing data, and normality revealed no issues (skewness < 2, kurtosis < 2).

Mental Toughness Development

Paired samples test examined changes in mental toughness between time one and time two. Significant improvements were evident for emotional control, which progressed from a mean score of 3.90 ($SD = 1.86$) to 4.46 ($SD = 2.36$), $t(68) = -2.57$, $p < .05$. Significant differences were observed also for confidence in abilities, which progressed from a mean score of 3.68 ($SD = 1.88$) to 4.46 ($SD = 2.51$), $t(68) = -2.93$, $p < .01$ and overall confidence, which progressed from a mean score of 3.91 ($SD = 2.01$) to 4.42 ($SD = 2.57$), $t(68) = -1.97$, $p < .05$. Overall, clear improvements were evident in the confidence and control elements of mental toughness.

Impact on Grades

Prior to analysis the researchers identified five different grade boundaries. These were A*/A, A/B, B/C, C/D, and E. In total, the sample contained 28 (40.60%) A*/A, 0 (0.00%) A/B, 29 (42.00%) B/C, 6 (8.70%) C/D. and 5 (7.20%) E. One participant did not have a grade specified. Correlational analysis demonstrated positive correlations between mental toughness scores and grade ($r = .28$, $p < .05$). The strongest relationships between components of mental toughness and grade were commitment ($r = .33$, $p < .01$) and life control ($r = .31$, $p < .01$).

Correlational analysis can only identify an association between variables, but has no predictive capabilities. As such, a linear regression analysis examined the extent to which baseline mental toughness scores predicted grade. In total, the baseline mental toughness measurement explained 27.6% of the variance.

Qualitative Data

Through a series of focus groups for students and questionnaires for teachers, we collected also qualitative data to evaluate the exercise. Below are examples of the questions addressed to teachers accompanied by typical responses.

How Engaged Were the Students in the MENTAL TOUGHNESS Lessons?

> *I was lucky with my group – Most of the students were engaged, with the exception of two or three. That said, these two/three students did engage in the activities. I was impressed with some of the discussions we had and they approached this maturely.*
>
> *I would say about 65–70% engaged the majority of the time.*
>
> *I believe that the students were engaged during all of the sessions. Very few tasks, if any, seemed to disengage the students. Only one student in the class appeared to have no interest in any aspect of the course. This remained consistent throughout the six-week delivery.*
>
> *They engaged well with some of the activities, especially activities such as 2,4,8 and the force field analysis where they felt they could get tips for organising and prioritising their revision. I found them less engaged with techniques such as breathing and power posing as they found it less obvious how it could help them with their exams. They needed more guidance with this and help to let go of their inhibitions.*

What Did the Students Comment on That They Liked Best about This Training?

> *They liked the activities, especially the relaxation and the visualisation.*
>
> *The practical ideas that helped them particularly with revision, for example the 2,4,8 technique, the strategies that they could relate too most easily due to their exams being imminent.*
>
> *Students commented on the positive effect of the breathing exercise and progressive muscular relaxation. Some students liked the values questionnaire and tried linking their core values to targets/activities they find particularly hard to stick at, others were struggling to make that link.*
>
> *I think the biggest comment came about from the investment – especially the idea that this was something new and they were trialling it. I also think they liked the idea of someone new (initially) taking the sessions – someone they didn't know.*
>
> *The students seemed to like strategies that could directly link to helping them revise or prepare for the exams. Techniques for dealing with exam stress/*

anxiety seemed particularly popular. One student commented that they felt the calmest they have ever felt after the relaxation training.

What Techniques from the MENTAL TOUGHNESS Sessions Have Students Been Using (Please Give Examples and State How You Know This)?

In the final lesson when they were asked to discuss how to use the various techniques it was apparent that they had engaged with a number of the techniques and could apply them to scenarios, for example, students talked about stressful situations and how breathing could help them. Also about 50% of the students were sticking to the 2,4,8 activity we had done in a lesson. This was evidenced when I asked students o show their revision in a follow up lesson.

I have had students comment that they have used the breathing exercises (reported after the lesson). Also, some students made comments that they had thought about how to focus during a test.

What Positive Differences Have You Noticed (If Any) in Student Behaviour Since the Sessions?

My year 11 English class have been a lot calmer in assessments where normally they would get quite wound up and anxious.

I have noticed a difference in attitude in two students, AW and GR, more positive generally.

The students' attitude remained positive throughout so it would be difficult to notice any changes in behaviour. I think that these will take place away from the class sessions

Qualitative data was also collected from teachers using a questionnaire.

How Has Being Involved in the Delivery of the Mental Toughness Programme Contributed to Your Professional Development?

The nature of the content of the lessons helped build my own mental toughness. The initial two day session was extremely insightful and enabled me to reflect on things I need to do differently. Delivering the material then pushed me out of my comfort zone and helped me develop confidence.

I've been able to use some of the activities and strategies with individual students in one-to-one sessions regarding motivation and confidence issues.

It has broadened my understanding of how to manage my emotions and stress, which in turn has helped me to be much calmer and less anxious about things

that are not in my control. In terms of professional development, the techniques have been really helpful in the classroom and I have used relaxation and breathing activities in my KS3 music classes.

I have gained invaluable knowledge/understanding of why certain students are so stressed and underachieve and how to help them deal with their stress/lack of confidence and commitment.

What Have You Gained Personally from Being Part of This Programme?

Given my personal scores I am more reflective in terms of my own MENTAL TOUGHNESS. I try out the techniques and use them with others.

I feel more in control with regards to work and find I'm much calmer when under pressing situations that I can't control.

It has given me a variety of strategies to help me cope with stress and lack of confidence etc., some of which I now use on a regular basis.

It has made me increasingly aware of my own mental toughness and how I personally deal with the four areas. It has made me more self-aware and supported me to overcome challenges that have arisen since the training

I have used some of the techniques we were taught personally in my life when dealing with stressful situations. I have particularly thought about the circles of control and the I have also used the breathing techniques with my daughter who doesn't sleep!

How Has MENTAL TOUGHNESS Impacted on Your Teaching Practice Overall?

I have used a number of the strategies with other students I teach and use the theory to inform delivery of tutor sessions.

I have tried to use some of the techniques in KS3 classes before assessments or music performance tasks.

I am going to share relaxation techniques with students in Years 10 & 12 to help them cope in stressful situations (speaking tests).

I don't think it has impacted specifically on teaching – but it certainly has on how I deal with difficult situations in and out of the classroom. I have learned how my behaviour can impact on others and how to curtail or mask this to improve situations.

I've tried to use all the strategies with my teaching practice. Having a Y11 class that has gone through the training makes it much more effective as they have already spent the time learning the strategies.

What Additional Skills Do You Feel You Have Gained?

Teaching MENTAL TOUGHNESS in itself is an additional skill. We all found it challenging, as the concepts are quite high level and very specialised.

Relaxation techniques.

Breathing! Learning to breathe and take a minute to assess situations before making decisions – not really a skill – but definitely something I do more of now.

I don't think I've gained any additional skills but certainly feel I've developed some of the skills I had.

I think being part of the programme has helped me both as a form tutor and as a subject teacher and has given me more confidence when coaching students.

What Are You Doing Differently as a Result?

From a personal perspective, I am operating in a much calmer, more pragmatic way, which I believe is making me more efficient and effective as a result.

Calming myself down in or before stressful situations, suggest the use of these strategies to students with anxiety issues.

I'm continuing to develop my own use of the MENTAL TOUGHNESS skills into my daily life.

I often apply techniques in my personal life and it has given me a greater insight when dealing with young people.

Case Study Conclusion

There has been has been considerable public debate concerning the impact of 'character development' within British schools. The MENTAL TOUGHNESS programme established at the Blue Coat School successfully improved aspects of student's MENTAL TOUGHNESS. We believe that we have developed an effective programme for our context, and hopefully one that will be transferable to other schools.

The head of the year group commented that very early on he realised that sharing this training with Y11 gave him a common language to use with students who were facing difficulties. For example, students with eating disorders, panic attacks, anger issues, and general anxiety, where all able to refer back to aspects of the 4C's model when discussing issues.

It has been excellent to see the positive impact on the MENTAL TOUGHNESS teachers and the desire from other teachers to be involved in the possible

development of the programme in school. Using these lessons we can change the way students respond to the stressors around them. If we can similarly develop tools to foster commitment, this programme will become a significant factor in improving academic attainment; particularly if these tools and techniques are embedded into the culture of the school. We believe that the MENTAL TOUGHNESSQ48 is a reliable and valid test for measuring aspects of 'character' and we hope to continue to develop the programme.

A Summary and Thoughts about What is Next for Mental Toughness in Education?

It is evident that there is a mental toughness advantage in education. Mentally tough pupils and students perform better as a group. It is also, clear that the current system is not particularly conducive for the development of the more sensitive child. Exams and other assessments put them at a disadvantage, and this can lead to a downward spiral of stress and under-performance. A number of educational establishments are developing ways of both improving the mental toughness of individuals and supporting the more sensitive students in their care.

One area of concern that is beginning to receive considerable research attention is the area of transitions. Transiting between the various levels of education is particularly difficult for the more sensitive. It is at these times that individuals are at most risk of disengaging from education. Offering appropriate guidance and support within the context of Mental Toughness may help to improve the situation.

In conclusion, Mental Toughness is one amongst many non-cognitive factors that impact educational effectiveness. It does however offer a broad and unifying perspective that brings many of these other factors under 'one roof'. It is measurable and is open to development. It is the author's view that understanding Mental Toughness is a way of allowing people to reach their full potential and, after all other things are taken into account, is this not the true purpose of all education.

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15. MENTAL TOUGHNESS

Correlates with Educational Outcomes

MENTAL TOUGHNESS: CORRELATES WITH EDUCATIONAL OUTCOMES

In recent years research has increasingly acknowledged the role of non-cognitive factors in educational success. A wide range of non-cognitive factors have been examined, such as resilience, buoyancy, perseverance, self-efficacy, confidence, motivation, and personality. There is substantial evidence that these factors are important, particularly for educational attainment (e.g. Ackerman, Chamorro-Premuzic, & Furnham, 2011; Morrison Gutman & Schoon, 2013; Putwain, Nicholson, Connors, & Woods, 2013; Stankov & Lee, 2014), but also for classroom behaviour (e.g. Bugler, McGeown, & St Clair-Thompson, 2015), and successful educational transitions (e.g. Aikins, Bierman, & Parker, 2005). Within this context, the present chapter is concerned with the concept of mental toughness. Mental toughness is related to how people deal with challenges, stressors and pressure irrespective of prevailing circumstances. There is a comprehensive framework of mental toughness (Clough, Earle, & Sewell, 2002), allowing for the examination of a number of non-cognitive traits. This chapter will begin by describing the mental toughness framework. It will then discuss conceptual similarities with other non-cognitive factors, and propose a number of advantages of adopting the mental toughness framework. The chapter will then review a series of studies which have examined the relationships between mental toughness and educational outcomes and experiences. Finally, the chapter puts forward suggestions for future research and discusses possibilities for designing interventions which aim to enhance children's and adolescents' mental toughness.

THE MENTAL TOUGHNESS FRAMEWORK

Mental toughness describes a construct related to how people deal with challenges, stressors, and pressure irrespective of prevailing circumstances. Historically mental toughness has been studied within the domain of sports, as an attribute of successful athletes (e.g. Bull, Shambrook, James, & Brooks, 2005; Connaughton, Wadey, Hanton, & Jones, 2008; Gucciardi, Gordon, & Dimmock, 2009; Jones, Hanton, & Connaughton, 2007). However, there are numerous competitive and pressured environments that exist outside of sport (e.g. Crust, 2008; Gerber et al.,

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2013). Therefore, mental toughness can be usefully explored within other contexts, including education.

A number of theoretical models of mental toughness have been proposed (e.g. Clough et al., 2002; Coulter, Mallett, & Gucciardi 2010; Fourie & Potgieter 2001; Golby & Sheard, 2006; Golby, Sheard, & van Wersch, 2007; Gucciardi, Gordon, & Dimmock, 2008; Jones, Hanton, & Connaughton, 2002). However, according to the most commonly used model, mental toughness comprises four broad characteristics: commitment, challenge, control, and confidence (Clough et al., 2002). Commitment is defined as the perseverance and ability to carry out tasks successfully, despite problems or obstacles. Those who score high on commitment will set goals and strive to achieve them; indeed they will be determined to complete these goals, despite problems or obstacles they may encounter. Challenge is defined as seeking out opportunities for self-development. Those who score high on challenge will see new situations as opportunities for self-development, rather than as threats. Control refers to being influential in one's own life and is subdivided into life control and emotional control. Those high in life control will feel that they have the power to shape their own life and future, while those with high emotion control will be able to manage their emotions in difficult situations and to regulate their emotions to an appropriate level of intensity. Finally, confidence refers to levels of self-assurance and is divided into confidence in abilities and interpersonal confidence. Individuals who are confident in their abilities will feel confident at attempting new or difficult tasks, whereas those with high levels of interpersonal confidence will feel confident in social situations. All four components can be regarded as positive psychological traits which can be developed, given the right support, encouragement and environment.

Alongside this model of mental toughness, Clough et al. (2002) developed the Mental Toughness Questionnaire 48 (MTQ48). This has emerged as the most commonly used measure of mental toughness in the existing literature (Gucciardi, Hanton, & Mallett, 2012). The questionnaire is comprised of 48 items for which respondents agree/disagree on a 5-point Likert-type scale (ranging from 'I disagree strongly' to 'I agree strongly'). Studies have reported suitable reliability and validity of the questionnaire for use with adult and adolescent samples (Clough et al., 2002; Crust & Swann, 2011; Perry, Clough, Crust, Earle, & Nicholls, 2013; St Clair-Thompson, Bugler, Robinson, Clough, McGeown, & Perry, 2014).

CONCEPTUAL SIMILARITIES WITH OTHER NON-COGNITIVE FACTORS

Mental toughness clearly overlaps with a number of concepts that have proved useful within educational settings. Here we will discuss links between mental toughness and resilience, buoyancy, perseverance, self-efficacy, confidence, motivation and personality. The conceptual overlap between mental toughness and each of these other constructs is also summarised in Table 1.

Table 1. The definition, conceptual overlap and published research findings relating to each subcomponent of mental toughness

Mental toughness construct	*Definition*	*Conceptual similarities*	*Evidenced educational outcomes*
Commitment	The perseverance and ability to carry out tasks successfully, despite problems or obstacles	*Resilience* *Buoyancy* *Perseverance* (grit) *Motivation* (achievement goal theory and self-determination theory) *Personality* (conscientiousness)	Undergraduate students' psychological well-being (Stamp et al., 2015) Adolescents' classroom behaviour (St Clair-Thompson et al., 2014, study 2)
Challenge	The preference for challenging tasks, and tendency to seek out opportunities for self-development	*Perseverance* (engagement) *Perseverance* (grit) *Self-efficacy* *Motivation* (self-determination theory)	
Control of life	The feeling of being influential in one's own life and having the power to shape one's own life and future	*Motivation* (achievement goal theory and self-determination theory) *Personality* (conscientiousness)	Undergraduate students' grades and progression (Crust et al., 2014) Adolescents' school attainment and attendance (St Clair-Thompson et a., 2014, study 1) Adolescents' classroom behaviour (St Clair-Thompson et al., 2014, study 2)
Control of emotion	The ability to manage one's emotions in difficult situations, and to regulate emotions to an appropriate level of intensity	*Resilience* *Buoyancy* *Perseverance* (engagement)	

(Continued)

Table 1. (Continued)

Mental toughness construct	*Definition*	*Conceptual similarities*	*Evidenced educational outcomes*
Confidence in abilities	Self-assurance, and associated confidence at attempting new or difficult tasks	*Resilience* *Self-efficacy* *Confidence* *Motivation* (expectancy value theory)	Undergraduate students' psychological well-being (Stamp et al., 2015) Adolescents' peer relationships (St Clair-Thompson et al., 2014, study 3)
Confidence-interpersonal	The feeling of being confident or not intimidated in social situations	*Resilience*	Undergraduate students' grades and progression (Crust et al., 2014) Adolescents' peer relationships (St Clair-Thompson et al., 2014, study 3)

Resilience

Mental toughness aligns closely with resilience, referring to the ability to adapt effectively in situations of adversity or stress. Within an educational environment this may include responding to adversities resulting from disadvantaged backgrounds (e.g. Yaeger & Dweck, 2012), or to more everyday academic pressures such as poor performance or test anxiety (Putwain et al., 2013).Some approaches view resilience as a process in which environmental influences serve as risk factors or protective factors (e.g. Coleman, 2015; Egeland, Carlson, & Sroufe, 1993). These factors include supportive relationships with teachers, family factors including parental concern, and school factors such as pro-social skills training. They also acknowledge student characteristics such as self-esteem, motivation, and accepting responsibility (e.g. Coleman, 2015; Mullis, Rathge, & Mullis, 2003). Other approaches to resilience focus entirely on these individual characteristics, acknowledging a role for self-efficacy, control, planning, composure, and persistence (e.g. Martin & Marsh, 2006). Each approach has evidenced relationships between resilience and academic outcomes, including attainment (e.g. Mullis et al., 2003; Putwain et al., 2013). Mental toughness relates most closely to approaches focussing on attributes of the individual. It is suggested that resilient students are typically better at controlling negative emotions, persisting with tasks, and maintaining a belief in their ability.

These attributes align with emotional control, commitment, and confidence within the mental toughness framework.

Buoyancy

Mental toughness is also similar to the concept of academic buoyancy, referring to a capacity to overcome academic setbacks and challenges which occur in everyday life. This might, for example, include meeting upcoming deadlines or completing a difficult piece of work (Martin & Marsh, 2006, 2008, 2009; Putwain, Connors, Symes, & Douglas-Osborn, 2012). What distinguishes buoyancy from resilience is the severity of the challenge or setback; resilience typically refers to the ability to respond to major challenges or setbacks, while buoyancy refers to less severe but more frequent challenges (Martin & Marsh, 2008). Resilience therefore applies to a relative minority of students, whereas buoyancy applies to them all (Martin & Marsh, 2009). Academic buoyancy has been related to attainment (Martin, 2014; Collie, Martin, Malmberg, Hall, & Ginns, 2015), and also motivational and emotional outcomes such as greater persistence (Martin, Colmar, Davey, & Marsh, 2010) and lower anxiety (Martin, Ginns, Brackett, Malmberg, & Hall, 2013). When applied in an educational context, mental toughness may be similar to buoyancy in terms of referring to everyday rather than major challenges. Similar to buoyancy, mental toughness is also characterised by commitment and low anxiety levels (e.g. Clough et al., 2002). Thus it seems reasonable to suggest that the conceptual overlap with buoyancy relates particularly to the mental toughness subcomponents of commitment and emotional control.

Perseverance

Components of mental toughness, in particular commitment, also overlap with the concept of perseverance. Morison Gutman and Schoon (2013) discussed two manifestations of perseverance; engagement and grit. Engagement refers to how student behave, think and feel regarding their commitment to school, thus having behavioural, cognitive and emotional components (e.g. Fredericks, Blumenfeld, & Paris, 2004). Behavioural engagement refers to involvement in academic tasks, including behaviours such as effort, persistence, concentration, attention, asking questions, and contributing to class discussions (Birch & Ladd, 1997). Cognitive engagement is concerned with psychological investment in learning, a desire to go beyond the requirements, and a preference for challenge (Connell & Wellborn, 1991). Finally, emotional engagement refers to managing interest, boredom, happiness, sadness, and anxiety (e.g. Skinner & Belmont, 1993). There is substantial evidence for relationships between engagement and academic outcomes, including attainment, school drop-out, and school transitions (e.g. Fredericks et al., 2004; Vasalampi, Salmela- Aro, & Nurmi, 2009).With reference to the mental toughness

framework, mental toughness appears to overlap with both cognitive and emotional aspects of engagement in particular. The preference for challenge as a hallmark of cognitive engagement (Connell & Wellborn, 1991) is captured in the challenge subcomponent of mental toughness. In addition, emotional engagement has clear correspondences to control of emotion.

Grit is defined as perseverance for long-term goals, particularly in the face of adversity (Duckworth, Peterson, Matthews, & Kelly, 2007). Researchers have recently suggested that dedication to goals results in more effort being expended to achieve them (e.g. Silvia, Eddington, Beaty, Nusbaum, & Kwapil, 2013). Similar to engagement, grit is a significant predictor of attainment, as well as rule violation behaviour in school, satisfaction with school, and the likelihood of dropping out of education (Duckworth et al., 2007; Duckworth & Quinn, 2009; Eskreis-Winkler, Shulman, Beal, & Duckworth, 2014; Ivcevic & Brackett, 2014). Grit predominantly entails maintaining effort and interest over a long period of time, despite failure and adversity, and also working strenuously towards challenges. It therefore shares some overlap with the commitment and challenge subcomponents of the mental toughness framework.

Self-Efficacy

Sub-components of mental toughness also align with self-efficacy. Self-efficacy refers to beliefs or judgments that people have about their own ability to perform well in a variety of tasks or situations, but particularly in novel or difficult tasks. A substantial amount of research has revealed that self-efficacy is a correlate and predictor of academic attainment (e.g. Caprara, Vecchione, Alessandri, Gerbino, & Barbaranelli, 2011; De Feyter, Caers, Vigna, & Berings, 2012; Stankov & Lee, 2014), even when controlling for other non-cognitive factors such as personality (e.g. Caprara et al., 2011). Self-efficacy is also related to academic motivation (McGeown et al., 2014) and meaningful cognitive engagement (Walker, Greene, & Mansel, 2006). It has also been suggested that children who have higher perceptions of their competence or abilities have a greater preference to engage in challenging learning activities (Boggiano, Main, & Katz, 1988). Self-efficacy therefore aligns most closely with the confidence in abilities subcomponent of mental toughness, but to some degree may also relate to the subcomponent of challenge.

Confidence

Confidence is a non-cognitive factor sharing some similarities with self-efficacy. It refers to a state of being certain about the success of a particular act, usually giving correct responses on a cognitive test. It has been suggested that confidence has the properties of a trait, a disposition to respond in a particular way relative to other individuals (e.g. Stankov, Lee, Luo, & Hogan, 2012). What distinguishes confidence from self-efficacy however, is that confidence is a general trait. In contrast, self-

beliefs or self-efficacy appear to be domain-specific (Stankov, 2013; Stankov et al., 2012). Confidence also commonly relates to a task that has just been completed, in comparison to self-efficacy which usually refers to tasks to be completed in the future. Recent research has made a convincing argument for the potential for confidence to be the strongest non-cognitive predictor of academic achievement (Stankov, 2013; Stankov & Lee, 2014; Stankov et al., 2012; Stankov, Morony, & Lee, 2014). In this research, confidence has been compared to other psychological traits such as motivation and attitudes, and has been found to be more closely related to attainment using data from large international studies (Lee & Stankov 2013). This concept, similar to that of self-efficacy, shares some overlap with the mental toughness concept of confidence in abilities.

Motivation

Motivation is the study of why individuals think and behave as they do (Morrison-Gutman & Schoon, 2013). There are a number of different theories of motivation (e.g. see Eccles & Wigfield, 2002), including achievement goal theory, expectancy-value theory and self-determination theory. Achievement goal theory proposes that student's reasons for engaging in academic work relate to having a mastery goal orientation (focused on gaining competence in a subject area) or a performance goal orientation (focused on demonstrating competence). Mastery goals are associated with academic attainment (Harackiewicz, Barron, Carter, Lehto, & Elliot, 1997; Harackiewicz, Barron, Tauer, & Elliot, 2002), and adaptive behaviours such as task involvement, challenge seeking, and deep processing of course materials (e.g. Meece, Anderman, & Anderman, 2006). Morrison-Gutman and Schoon (2013) argue that a mastery goal orientation is equivalent to a growth mindset (Dweck, 2006), that is, a belief that you can increase your ability through your own efforts. This theory of motivation would therefore appear to align with the mental toughness subcomponents of life control and also commitment. Other theories of motivation, however, relate more to confidence in abilities. Expectancy-value theory suggests that motivation arises from expectations of success along with perceived value of a task. Both of these factors have been found to be important predictors of educational outcomes (Anmarkrud & Braten, 2009; Eccles & Wigfield, 2002; Wigfield & Eccles, 2000). Expectations of success aligns closely with confidence in abilities from the mental toughness framework.

Self-determination theory (Deci & Ryan, 1985) identifies differences between intrinsic and extrinsic motivation. Intrinsic motivation refers to the desire to engage in a task to develop skills or because it is inherently interesting and enjoyable, whereas extrinsic motivation refers to the desire to engage in a task to receive external rewards, such as recognition or grades. The former type of motivation is considered to be more autonomous and not controlled by external factors; as such, individuals feel they have a sense of power and control over their decisions. Intrinsic motivation has been found to be beneficial for academic success (Lepper, Corpus, & Iyengar,

2005; Soenens & Vansteenkiste, 2005; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). In contrast, some studies have revealed that extrinsic motivation is inversely related with attainment (Lepper et al., 2005; Ratelle, Guay, Grossi, & Simonsson- Sarnecki, 2007). Within this theory of motivation, intrinsic motivation aligns with the concepts of challenge (an internal desire to develop abilities) and commitment (setting of own goals) from the mental toughness framework. Intrinsic motivation may also be more common in individuals scoring high on life control (those who feel a sense of autonomy).

Personality

Mental toughness, as conceptualised by Clough et al. (2002), may also share some commonalities with aspects of personality. The dominant conceptualisation of personality within the field of education is the five-factor model (McCrae & Costa, 1997). This model proposes that personality comprises Neuroticism, Extraversion, Openness to experience, Agreeableness and Conscientiousness. Many studies have evidenced the importance of personality for academic success (e.g. Ackerman et al., 2011; O'Connor & Paunonen, 2007; Poropat, 2009). These studies have particularly emphasised the role of conscientiousness (e.g. O'Connor & Paunonen, 2007), for both general attainment as well as more narrow indicators of success such as single exam grades (e.g. Chamorro-Premuzic & Furnham, 2003). However, it is important to note that this theory proposes a personality hierarchy, with the five major components residing at the highest level. A different approach to the study of personality within education has been to investigate narrow traits, residing at a lower level of the model. For example, narrow traits that reside under the heading of conscientiousness include achievement-striving, competence, deliberation, dutifulness, order and self-discipline (O'Connor & Paunonen, 2007). An important issue is related to the relative predictive utility of the big five factors and their constituent narrow traits. Research has suggested that lower-level traits can be even more powerful predictors that the big five (Chamorro- Premuzic & Furnham, 2003; O'Connor & Paunonen, 2007; Paunonen & Ashton, 2001).

Horsburgh Schermer, Veselka, and Vernon (2009) examined relationships between mental toughness and the big five personality factors. Positive correlations were observed between each component of mental toughness and extraversion, openness, agreeableness, and conscientiousness. There were negative correlations between each aspect of mental toughness and neuroticism. More recently, it has been suggested that mental toughness may in fact be a narrow personality trait (e.g. St Clair-Thompson et al., 2014). In this way mental toughness may be similar to grit, proposed as a lower-level trait in the domain of conscientiousness (Duckworth et al., 2007). The aspects of mental toughness which would appear to be most closely related with conscientiousness are commitment and control of life. However, due to the multifaceted nature of mental toughness, it is perhaps better to view mental toughness as a set of independent but related traits (e.g. McGeown, St

Clair- Thompson & Clough, 2015). More work is therefore needed to develop a clear understanding of how the subcomponents of mental toughness relate to existing conceptualisations of both broad and narrow personality traits.

ADVANTAGES OF THIS FRAMEWORK

As discussed in the previous section, there is conceptual overlap between the mental toughness framework and other non-cognitive factors studied within educational settings. The mental toughness framework brings together quite different concepts, enabling a relatively comprehensive approach. McGeown et al. (2015) suggested a number of advantages of this mental toughness framework over some of the other mental toughness models. For example, it has been successfully used in sport, business, learning, mental health, and education, and both within research and applied settings. The mental toughness framework also allows the parallel study of several non-cognitive attributes and has a well validated and reliable measure of mental toughness – the MTQ48 (Perry et al., 2013). In addition, the use of sub-components (commitment, challenge, life control, emotional control, interpersonal confidence and confidence in abilities) affords the possibility to provide focused or targeted intervention and support as necessary. We discuss possibilities for designing interventions which aim to enhance children's and adolescents' mental toughness in a later section.

There may also be advantages in employing the mental toughness framework rather than other non-cognitive factors in educational settings. For example, Gerber et al. (2013) noted that mental toughness is a part of young people's daily speech. Its less academic terminology (i.e. compared to terms such as motivation, self-efficacy, perseverance, etc.) may make this concept more appealing to children and adolescents, particularly those who may be difficult to reach with intervention.

Research using the MTQ48 has also started to investigate possible mechanisms that underpin the "mental toughness advantage". For example Nicholls, Pollman, Levy and Backhouse (2008) found that mentally tough individuals used more problem focussed rather than emotion-focussed coping strategies, a finding supported by Kaiseler, Polman, and Nicholls (2009) in a later study. Problem-focussed strategies target the cause of stress in a practical way. In contrast, emotion-focussed strategies are aimed at emotional responses and may include reappraisal or avoidance. Students who engage in problem focused coping strategies have been found to be more motivated, and perform better than students who engage in emotion focused coping strategies (Struthers, Perry, & Menec,2000). In addition, Crust and Azadi (2010) reported that mentally tough individuals were more likely to use psychological strategies such as relaxation, positive self-talk and emotional control. These are all types of skills that can be taught and developed. Recent research has also explored potential cognitive underpinnings of the mental toughness advantage. Dewhurst, Anderson, Cotter, Crust and Clough (2012) showed that mentally tough individuals were better able to suppress irrelevant information when learning new

information. Therefore enhanced memory skills that allow for the better suppression of unwanted information may offer a way of building toughness through a cognitive process intervention.

McGeown et al. (2015) also noted that a potential reason for adopting the mental toughness framework in education is the fact that Clough et al. (2002) discuss degrees of mental toughness. The opposite of mental toughness is not mental weakness, but rather mental sensitivity. While mentally tough individuals may be better able to deal with high-pressure environments, which may confer advantages in sports, work or school, a balanced society needs both the sensitive and the tough (Clough & Strycharczyk, 2012). The challenge for education is to foster an environment that enables both the tough and the sensitive to fully meet their potential. For example, it would be expected that the mentally tough would prosper in an exam heavy system, such as that adopted increasingly in the UK. This may not necessarily be the case for other educational environments and systems.

RESEARCH FINDINGS

To date there are few studies in the peer review literature concerned with mental toughness in education. However, the number of studies is growing and thus we are starting to develop an understanding of the role of mental toughness within this domain. One published study examined mental toughness in relation to achievement and progression in first year undergraduate students in the UK. Crust, Earle, Perry and Earle et al. (2014) found significant correlations between each subcomponent of mental toughness, grades, and progression. In further analysis the subcomponents of life control and interpersonal confidence emerged as being particularly important. The authors suggested that a measure of mental toughness could be a useful tool for identifying students at risk of failing and dropping out of undergraduate study. Other published research examining mental toughness in undergraduate students has focussed on psychological well-being. Stamp, Crust, Swann, Perry, Clough, and Marchant (2015) revealed that each subcomponent of mental toughness was correlated to students' psychological well-being (see also Gerber et al., 2012). Further analyses then revealed particular roles for commitment and confidence in abilities.

In work carried out by our own research group, we have explored mental toughness in children and adolescents. In St Clair-Thompson et al. (2014) we reported a series of three separate studies. In the first we examined relationships between mental toughness, attainment and attendance in adolescents aged 13–15 years. Challenge, commitment and control of life were significantly related to attainment. Each subcomponent of mental toughness with the exception of interpersonal confidence was significantly related to attendance. Further analyses revealed a particular role for control of life in both attainment and attendance. Figure 1 (a and b) shows the attainment and attendance of individuals with high and low control of life, categorised on the basis of a median split. Study 2 examined the

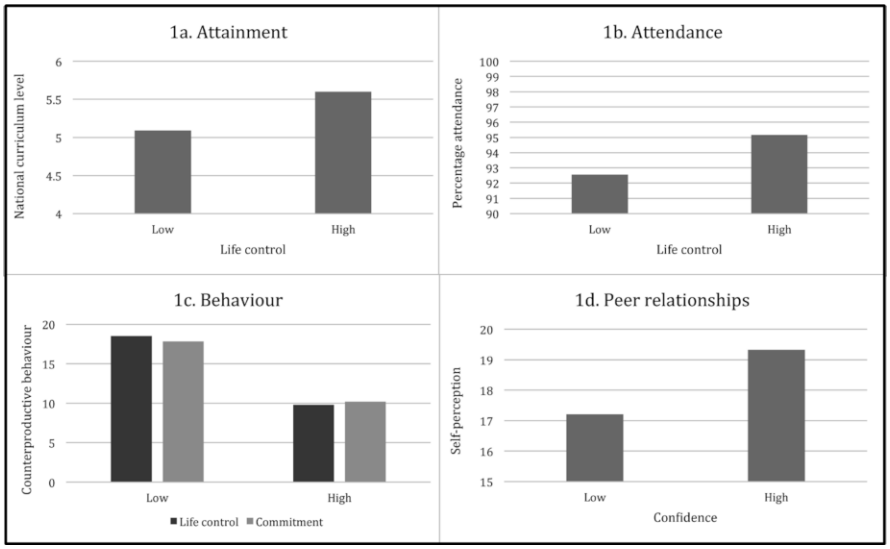

Figure 1. Educational outcomes and experiences of individuals with differing levels of mental toughness

associations between mental toughness and adolescents' counterproductive classroom behaviour. Adolescents aged 11–16 years completed the MTQ48, and their teachers completed a Conners' Teachers Rating Scale for each child. Each subcomponent of mental toughness, with the exception of confidence in abilities, was significantly negatively related to counterproductive behaviour. Regression analyses revealed particular roles for the subcomponents of commitment and control of life. Figure 1 (c) shows the levels of counterproductive behaviour in individuals with high and low levels of commitment and control of life respectively. Finally, in study 3 we explored the relationships between mental toughness and adolescents' peer relationships. Pupils aged 11–13 years completed the MTQ48, and provided ratings of their peer relationships, and the extent to which they liked to play and work with each of their classmates. Each subcomponent of mental toughness, with the exception of commitment, was related to self-perceptions of peer relationships. In further analyses both aspect of confidence were revealed as important predictors of peer relationships. Figure 1 (d) shows levels of self- perceptions of peer relationships in individuals with high and low levels of overall confidence. As a summary of the information provided thus far, the educational outcomes and experiences which have been linked to each subcomponent of mental toughness, along with the conceptual similarities of each component are summarised in Table 1.

In recent work, we have also explored the relationships between mental toughness and educational transitions (St Clair-Thompson, Giles, McGeown,

Putwain, & Clough, submitted). Moving from primary to secondary school is known to involve many changes, including to learning environments, academic expectations, and social interactions (e.g., Anderson, Jacobs, Schramm, & Splittgerber, 2000). Adjusting to these changes can be anxiety provoking and difficult to negotiate (e.g., Tobbell, 2003; Zeedyk et al., 2003). One hundred and five pupils aged 12–13 years, who were about to undergo the transition from middle to high school, completed the MTQ48 along with a measure of their concern about the upcoming school transition. There were significant correlations between each subcomponent of mental toughness and school concerns, but regression analysis revealed that the most important aspect of mental toughness was confidence in abilities. A second study examined the relationships between mental toughness and self-reported adjustment to undergraduate study. Each aspect of mental toughness with the exception of challenge was shown to be a predictor of adjustment.

These findings have important implications for educational practice. They suggest that interventions aimed at enhancing mental toughness have the potential to have widespread effects, perhaps benefitting attainment, attendance, behaviour, peer relationships, well-being, and successful educational transitions. The results suggest that interventions targeting control of life would be particularly beneficial for attainment, attendance, and behaviour of adolescents at school. Interventions targeting commitment may be most beneficial for behaviour, well-being, and successful transitions, and those targeting confidence may be helpful for well-being and peer relationships.

The research so far has therefore started to evidence the mental toughness advantage. Individuals higher in mental toughness are likely to attain higher grades during both school and undergraduate study, display less counterproductive behaviour, have better peer relationships, have higher levels of well-being, and deal better with educational transitions. As suggested earlier, research in domains other than education has also started to identify possible mechanisms that may underpin this mental toughness advantage, including coping (e.g. Nicholls et al., 2008) and the ability to inhibit irrelevant information (Dewhurst et al., 2012). However, there are several other areas of education in which evidencing a role for mental toughness could have some value, and further research is needed to explore potential mechanisms underlying the mental toughness advantage in the domain of education. Research is also needed to examine potential methods of developing mental toughness. These issues are discussed in the following sections.

AVENUES FOR FUTURE RESEARCH

McGeown et al. (2015) discussed four diverse areas in which mental toughness research may have some value, in order to illustrate its varied application. The study of mental toughness as it relates to academic attainment, test anxiety, academic stress, and peer relationships in a school context were considered. However,

numerous other areas are likely to provide fruitful for future study. Nevertheless, here we discuss these four potential avenues, as well as considering the need for future research into the mechanisms that may underpin the mental toughness advantage, thus allowing a better understanding of both the determinants and consequences of mental toughness.

Academic Attainment

As acknowledged in the introduction, there is a growing body of evidence demonstrating the importance of non-cognitive factors for academic attainment (e.g. Morrison Gutman & Schoon, 2013). Studies have evidenced the ability of mental toughness to predict attainment in secondary school (St Clair-Thompson et al. 2014) and during undergraduate study (Crust et al., 2014). These studies revealed important roles for control of life and interpersonal confidence in particular. However, other components of mental toughness could also be important. Challenge may be important, as those who seek out challenging activities will likely set higher academic goals and thus have greater opportunity to achieve more academically. Those scoring higher on commitment may also be more likely to persevere to achieve higher levels of academic attainment. In addition, confidence inabilities may be important, because those students who have higher perceptions of their competence are likely to engage more in challenging learning activities (e.g. Boggiano et al., 1988). In the published research, only broad measures of attainment were used; teacher ratings of children's progress according to the national curriculum in the UK, and average grade during the first year of University. A more detailed examination of the role of mental toughness in attainment may therefore be useful. This could, for example, differentiate between exam and coursework grades, as has been the case in research into personality (e.g. Chamorro-Premuzic & Furnham, 2003). Alternatively, it could examine attainment in different subject areas, perhaps along with perceived difficulty of those areas.

Test Anxiety

Several studies have demonstrated a relationship between test anxiety and lower test performance (e.g. Putwain, 2008; Putwain, Connors, & Symes, 2010). McGeown et al. (2015) discussed the potential for mental toughness to provide a buffer against the negative influence of test anxiety. In a recent study by Putwain et al. (2013), higher levels of resilience were found to predict lower test anxiety and higher test scores. Indeed, resilient students would be predicted to experience lower test anxiety, which may then enable them to perform under pressured situations, such as during tests. Several other non-cognitive factors have also been related to levels of test anxiety, including self-esteem (Croyle, Weimer, & Eisenman, 2012; Hembree, 1988), academic buoyancy (Putwain & Daly, 2013), motivation (Putwain & Symes,

2012), and personality (Chamorro- Premuzic, Ahmetoglu, & Furnham, 2008). Future research should therefore examine mental toughness in relation to test anxiety and test performance.

Academic Stress

Academic stress has been studied in secondary school pupils (e.g. Banks & Smyth, 2015; Liu, 2015; Liu & Lu, 2011) and within higher education (e.g. Del-Ben et al., 2013). Research shows that students in more academically challenging programmes tend to report higher levels of stress than other students (Suldo, Shaunessy, & Hardesty, 2008). In particular, a significant body of research has examined academic stress among medical students (e.g. Del-Ben et al., 2013; Park et al., 2012; Voltmer, Lotter, & Spahn, 2012). Academic stress can influence academic attainment (e.g. Kaplan, Liu, & Kaplan, 2005; Liu & Lu, 2011), and has also been found to be an important predictor of anxiety and depression (e.g. Del-Ben et al., 2013). Research has therefore examined factors which may be related to student stress levels. These include higher levels of self-esteem (e.g. Schraml, Perski, Grossi, & Simonsson- Sarnecki, 2011), academic self-image (Banks & Smyth, 2015), better academic motivation (e.g. Park et al., 2012), and a hardy personality (Hystad, Eid, Laberg, Johnsen, & Bartone, 2009). As mental toughness has been shown to act as a resilience resource when confronted with pressure or stress (e.g. Crust, 2008; Gerber et al., 2013), it may be a useful support within this context.

Peer Relationships and Bullying

Peer relationships are important for a number of aspects of children's development (e.g. Parker, Rubin, Price, & DeRosier, 1995). In recent years, the subject of bullying in school has also received increased attention (e.g. Hansen, Steenberg, Palic, & Elklit, 2012; Juvonen & Graham, 2014). As described earlier, St Clair-Thompson et al. (2014) found significant relationships between mental toughness and peer relationships. Specifically, there were relationships between a student's interpersonal confidence and the extent to which classmates reported wanting to play with them, and between both interpersonal confidence and confidence in abilities and self-perceptions of social acceptance. Research has not yet examined mental toughness in the context of bullying. Theoretically, the mental toughness sub-components most likely to predict the ability to deal successfully with bullies may be life control, emotional control, and interpersonal confidence. Children and adolescents with high levels of life control feel that they have the ability to shape their own life, so may attribute less importance to the actions of others, thus minimising the effects of peer victimisation. Children and adolescents high in emotional control

will be able to manage and regulate their emotions, which may well be advantageous if dealing with peer conflict. Those high in interpersonal confidence are likely to find it easier to get along with others, thus having successful peer relationships. Hansen et al. (2012) also suggested that an important factor in dealing with bullying is negative affectivity, a personality trait characterised by emotional reactivity and low self-confidence, which would appear to share some links with mental toughness. Therefore mentally tough individuals may be better able to deal with the effects of peer victimisation, and in fact may be less likely to perceive that they are being bullied, due to dismissing the behaviour or actions of others and not feeling bullied or threatened by that behaviour. Future research could therefore examine mental toughness in the context of bullying.

Mediating Factors

As suggested earlier, research in domains other than education has started to identify possible mechanisms that may underpin the mental toughness advantage. However, in order to further develop our understanding of mental toughness within an educational context, further research is needed to explore potential reasons for the mental toughness advantage within this domain. One potential factor that has already been discussed is that of test anxiety. It may be the case that students with higher levels of mental toughness experience less test anxiety, allowing them to perform well in examinations and thus gain higher grades. Another factor is that of motivation. It is well established that intrinsic motivation is beneficial for academic success (Lepper et al., 2005; Soenens & Vansteenkiste, 2005). It was suggested earlier that intrinsic motivation may align with the concepts of challenge, commitment, and life control. It may therefore be the case that individuals scoring highly in each of these domains are better able to maintain levels of intrinsic motivation, thus achieving higher grades. Another factor that could be explored in future research is learner autonomy. It is frequently suggested that educational success, particularly in higher education, requires students to become autonomous learners (e.g. Macaskill & Taylor, 2010). This is a described as the ability to acquire knowledge and skills independently, by processes that he/she determines (Chene, 1983). It could be the case that mentally tough individuals are more autonomous learners. For example, those scoring high on life control feel that they have the power to shape their own lives, perhaps resulting in taking more responsibility for their own learning. Other factors that could potentially contribute to the relatively good performance of those with high mental toughness include more adaptive approaches to learning (e.g. Entwistle & Peterson, 2004) and study skills (e.g. Jansen & Suhre, 2010). Therefore future research is needed to examine mental toughness in relation to important educational outcomes and experiences, but also to examine factors which may underlie the better performance of those who are mentally tough.

ENHANCING MENTAL TOUGHNESS

Within the mental toughness framework, challenge, commitment, control and confidence can be regarded as positive psychological traits which can be developed, given the right support, encouragement and environment (e.g. Crust & Clough, 2011; Gerber et al., 2013). Indeed, Horsburgh et al. (2009) revealed that nearly 50% of individual differences in mental toughness are attributable to unique environment effects. Crust and Clough (2011) suggested that in a sports setting, parents and coaches of young athletes are likely to be crucial in cultivating the correct environment for mental toughness to flourish. They also proposed that individuals must be exposed to (rather than sheltered from) challenging situations which allow personal resources such as coping skills to be developed through problem solving. Indeed, outdoor adventure programmes (sometimes termed wilderness programmes) which develop, among other things, mental toughness type characteristics, have been found to produce positive effects on a range of outcomes, for example self-esteem, locus of control and school attendance (Cason & Gillis, 1994).

Interventions targeting mental toughness have been employed with sports settings. For example, Sheard and Golby (2006) evaluated the effects of a program consisting of goal setting, visualisation, relaxation, concentration, and thought stopping skills. It was found to result in significant increases in mental toughness in a group of athletes. Other work has theorised about a number of strategies which may enhance components of the mental toughness framework in domains outside of sport. Strycharczyk and Clough (2014) suggested that interventions fall into broad categories: positive thinking, visualisation, anxiety control, attentional control and goal setting. Some of these interventions have been used to enhance other non-cognitive factors in education. For example, there is substantial evidence that domains of self-concept can be improved, particularly through the use of praise and positive feedback (e.g. Craven, Marsh, & Debus, 1991; O'Mara, Marsh, Craven, & Debus, 2006). There is also evidence that interventions can improve motivation and engagement. Martin (2008) reported a study in which participants took part in a self-complete program of activities, allowing them to reflect upon various aspects of their motivation. This included engaging in positive thinking, for example by identifying their strengths and talents in each area. Significant improvements in motivation and engagement were observed. Several types of strategies have also been used to reduce test anxiety, including engaging in positive thinking (Nelson, Webster, & Ashley, 2010), but also looking ahead in an exam (Mavilidi, Hoogerheide, & Paas, 2014), and practicing retrieval of items from memory (Agarwal et al., 2014).

As yet research has not explored mental toughness interventions within educational settings. However, given the relationships between mental toughness and various educational outcomes and experiences, interventions have the potential to have widespread effects. The use of the sub-components (commitment, challenge, life control, emotional control, interpersonal confidence and confidence in abilities)

affords the possibility to provide focused or targeted intervention, and the potential to enhance mental toughness is likely to be a topic that captures much attention in the near future.

CONCLUSION

In this chapter we discussed the concept of mental toughness, describing its definition, conceptual overlap with other non-cognitive attributes and correlates with educational outcomes. The study of mental toughness in education is still in its infancy; more research is necessary to fully understand the determinants and consequences of the attributes described within this framework. While experimental and intervention research will allow a better understanding of the transfer effects from mental toughness to educational outcomes, there is arguably still considerable merit in developing mental toughness attributes in their own right (i.e., as positive non-cognitive characteristics), regardless of their potential benefits to specific educational outcomes.

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16. IT IS NOT ABOUT "BEING BEST IN THE WORLD" … IT IS ABOUT "BEING BEST FOR THE WORLD"

INTRODUCTION

This chapter focuses on the psychosocial non-cognitive elements of children's early years learning, reported in the perceptions of educators, principals and teachers, working in Catholic Singapore preschools. The chapter commences with an introduction of the context for the study. A review of the literature on values based social conventions for children, non-cognitive elements of children's early years learning, follows. Next, the mixed method methodology is described. Findings are presented and discussed. The chapter closes with a discussion on the limitations, future directions, and implications of the study. The research reported in this chapter is part of a larger five year character education research project conducted in Catholic (Singapore) preschools.

The island state of Singapore, with a landmass of 682.7 square kilometres, is seen as an economic giant in the Southeast Asia's region. It has a democratically elected government that is based on the Westminster system. Singapore is a culturally diverse city-state where its citizens and permanent residents comprise Chinese (~74.3%), Malay (~3.3%), Indian (~9.1 %) and Eurasian/others (3.3%), and ethnicities living harmoniously together. Non-permanent residents (~29.2%) represent foreigners living, studying or working in Singapore (Yearbook of Statistics, 2015). School is conducted in English, with children learning both in English and in their 'mother tongue': Mandarin, Tamil, or Malay.

With its endorsement of democratic doctrines including individualism, autonomy and free will, Singapore is influenced by cultural variability, reflective of an individualism-collectivism continuum. Singapore's model of socialization is grounded in Confucian ethics and individualism, reflective of subservience to family and authority, personal freedom, autonomy, and self-containment. This perceived dichotomy has stimulated considerable research (Miller, 2002; Voronov & Singer, 2002), with McInerney and Liem (as cited in Burton, Westen, & Kowalski, 2009) upholding, that the individualist-collectivist separation is being replaced with a worldview "that all cultures have many of these values in combination" (p. 808).

In Singapore, there is a ministerial directive that character education form an integral part of the school curriculum. In 2011, Mr Heng Swee Keat, Minister for Education (Singapore) identified four key attributes of a learner-centric, values-

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driven education focusing on student engagement, the school as an effective environment, the teacher as a caring educator, and parents as supporting partners. Highlighting the important role of the principal in acting as a catalyst and leader in inspiring education, Keat (2011) elaborated that in order for this to be achieved, the principal needs to focus on two strategic areas: nurturing of children and promoting the ongoing professional development of their staff. As an effector leader the principal needs to be grounded in the conviction that education is vital; it is a holistic venture that encompasses both cognitive and non-cognitive learning. Only by believing in the uniqueness of individual children will educators inspire children to be unique, self-directed, engaged, active, inquisitive, reflective and competent learners. Through this process, the principal creates, leads and managers teaching and learning environments that strengthens the professional knowledge and competence of teachers, deepening their pedagogical skills and understanding.

Achievement in Singapore's early childhood education and care (ECEC) settings is equated with building a strong foundation for healthy and productive living as global citizens. "To be future-ready, our young need to be able to think critically, assess options and make sound decisions. They should have a desire to learn, explore, and be prepared to think outside of the box" (Nurturing our Young for the Future, Competencies for the 21st Century, MOE, 2010, as cited in Ministry of Education, 2012 Nurturing Early Learners. A Curriculum Framework for Kindergartens in Singapore, p. 11). This statement challenges educators' mind-sets, moving from environments of fear, punishment, negativity and external control, toward environments based on values including esteem, appreciation, cooperation, thoughtfulness, and perseverance. Within the ECEC context, the first step in this process is engagement in repeated moral experiences with children developing their understanding, skills, and capacity of behaving in accordance with values based social conventions.

Non-cognitive skills including social competence, emotion knowledge, and emotional regulation, have been "elevated to playing a central role in national curricula" of countries including Singapore, Korea, Finland, and the United Kingdom, "fuelled, in part, by a new understanding that these skills are critical in the global economy" (Lipnevich & Roberts, 2012, p. 173). Researchers are examining these domains as essential elements of children's schooling, including their readiness, attitude, adjustment, participation, achievement, and success (Crede & Kuncel, 2008; Denham et al., 2012; Lipnevich & Roberts, 2012; McClelland et al., 2007; Trentacosta & Izard, 2007).Children having difficulties with confidence, assertion, self-efficacy, self-control, social problem solving, and teamwork "may not have the personal resources to focus on learning, whereas those who can maintain a positive emotional tone might be able to remain positively engaged with classroom tasks" (Denham et al., 2012, p. 248).

Non-cognitive skills including social skills, emotional control, attitudes, conscientiousness, academic discipline, and study habits, have been linked to educational processes and outcomes (Lipnevich & Roberts, 2012; Spector & Kim,

2014). Previous research conducted in Singapore (Carter, Frewen, & Chunn, 2014) has identified differences between parents regarding the importance they place on their children learning cognitive skills (problem solving and creativity skills including numeracy and verbal skills) compared with non-cognitive skills (practical and conformity skills including social behaviours, emotions and relationships). The research identified that majority of the parents who participated within the research rated non-cognitive skills as less important than cognitive skills (Carter et al., 2014). However, parents who were older were more likely to report non-cognitive skills are more important than cognitive skills. This relationship was still present when controlling for the gender of the child, and parent ethnicity, gender and occupation (Carter et al., 2014). This small study points out that within Singapore, generally parents do not perceive non-cognitive skills as important for their children to learn. However, as the parents get older, there is recognition that these skills are just as important as cognitive skills.

In studies examining learner engagement, researchers (Hughes & Kwok, 2007; Pianta, Cox, & Snow, 2007) report that children's behavioural engagement alongside educators quality learning experiences are important predictors of early school achievement. Furthermore as McClelland, Acock, and Morrison's (2006) research with 538 children signposts, at kindergarten, learner related skills, including self-regulation, self-responsibility, and social competence, "uniquely predicted reading and math skills between kindergarten and sixth grade after controlling for background variables, such as child IQ, age, ethnicity and maternal education level" (p. 482).

Methodological Framework

Given the literature relating to non-cognitive elements of learning in preschool environments, the researchers were curious to record educators' perceptions of how they work with young children to support their social learning and development. Consequently, the following research questions were investigated:

1. How do teachers promote social norms in their teaching? (Survey)
2. What is the role of the principal in promoting social norms in their preschool? (Focus Group)

The ethical guidelines of the university and the archdiocesan commission for Catholic preschools Singapore were followed with approval for ethical conduct of this research obtained prior to the commencement of the study. The 'captured audience' technique was followed with the survey research, with participant's attending a professional development (PD) workshop, were given the rationale for the survey prior to being invited to participate in the study. The researchers' regarded the survey sample representative of the diocesan preschool employees. The response rate was very high, with all staff attending the PD workshop volunteering to complete the survey.

The audiotaped focus group was conducted with a smaller group of principals, for the purpose of deeper exploration of the issue under examination. An email

advertising the focus group was forwarded to principals by the project officer inviting their anonymous and confidential participation in the project. Principals indicated their willingness to participate in the group, scheduled the final day of the school vacation at the conclusion of the school year. The focus groups ran for approximately 1 hour 30 minutes, and was facilitated by one member of the research team. Once completed, the focus group audiotape was transcribed with participants being asked to review the transcript to maintain trustworthiness of the data.

A comprehensive literature search was unable to locate a survey measure that contained all the items of interest under investigation. Therefore, informed by existing literature on social conventions, social learning, values education a 19 item survey instrument was developed. The instrument included demographic questions (n = 8) and four point Likert-type scale questions (n = 11). The Likert-type scale questions measured the importance of social conventions, social learning and values education ranging from 'Not Important' to 'Very Important', as well as how frequently these concepts were included in the classroom ranging from 'Never' to 'Continually'.

Analysis

The collected survey data was entered into SPSS version 22. Simple exploratory analysis using Person's correlation was conducted to identify relationships between the variables under investigation. Where appropriate, t-tests were used to identify any difference between groups and multiple regression techniques were also used to identify predictive variables. The criterion level of $p < 0.05$ was employed to establish if there were significant differences between the responses of staff and students. A qualitative content analysis was conducted of the data gathered from the responses to the open ended questions in the survey.

The focus group was audio taped and the narrative was transcribed verbatim. Participants were given copies of the transcript to review and verify. The framework for organizing, analysing and reporting patterns of meaning (i.e., themes) across the focus group was thematic analysis. The data was triangulated into themes, aligned with Braun and Clarke's (2006) six phase thematic analysis process (see Table 1).

Table 1. Thematic analysis process

Phase 1: Familiarization with the entire data set
Phase 2: Generating initial data
Phase 3: Searching for themes
Phase 4: Checking identified themes
Phase 5: Refining themes
Phase 6: Writing a scholarly report connected to the research questions and the literature

Source: Braun and Clarke (2006, p. 87)

Participants

A total of 56 female ECEC teachers employed with Singapore Catholic preschools completed the survey with an average age of 47.69 years (*SD* = 11.72, range = 23–66). On average, the participants had been working in ECEC in Singapore for 11.71 years (*SD* = 8.20, range = .5–32), and had been working at their current preschool for 6.44 years (*SD* = 6.72, range = 0–28). The majority of the participants had a Diploma level qualification (66.1%). Other qualification levels reported include Advanced Diploma level (1.8%), Bachelor level (5.4%), and Master level (3.6%). Of the participants, 92.9% reported their nationality as Singaporean, 1.8% as Chinese, 3.6% as Malaysian, and 1.8% as Filipino.

Five principles participated in a focus group with an average age of 45.6 years (*SD* = 6.66, range = 40–55). The participants had been working in ECEC in Singapore for an average of 16.5 years (*SD* = 11.17, range = .5–32) and had been working at their current preschool for an average of 6.3 years (*SD* = 7.09, range = .5–18). All principles reported their nationality as Singaporean. The preschools ranged in total student enrolments and capacity from 72 to 309 with total staff employed ranging from 10 to 16.

Findings

The views of responses have been pooled and are not reported individually. The results from the survey data indicates that preschool teachers within ECEC settings in Singapore are very conscious of teaching non-cognitive skills, such as social behaviour and rules, to the children. Teaching social standards was important as was being consistent and diverse in this teaching. Teachers were aware that having respectful relationships with children was important for providing a safe, productive and peaceful learning and teaching spaces for teacher and children. Overall, the results from the survey are consistent with the results from the focus group.

Survey and focus group data revealed five central themes of practice that reflects the lead management role of principles in character in education and social conventions, and the creator of expectations role of teachers in aligning cultural vision with action; credible professional; purposeful collaborator; astute manager; coaching teacher; and discerning monitor. While participant demographics, ECEC settings and characteristics varied, these themes were common threads enabling participants to intentionally lead manage cultural change targeting values education in their school communicates. The collaborative and responsive nature of the school as a learning organization was evident as participants created systems, processes and practices (principals with teacher and families; teachers with students and families) to raise awareness "about core values that underpin the whole curriculum" (Treston, 2001, p. 54).

Theme A: Credible professional. Participants, as credible ECEC professionals, saw their role as leading cultural change in the school. The vision for the school starts with principal as leader, and all teachers need to buy in to this shared vision. As Helstad and Moller (2013) explained, leadership is "shaped through positioning, negotiations and trust-building, traced in interaction over time" (p. 248).

As leaders, we should be the one to start it and we should be the one to show it to our teachers as role models; to our teachers as well as the children, and also encourage everybody that whoever walks into the gate of St Jude's, every teacher has a share in that child. Every teacher should invest in that child, the total child itself.

I constantly remind the teachers that one of the vision mission in our school is the moral fibre of the child. That is what we have in this school.

It is building that culture constantly by having to support the teachers at the same time.

Children observe respectful relationships in action. As Kolb (1984) explained, "Learning is a process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience" (p. 41).

When I walk into a classroom, it's the teacher that greets me first, "Good morning teacher", and then the children will be influenced. Then the partner, the so-called partner, will always, "Oh good morning teacher"

So among teachers the teacher will say, "Thank you teacher" or "Would you like to have a seat?" or something. So this kind of gesture around among teachers, it actually influence the children.

When I go to class I will tell, "Sorry children. Sorry for taking up your time. I just need a short time with teacher so and so" and when I'm done I say, "Thank you very much"

Person oriented leadership was evident as participants explained how they intentionally highlight psychosocial development in children's ECEC work. This was supported in the survey by 64.3% and 28.6% of teachers respectively reporting that they continually or often focus on social behaviour in their interactions with children. In some instances, this non cognitive developmental focus involved a paradigm change for teachers, moving from an authoritarian style of managing toward a training approach.

I bring that across to my teachers that listening is a skill and the children must be taught, because when you listen you will be able to carry out instructions or whatever. So this listening thing is consciously disseminated to everybody in the school.

Honouring the teacher, was consistently recognized as essential in building professional identity. Treston (2001) concedes this leadership as empowerment, with principals developing "the gifts of each person to attain the goals of the school" (p. 22).

I will say "Teacher so and so will share with you how she carries out when there's incidental.

Principals are sensitive translators, looking for the best in staff; willing to have the tough conversations when a "disconnect" exists between the schools vision and teacher's practice of social conventions. Participants emphasised the importance of respecting their teaching staff where they are, and working with them to grow and develop as they embrace the culture and vision of the school. They acknowledged mistakes happen, with the focus being that teachers, like the children, learn from these mistakes.

So it's never a put down. It's for them to know because, like I said, we bring our knowledge as experience or as an older, like a scaffolding to them, and even with teachers … maybe that teacher is not aware. Maybe they have been using that in the other environment where they come from… (so) to share with them that reason, that compassionate side is very important to me.

Theme B: Purposeful collaborator. Social cognitive theorists including Bandura (2002) maintain that the moral component of social behaviour is affected by the situational context and the role of cognitive processing of social experiences. Learning is a result of observation and imitation of other people, human agency, self-efficacy, vicarious reinforcement, and reciprocal determinism. Central to this theory is social perspective taking, also referred to as role taking skills. Providing children with opportunities for social perspective taking enables children to think "about moral issues from different points of view, predicting the consequences of a person's actions for others and empathising with others" (Sigelman, Rider, & De George-Walker, 2013, p. 360).

Pedagogical practices for instilling values were considered, with educators verbalizing actions of achieving this within their current curriculum. The importance of values education was supported by the survey data with the majority of teachers (76.8%) perceiving that values education is very important. Just over half (55.4%) reported that they continually include values education in their teaching. Interestingly, a significant correlation was found between age and including values education in teaching ($r = .14$, $p < .05$). A multiple regression was performed for the inclusion of values education in teaching as the dependent variable and age as the independent variable. Age explained 17% of the variance in the inclusion of values education in teaching ($\beta = .41$, $p < .05$). Similarly, the majority (83.9%) of the teachers perceived that teaching children social behaviour was very important. However, only 64.3% continually focused on social behaviour in their interactions with children. Age was not found to be correlated with either measure of social behaviour.

Social conventions and moral standards permeated all aspects of the preschools. This was reflected in the schools culture, reflected in purposeful visioning, and enactment. This process of developing a shared understanding of values based social conventions and moral standards was reflected on. Participants demonstrated

a participative leadership style emphasising staff involvement in 'waling the talk'. Collaboration and community were recognized as essential for promoting a culture of values based social learning. As with all developmental domains, "social-emotional learning develops in the context of a positive environment in which adults nurture supportive relationships with children, scaffold children's skills, and use direct instruction to teach specific social skills and foster positive relationships" (Gallagher, 2013, p. 27).

When we share in our staff meeting, the strategies that if a child is misbehaving in a classroom, despite the teacher's request to calm down, the teacher say, "Okay, I'm sorry, I have told you a few times, you have to go sit on the chair behind until you are ready to calm down" ... And I say, always remember when a few minutes is up, "Are you ready to come and join us? If you are, then you can come back to the place."

The importance of building this culture was evidenced by principals and teachers describing, explaining, modelling and teaching moral behaviours and social norms within their ECEC surroundings. This "climate of courtesy, respect for individuals and hospitality is evident in how people relate to one another" (Treston, 2001, p. 22). Statements including the following validate this:

Children observing peaceful and courteous ways of interacting and translating their learnings.

I make it a point of greeting the children. Our greeting is like "Good morning so and so. Jesus loves you." So when they greet anybody, even visitors who come, they will say, "Good morning, Jesus loves you" and some even visitors were caught by surprise and they will laugh and they, "Oh that's very nice." Nobody bless me before.

Theme C: Astute monitor. Vygotsky's social cultural theory emphasises the guiding role of social context and culture in children's maturation. Viewing the transmission of skills in terms of teaching and learning, Vygotsky lay claim to the term zone of proximal development (ZPD),referring to the distance between the actual level of the child's performance and the potential level of functioning with the support of a more skilled peer or adult. Scaffolding is related to the ZPD where cognitive change pertaining to social knowledge, understanding and skills, occurs with children co-constructing new knowledge based on their existing knowledge base.

Responding to maturational and environmental differences in children's cognitive and non-cognitive development was recognized as sound educational practice. Instruction is designed to reach a developmental level that is just above the child's current developmental level, providing opportunities to build on exiting knowledge in the construction of new knowledge. Varying levels of support are provided to promote children's understanding of altruism, the cornerstone of prosocial behaviour.

Being realistic about and responsive to the differences in development is a key in successful behaviour teaching and learning.

A different age group also perceive differently: For the nursery group, wise word to them is you say think you, you say please, but for a K2 level, we would expect more

to say that other than thank you, what else wise word you use to make other people happy, to make yourself comfortable.

Once in a while in K1, I realise that in K1 we still need to remind them, but when they proceed to K2 it's like in them. So I do see a progression there.

Of the participants who completed the survey, 83.9% perceived teaching children social behaviour as very important, 14.3% as pretty important, and 1.8% as just a little important. For teaching children social rules, 82.1% perceived this as very important and 17.9% as pretty important. Respectful relationships were perceived as very important to safe, productive and peaceful learning and teaching spaces by 83.9%, pretty important by 12.5% and just a little important by 3.6%.

Responsibility for behaviour, belongs with the owner of the behaviour, with teachers and principals supporting children learn from their mistakes. This learning involves a blend of the individualistic values of Western cultures (e.g., autonomy and independence) with the collectivist values of Asian cultures (e.g., filial piety represented by obedience, respecting elders, honouring the family, emotional self-control, humility, achievement and diligence) (Chao, 1995; Xu et al., 2005). Inductive techniques, designed to encourage appropriate behaviours, were enlisted by principals and teachers to promote prosocial behaviours. These techniques were acknowledged as effective as they appealed to the child's sense of reason and fairness.

The idea is to let the child listen and hear that from another person's point of view, and I'd say that, you know, "I hope you hear what I said. You heard what I said.

If a child misbehave, for me I would go to the child and say, "I've seen you've done that. You did that, you know, is there a reason for you to do that?" So I prompt the child with questions and then allow the child to think of a reason why was it done, sometimes they do, sometimes they do not have a reason.

While there was some confusion between telling children what to think and teaching children how to think, children were supported to be part of the solution. The educator in many instances becomes the discerning enabler, the social bridge between the children in conflict, providing specific focused feedback so children learn to work together to resolve conflict. Time is allowed for children to resolve disputes, and this process is scaffolded when necessary. Educators give help, sharing expertise as they refrain for doing for children what they can do, with support, for themselves.

When the child misbehave they will do this, "Come", then lower themselves and look eye to eye and they just talk to the child, see what's going on, what do you think and everything. And the other teacher will take the whole class, because if not, the other children will be running around and misbehaving and then accident happen. So there will be always a partner. So one teacher will take the child to the corner, the other teacher will take the other child to be occupied with songs, stories or rhymes or anything, and then after talking for about ten minutes, then that's where we bring the child back.

Certain thing we discuss in front of the whole group, some we just individually.

Affirmations and acknowledgments of efforts were noted as essential with principals intervening wisely in the lives of children.

Acknowledgement is very important, because it will bring out the best to the child, "Oh, you have done a good job, you say thank you, you know, you say something so nice." We use the wise word.

Within the survey data, a significant correlation was found between recognising efforts following social rules and focusing on social behaviour in interactions ($r = .64$, $p < .05$).

Theme D: Coaching teacher. Participants emphasised their obligation to understand the meaning behind children's behaviour. This involves the critical analysis of behaviour, making connections between self-regulation and mutual regulation, development of autonomy and sociability.

Every behaviour is a form of communication, especially a misbehaviour. The child is trying to tell you to draw closer to the child. And so what the teacher does is that behind every behaviour we try to understand what the social is and mostly importantly the emotional needs behind that child. So with that understanding, the teacher sees the child in a different manner and they then scrutinise every misbehaviour and say, what is it that the child wants.

The traditional African proverb "it takes an entire village to educate a child", was constantly promoted by the participants, with intentional, explicit teaching of communal values the order of the day. Non-coercive practices, encompassing mutual respect, collaboration, reciprocal teaching, problem solving teaching, and shared responsibility, was apparent within the schools.

Teach the children the rules … the teaching is very important and during the morning gathering we can use the time to teach.

In the class and assembly … there's some sign for them it's the listening time.

I'm a Chinese teacher, so sure talk it in English and now I will do it in Mandarin, so the children are free to explain in their comfortable language.

Children develop as problem solvers growing their understanding of learning how to peacefully be with one another in shared work spaces. Part of this growth involves reflecting in action and on action. As one participant explained, the teachers' role is to apply responsible care in conjunction with meta-cognitive processes enabling children to think about their thinking.

Being in the child care centre, we actually spend more time talking to children and teach them how to reflect. We are quite willing to put down our academic learning. So today no lesson, we will just talk about this incident. How can we prevent this incident happen again? So what can we do as a classroom basis? So the other teachers will talk about it and the children will contribute the ideas and suggestion to improve it.

The practice of prioritizing social, emotional and moral development as the situation demanded, was encouraged. Taking time to scaffold children's social

learning was considered important, helping children their repertoire of skills for working with others peacefully and diligently.

We are willing to give up the lesson for that day … So there are many times we are not having a lesson but we just discuss the incident, yeah. So that's how the children learn from it and they will remind each other, "Oh you cannot do this. Teacher say cannot. It's not right… We are happy to see that the children are conscious about their behaviour in classroom.

Being respectful with children was a non-negotiable expectation. Teacher accountability in terms of explicitly teaching children the values based social conventions was reiterated by participants. It was one objective to know the social rules and the values, it was a different objective to intentionally and consistently teach these in cultural relevant and intentional ways. This teaching encompasses an ethos of team work, shared language, shared understanding, shared responsibility and joint involvement.

We should not feel offended or we should not feel threatened if another teacher were to come and help us, you know, work on the social skill of that child. That means if I find that your child is not behaving anywhere and you are not there, it is okay for me to say, "What you did was not right. You shouldn't be doing this." And I always make it a point that I will do that when I see them, you know, not doing what they should be doing around the school, in the toilet, in the eating area, all this. So that is what builds the culture for the school.

Taking the mystery out of mistaken behaviour and responding respectfully with consequences was noted as an effective way of supporting children develop knowledge of social conventions and values in education. The Chinese proverb, "It's better to light one candle than to curse the darkness," resonances this commitment to building a culture of care and compassion, through an alignment of vision, communal values, and social teaching practices.

I think we have to differentiate between punishment and consequence. Be prepared for this consequence and that is what the corrective part of the child, then there is the formative part of the child where you have to teach them management skills before they do it, how.

Participants emphasised the importance of scheduling time each day for children to collaboratively reflect and acknowledge their values based social learning. Rote learning and memorization is replaced with a deep approach to learning and enacting values based social conventions. Rather than disseminating knowledge, the children actively engage in problem solving teaching, experiential learning and critical reflection.

As Brady and Kennedy (2014) remind us, "there is no one correct way to carry out values education and it is good to have a range of possibilities that can be used to suit different needs" (p. 113). Participants reported examples where teachers are allocating time and resources, pro-actively teaching social norms and moral standards in their ECEC curriculums. Some participants integrated values based

learning within their daily program while others scheduled character building lessons weekly.

I intentionally built in the character curriculum a half hour. It's different from the Bible Stories things. It's a character building slot.

Consistency across the curriculum not complacency was the mantra of the social teaching and learning. Promoting a culture of values based learning, principals named strategies enacted in their schools that challenged and supported children to: question and reflect; develop social problem-solving skills; partake in constructive collaboration.

We will take a story every day; we'll talk about it. The older classes will do a discussion. We ask the children, what if this thing happen in the class and some of the kids not happy.

We have particular focus, like talking about appreciation. So whatever words they use to appreciate other people they write down. So they come and share. The children bring a book to come and share with their friends.

The importance of consistency was also evident within the survey data as 83.9% of participants perceived teacher consistency with social rules as very important and 16.1% as pretty important. The importance of teacher consistency with social rules was found to be significantly correlated with the importance of social rules in teaching ($r = .30$, $p < .05$) but not with the importance of children learning the social rules in the classroom ($r = .24$, $p > .05$). The importance of social rules in teaching was also found to be significantly correlated with the importance of children learning the social rules in the classroom ($r = .55$, $p < .05$).

Theme E: Discerning monitor. As discerning professionals, participants reflected on shared values and beliefs between school and home. Discussion centred on the parents' role in supporting children develop "socialization with the goals of developing self-discipline" (Papalia & Martorell, 2015, p. 247).

The parents also have the role to play to share these values.

The parents practice the rules at home they use the same language at home too when they are managing the children so that work well for us. To practice.

Both the home and the school share the same value. So the children at least speak the same language.

Principals, whilst supportive of their teachers when meeting with parents whose children are demonstrating inappropriate social behaviours at school, have a standard of practice their teachers need to engage with when documenting children's social errors. They place ownership with the teacher to explore below the surface of the child's behaviour. Shaming and blaming children who misbehave is not an acceptable practice.

The teacher has to know that I cannot just say that the child is very naughty and misbehaving. You must tell me when, why, so that when I sit down with a parent, we cannot just say that your child misbehaving. Because the teacher has noted … when are the times, why, you know, things like that and we tell them what we do with the

child; we spoke to the child, we asked the child … This is presented to parents that we have noticed a pattern.

Some principals' commented that the home is leading the school, whereas in other schools, principals acknowledged that parents are viewed by the teachers as responsible for character education, and neither the twain should meet. The challenge is remaining influential in relationships and refraining from being dogmatic.

At the end of the day, parents are the first teachers.

We need their support as well so that they can be successful, and the important thing is when sharing with the parents, we also have to know why it is important because it's their success when they leave the school, lifelong success, when they grow with other people, peer acceptance into society and things like that.

During the holidays there are always talks organised for the parents … and the topic will be like EQ drives IQ. So certain things that drives home the message if you want your child to do academically well then you must focus on the emotional of the child.

Participants agreed that a child centred approach to values based social norms and moral standards is necessary in response to today's multicultural, rapidly changing global era. As Banke, Maldonado, and Lacey (2012) promoted, "the most important job of every school leader is the responsibility to make a difference in the lives of the students placed in the schools' administrator's care (Fullan, 2002) and to genuinely lead and serve for a higher purpose for the right spirit" (p. 239).

We know that if there is no social skills, academic learning won't go in that because they won't have the heart ready to learn. In their heart it's not ready, you know, for all these skills that they require.

Character education was something that was important I believe to all of us. We know

Participants were strategic and forward thinking with regards a sense of ownership and participation in values based school living. The Japanese proverb "vision without action is a day dream; action without vision is a nightmare" embodies this mindset of thoughtful planning.

Next year we are going to have a … booklet for the parents to fill out what they have been done at home regarding all this.

DISCUSSION

In today's rapidly changing technological era, the focus in many national school systems throughout the world has been on academic success and education achievement; pathways associated with earning higher education qualifications, securing employment, advancing in careers, and attaining overall happiness. In education systems often dominated by academic diligence, academics and selfhood has taken precedence over moral standards, resulting in an indifference to or neglect of character development and citizenship education. This has resulted in concern that

children are not learning core values including respect, compassion, truthfulness, responsibility, fairness, and citizenship.

A conceptual turning point occurred in recent decades, with policy makers in countries including Australia, United Kingdom, China, Hong Kong, Singapore, Malaysia, and Korea formulating government policies encouraging and in many instances, mandating, the inclusion of social teaching, citizenship education and character development as part of the holistic development of the child (DEEWR, 2005; MCEETYA, 2008; Lee, 2013).

Promoting peace, harmony and mutual respect are the Golden Rules conveyed by participants in this study. Educators intentionally build expectations with children, delivering, monitoring and managing their progress as they play and work with others. They "shape the organizational culture through consistency and alignment of words, attitude and actions. Leaders influence and modify group norms through their emphasis, actions and hiring practices" (Minckler, 2014, p. 672).

Educational leadership reported in this study represents a multidimensional systematic integration of various psychological and counselling theories and leadership models: servant leadership, transformational leadership, and principled centered leadership). Principals connect with their staff and with children, aligning instructional practices, school culture, and classroom climate with compassion, peacefulness, and politeness. They provide authentic structure, order and consistency where children are respected and appreciated for who they are as learners. As wise and trusted advisers, principals influence the future, teaching and supporting ECEC educators and children in living and learning together productively and harmoniously. They acknowledge mistakes as platforms of learning, and support educators' extend their competences in non-coercive behaviour teaching, learning and management.

Productive and peaceful ECEC places are spaces where children are related to with courtesy by kind staff members; they are provided with opportunities to meet basic life needs responsibly; they learn that conflicts can be worked out calmly and amicably. Persuasion rather than coercion is used as a way to influence others (DePree, 1989). As young children develop self-control, self-regulation and their emerging sense of self and connection with others, educators endorse standards of working together. When children are in the same work space a consensus among educators exist pertaining to the parameters of these social norms. Consequently social rules are the codes of engagement and as such form "part of moral or values education in school" (Thornberg, 2008, p. 37).

For many children in ECEC settings, the opportunity to work with a group of children brings challenges related to self-regulation, social problem solving, friendship development, and conflict resolution. As evidenced by participants in this study, it is important that an educational community is established with a shared vision of children yearning to learn, peacefully and industriously working together in shared work spaces. Non cognitive and cognitive elements of the

curriculum are prioritized with children taught the required social conventions to engage in the curriculum. As espoused by Carter and Pool (2012), "we cannot expect children to meet expectations in early childhood if we do not teach them directly and systematically" (p. 320).The manner in which social conventions are taught and enacted is reflective of the schools culture and related with child outcomes (Newman & Newman, 2015).

As Asian societies are becoming more globalized and more ethnically diverse, traditional values of *filial piety* are being taught with authoritarian processes and strategies, encouraging individuality, decisiveness, responsibility and autonomy (Clayton, 2011; Carter et al., 2014; Way et al., 2013). Consequently, teaching values informed social norms are part of the skill set of quality educators in ECEC settings in Singapore. As noted in this research, effective principal leadership is the touchstone for shaping the culture of the school. Principals are the leaders who work closely with their teachers, parents and the community, to ensure consistent quality cognitive and non-cognitive teaching and learning experiences for the children.

LIMITATIONS AND FUTURE DIRECTIONS

Some limitations of the current study need to be addressed. Firstly, social desirability is a limitation of survey research with some respondents providing favourable responses to the questions, perceiving specific responses are more desirable and acceptable. Furthermore results may be bias because respondents want to present themselves positively, and their responses may not be a true indication of practices.

Sternberg's triarchic theory of intelligence (Sternberg, 2004; Gillies, 2011) identifies three subtheories of intelligence, namely analytic intelligence (academic ability); practical intelligence (ability to adapt to environmental demands); and creative intelligence (ability to cope with novel situations and benefit from the exposure). According to Sternberg, only analytic skills are measured by intelligence tests with creative and practical components of intelligence ignored in these measurements. Sternberg refined histriarchic theory of intelligence, to include the successful intelligence theory, with persons viewed as intelligent having practical intelligence, creative intelligence, and analytic intelligence.

Sternberg maintained that intelligence is viewed differently across cultures and in subcultural groups. Social competence may be valued in some cultures, cognitive skills resulting in good academic grades prioritized in other cultural groups, while "doing what is right and showing humility without judgment of others" (Newman & Newman, 2015, p. 299), emphasised in other cultures. Studying Sternberg's information-processing theory with regards children's social learning and competencies, aligned with their analytic, creative, and practical intelligence warrants further investigation.

The influence from British colonial times has influenced the culture of modern day Singapore with Chinese confusion beliefs and values existing alongside Western values. As Chan and Chan (2009) explained, "Chinese parents are authoritarian in the Western sense but responsible and caring in the Chinese sense" (p. 440). Conceptualizing the association between educators' and parents values pertaining to values based social teaching within the early years curriculum is an additional area for exploration.

PRACTICAL IMPLICATIONS AND CONCLUSION

The results of this study contribute to the socialization literature of early childhood educators and the leadership literature of transformational leaders. Participants reported that children learn social norms and moral standards by being purposefully taught and that teaching incorporates many diverse practices and processes embedded within the school culture. The authoritative framework of teaching and learning provides the building blocks for this teaching to happen. Authoritative adults have an egalitarian relationship with children. They are high in demandingness and responsiveness. Looking through the lens of principles including justice, beneficence, faith, hope and love, educators were challenged to move away from creating an environment of fear, negativity and external control to building an environment based on values including esteem, appreciation, cooperation, thoughtfulness and perseverance.

Learning social conventions and moral standards provides a strong foundation for children as they grow and develop their citizenship. Children are involved in the mental creation of these norms so they become committed to the physical creation. The specifics of these standards and practices are tailored to the ECEC setting, congruent with the needs and the development stages of the children.

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17. THE ROLE OF NON-COGNITIVE FACTORS IN PATHWAYS TO COLLEGE ATTENDANCE AND DEGREE COMPLETION

It is well established that higher education is beneficial to the individuals and the society (Pascarella & Terenzini, 2005; Wolfe & Haveman, 2001). However, the rates of college attendance have not been improving over the years. Furthermore, the gaps related to racial and income in college graduation rates and college access remain steady (Bowen, Chingos, & McPherson, 2009).

In 2014, 21.6 % of African-Americans and 15.1% of Hispanics between 25 and 29 years of age have earned a Bachelor's degree or higher, compared with 40.8 % of non-Hispanic Whites (U.S. Census Bureau, 2015). The gaps among racial groups are similar compared to 2007 (African-Americans 19%, Hispanics 12% and non-Hispanic Whites 36%, U.S. Census Bureau, 2008). The gaps in college enrollment by family income remain large even with the increasing federally financial aid programs facilitate access to college for low-income students (Haveman & Smeeding, 2006). Low SES Americans are less likely to enroll in college and obtain a postsecondary degree than their middle- or higher SES peers (U.S. Department of Education, 2003). The differences in percent of recent high school completers enrolled in college (2 or 4-year colleges) between the top and the bottom 20 percent of all family income remain stable over the past decade, ranging from 25% to 31% (Snyder & Dillow, 2015). With the continuing concerns on equitable access to postsecondary education and the benefits related to postsecondary education, such as improving health and rising living standards, it is crucial to facilitate participation in postsecondary education for underrepresented groups in particular. To achieve this, efforts make early in life might be more cost-effective especially educational attainment is a long-term process.

Programs implemented in high schools and colleges aiming to increase accessibility for underrepresented groups or improve retention rates would be beneficial to some students. However, those programs will only reach limited students, and they will not be able to reach students who are far remote from the college gates. In other words, the most disadvantaged students who either dropped out of high school or have not considered attending college as an option in their life. Prevention is more effective than remediation. In fact, reviews of various interventions targeted to different stages of the life cycle (ranging from targeting prenatal infants to targeting young adults) have showed that evidence

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on long-term effects of interventions that start in early childhood and elementary school are larger compared to their adolescent counterparts. Many early intervention programs are associated with better later-life outcomes (Kautz, Heckman, Diris, Ter Weel, & Borghans, 2014).

The purpose of the present study is to examine how alterable factors are associated with college attendance and degree attainment on a cohort of economically disadvantaged minority youth in inner-city Chicago. Understanding the early determinants of postsecondary education of this underrepresented group will inform both higher education research and policy. Findings from the present study will also provide insights on the potential components of effective intervention programs.

Predictors of Postsecondary Education

There are numerous studies on postsecondary education, especially on enrollment, persistence, college decisions, and college experiences. Paths to college completion is a complicated process determined by not only the individuals but also the institutions. In particular, institutions play critical roles in the process, and can contribute significantly to either encourage or discourage college attendance and persistence. Therefore, there are many studies on college retention and institutions. See Braxton (2000) and Seidman (2005) for more information. The focus of the present study is on alterable factors of college attendance and degree completion that are related to individual. The review here includes only relevant studies. They are briefly described here in three categories: sociodemographic factors, cognitive factors, and non-cognitive factors.

Sociodemographic factors. Many sociodemographic factors are identified as important predictors of college attendance. For instance, the gaps in college attendance by race and family income are discussed frequently (Ellwood & Kane, 2000; Kane, 2004). White has higher rates of college attendance compared with Black and Hispanic. Gender is found to be associated with college attendance (Hossler & Stage, 1992; Jacob, 2002; Kane, 2004; Trusty, Robinson, Plata, & Ng, 2000). Females have higher rates of college attendance compared with males. Students from higher SES families have higher rates of college attendance compared with those who from lower SES families. Family context, such as socioeconomic status, family structure, and the level of parents' education are also associated with educational attainment (Christensen, Melder, & Weisbrod, 1975; Eccles, Vida, & Barber, 2004; Ellwood & Kane, 2000; Hossler & Stage, 1992; Jacob, 2002; Trusty, Robinson, Plata, & Ng, 2000).

Cognitive factors. Cognitive ability, such as the Intelligence Quotient (IQ), and academic performance, such as achievement scores, receive the greatest attention as predictors of educational attainment in the literature (e.g., Alexander, Entwisle, & Horsey, 1997).Academic performance are associated with college attendance

(Eccles et al., 2004; Ellwood & Kane, 2000; Hossler & Stage, 1992; Jacob, 2002; Martinez & Klopott, 2005; Trusty et al., 2000; St. John, 1991).

Non-cognitive factors. Non-cognitive factors are the factors not measured by IQ tests or achievement tests. Students have found that non-cognitive factors are associated with educational attainment and future wellness positively (Farrington et al., 2012; Heckman, Stixrud, & Urzua, 2006; Heckman & Rubinstein, 2001; Jones, Greenberg, & Crowley, 2015; Kautz et al., 2014).There are many non-cognitive factors, and they can be examined at three levels: individual, family, school or neighborhood.

First is the factors in the individual level, such as motivation, time management, and self-regulation. Academic preparation, students' plans for college and education aspirations are found to be associated with college attendance (Eccles et al., 2004; Ellwood & Kane, 2000; Hossler & Stage, 1992; Martinez & Klopott, 2005; St. John, 1991). Socio-emotional and behavioral indicators, such as hyperactivity, inattentiveness, self-esteem, future expectations, peer relations, and antisocial behavior, are found to be associated with educational outcomes (Rumberger, 1987; Fagan & Pabon, 1990; Rosenthal, 1998). Second is the factors in the family level. Family functioning and resources, such as parental expectations, parent/adolescent discussion of school activities, parental involvement in the child's education, and parent-school academic contact, are associated with college enrollment (Eccles et al., 2004; Hossler & Stage, 1992; Martinez & Klopott, 2005; Sandefur, Meier, & Campbell, 2006).Third is the factors in the school level. School factors, such as Catholic school attendance and school mobility, are related to postsecondary enrollment (Sandefur et al., 2006). In addition, specific school experiences, such as school mobility, have been found to have effects on education (Mehana & Reynolds, 2004). However, findings concerning the effects on education of other school-related indicators, such as school quality, are mixed (Card & Krueger, 1996; Greenwald, Hedges, & Laine, 1996). See Ou and Reynolds (2008) for a review of research on educational attainment.

College Attendance and Degree Completion as a Long-term Process

The ecological system theory emphasizes the framework of person-within-context within a comprehensive developmental approach that helps to explain how individual characteristics and environmental factors influence the process of college attendance and college completion. A full elaboration of Bronfenbrenner's (1998) ecological system theory is beyond the scope of this paper, but it is important to highlight that this perspective suggests that features of the individual, family, environment, and the interactions among them all influence a child's development. College attendance is a socio-psychological phenomenon rather than an intellectual achievement alone within this framework. Factors at different levels, such as personal traits, family, and school, contribute to college attendance. Of these levels,

although family is usually the most important system, particularly for children and adolescents, it is important to note that the overall impact of the environment emerges from the dynamic balance among all levels of influences.

To sum it up, some limitations in the literature are evident. First, college attendance and college completion should be considered asa social-psychological process instead of an intellectual achievement. College enrollment and degree completion results from a long-term process of interactions among factors from different sources, such as individual, family, and school (Cabrera, Burkum, & La Nasa, 2005; Tinto, 1993). However, majority of the studies in college attendance have focused on academic achievement or family factors, and neglected the potential influence of individual's social psychological abilities in the process. Second, although researchers are aware that college attendance is a long-term process, most studies have focused on sociodemographic and family factors, and high school experiences. Limited studies have examined early factors that might predict college enrollment or degree completion (Eccles et al., 2004; Ou & Reynolds, 2014). Longitudinal studies spinning from early childhood to adulthood will shed light on the process of college attendance and college completion. Finally, it is crucial to promote both college persistence and college attendance, although the economic benefits of college attendance might not be as large as college degree. Many young adults, especially economically disadvantaged minority youth, do not even attempt to attend college. Studying a cohort of disadvantaged group starting from childhood can improve our understanding of the underrepresented group. It might be more efficient and effective to alter the trajectories early on than intervening later in the process.

THE PRESENT STUDY

The present study is unique in important respects. First, the present study uses data from an on-going longitudinal study of a cohort of minority youth living in high poverty neighborhoods, an underrepresented group in postsecondary education enrollment. This longitudinal dataset provides a unique opportunity to examine postsecondary education enrollment in this low-income minority community and to explore how early life experiences might affect postsecondary education. The present study identifies factors that can be used to promote college attendance for this specific group. Second, longitudinal data are used spanning birth to young adulthood, which enables an examination of early characteristics that other studies cannot examine, especially factors prior to high school. Factors examined in college or high school can be helpful in terms of providing information on intervention strategies, but they are less cost-effective compared to early intervention (Kautz et al., 2014). Intervention in high school is not as effective as intervention provided early in life. For example, high school dropout prevention programs are not as cost-effective as early childhood education programs on preventing high school

dropout (Heckman, 2000).Non-cognitive factors (such as parent involvement and social adjustment) can be altered through intervention programs. Results of the present study will inform research and policymakers on increasing participation in postsecondary education for underrepresented groups.

METHODS

Sample and Data

The study sample is drawn from the Chicago Longitudinal Study (CLS, 2005), an ongoing study of a cohort of low-income minority children (93% African American) born in 1979 or 1980 who grew up in high-poverty neighborhoods. The original sample (N = 1,539)included 989 children who entered the Chicago Child-Parent Center (CPC) program in preschool and graduated from kindergarten in 1986 in 20 Centers, and 550 children who participated in alternative government-funded kindergarten programs in the Chicago Public Schools in 1986 without CPC preschool experience.

Over sixty percent of the study sample participated in the CPC program. The CPC Program is a center-based early childhood intervention that serves high-poverty neighborhoods that are not being served by Head Start or other early intervention programs. Eligible children may attend the program for up to six years from ages 3 to 9. The goal of the CPCs is to promote children's school competence, especially school readiness and academic achievement, by providing comprehensive educational and family-support services. See Reynolds (2012) for more information on the CPC program. Positive long-term outcomes, such as a higher rate of high school completion and college attendance, and lower rates of juvenile arrest and adult incarceration, have been found to be associated with participation of the CPC preschool program (Ou & Reynolds, 2006; Reynolds, Temple, Robertson, & Mann, 2001; Reynolds et al., 2007; Reynolds, Temple, Ou, Arteaga, & White, 2011). Therefore, program participation was included as covariates.

The study sample includes 1,379 youth whose status of educational attainment could be determined by August 2006 (mean age = 26).Students in and outside of the Chicago Public Schools were located. Data have been collected longitudinally starting from child's birth from various sources, such as participants, parents, teachers, and schools (CLS, 2005; Reynolds, 2012). Data of postsecondary education were collected from the colleges youth attended, supplemented with self-report for those who school records were not available.

Measures

Table 1 shows the definition of variables used in the present study. In addition to outcome measures, variables were described in the following categories:

Table 1. Definition of variables

Variables	*Definition*
Postsecondary education by age 26	
College attendance	Ever attended any 2- or 4-year college (1 = yes, 0 = no) by August 2006. N=1,379.
4-year college attendance	Ever attended any 4-year college (1 = yes, 0 = no) by August 2006. Participants who attended 2-year college but not 4-year college were excluded from this variable. N=1,034.
BA degree completion	Completed BA degree (1 = yes, 0 = no) by August 2006. The sample included only participants who were ever attended any college. N= 548.
Covariates	
CPC preschool participation	Participated in CPC preschool program (1 = yes, 0 = no).
Female	Sex (1 = female, 0 = male)
Mother did not complete high school	Mother did not compete high school by age 8 (1=did not complete high school, 0 = completed high school).
TANF or AFDC participation	Family public aid receipt (TANF or AFDC) by child's age 8 (1 = yes, 0 = no).
Cognitive factors	
ITBS reading scores	Iowa Test of Basic Skills (ITBS) reading scores at age 14. The reading test contained 58 items and emphasized understanding of text passages. The reliability was .92.
Non-Cognitive factors	
School adjustment and family functioning:	
Classroom adjustment (ages 7–12)	Classroom adjustment was measured on a six-item scale rated by teachers from grades 1 through 6 (ages 7–12). Teachers were asked to rate children on items,such as concentrates on work, whether the child follows direction, and whether the child takes responsibility for actions (alpha = .91). Teachers' responses ranged from poor or not at all (1) to excellent or very much (5). The average score was used.
Parent involvement (ages 7–12)	Parent involvement was measured through parents' involvement at their child's school. It was assessed yearly by teachers between grades 1 and 6 (ages 7–12). Teachers rated "parent's participation in school activities" on a 5-point scale, from poor or no involvement (1) to excellent or much involvement (5). The average score between ages 7 and 12 was used.

Commitment to education:	
Parent expectations for child's education (years)	Parental expectation concerning the child's educational attainment was measured by an item in the fourth grade (age 10), which asked parents about their expectations concerning the highest education level their child will reach. The results were coded into a four-point scale: some high school (1); completed high school (2); some college (3); and completed 4-year college (4). The 4-point scale was transformed into years of education: 10 years (1); 12 years (2); 14 years (3); and 16 years (4). Missing values at fourth grade were imputed with information from second grade. If responses were missing from both the second- and fourth-grade, information from the eleventh grade was used.
Student expected to go to college	Students' expectation was measured through a dichotomous variable indicating whether students expected to go to college. This measure was based on the item, "How far in school do you think you will get?" from a survey in participants' fourth grade year. If students' scores were missing from the fourth grade survey, tenth-grade survey responses on the same item was used.
Truancy by age 12	Number of absent days by age 12 rated by teachers at fifth and sixth grades and by parents at fourth grade. Averages of fifth-grade and sixth-grade teacher ratings were used. If one was missing from both teacher ratings, parents' ratings were used. A composite measure was constructed and it ranged from 1 to 5. The 5-point scale wasre-coded into days of absence based on the following rules: 2 days (1); 6 days (1.5–2); 10 days (2.5 to 3); and 17 days (above 3).
School- based functioning:	
Grade retention	Ever retained in grades 1 through 8 (ages 7 to 14, 1 = yes, 0 = no).
Number of school move	Number of school moves between grades 4 and 8 (ages 10–14).
Lift event:	
High school graduation by age 19	If graduated from high school by age 19 (1=yes, 0=no).

covariates, cognitive factors, and non-cognitive factors (school adjustment and family functioning, commitment to child's education, school-based functioning, and life events). Dichotomous variables were used for covariates because most

of the characteristics were categorical, such as gender and AFDC participation. Furthermore, dichotomous variables were employed for maternal education, because it is more meaningful to examine the difference between above and below a certain threshold in education than to examine the difference between a continuous scale. Such thresholds are meaningful because they might have different effects on education attainment (Rumberger & Larson, 1998; Steinberg, Blinde, & Chan, 1984; Frank, 1990; Kronick & Hargis, 1990; Roderick, 1993). Table 2 provides the valid sample sizes and means for key variables.

Table 2. Descriptive statistics for study variables (N = 1,379)

Measures	*N*	*Min.*	*Max.*	*Mean*	*SD*
Covariates					
CPC preschool participation	1379	0	1	.65	.48
Female	1379	0	1	.52	.50
Mother did not complete high school age 8	1364	0	1	.44	.50
TANF or AFDC participation age 8	1324	0	1	.58	.49
School adjustment and family functioning:					
Classroom adjustment (ages 7–12)	1326	7.50	30.0	19.07	4.41
Parent involvement (ages 7–12)	1320	1.0	5.0	2.55	.88
Commitment to education:					
Parent expectations for child's education (years)	1066	10.0	16.0	14.4	1.89
Student expected to go to college	1105	0	1	.81	.40
Truancy by age 12	1118	2	17	7.21	5.03
School- based functioning:					
Grade retention (ever; ages 7–14)	1379	0	1	.25	.44
Number of school move (ages 10–14):	1266	0	4	.94	.98
ITBS reading scores (age 14)	1252	77.0	212.0	145.31	21.72
Life Event:					
Graduation by age 19	1379	0	1	.52	.50
Postsecondary education by age 26					
Any college attendance	1379	0	1	.40	.49
4-year college attendance	1034	0	1	.20	.40
BA degree completion	548	0	1	.14	.34

The Hypothesized Model

The model used in the study was based on the results of empirical research on educational attainment. Factors were selected based on literature and availability in the CLS. Figure 1 presents the hypothesized model. The sequence was arranged according to previous studies and the developmental sequence. Factors occurred earlier were expected to link to later factors if the relations were suggested in the literature. Cabrera and La Nasa (2001) pointed out that one of the critical tasks on the path to college among socioeconomically disadvantaged students is to graduate from high school. Therefore, high school graduation by age 19 was assumed to be the gateway leading to participation in postsecondary education. All factors have direct paths to high school graduation by age 19.

The boxes on the extreme left represent covariates, including gender, CPC preschool participation, maternal education at child's age 8 and AFDC participation at child's age 8.Covariates are associated with all variables in the model. However, to simplify the model, their relations are not shown. Previous studies have found that grade retention is associated with lower rates of college attendance (Fine & Davis, 2003; Ou & Reynolds, 2010), and the associations between academic performance and student expectation, and college attendance, were also reported in studies (Eccles et al., 2004). Therefore, the direct paths between the 3 factors (grade retention, academic performance at age 14, and student expectation to attend college) and ultimate outcome, postsecondary education, were assigned. See Appendix for the correlation matrix of variables included in the model.

Data Analysis

Structural equation modeling was used because it allows the simultaneous estimation of a number of hypothesized relations and provides a decomposition of those relations across all variables in the model. Factors in the model were constructed as latent variables through single indicators with estimations of measurement errors. The models were estimated by the software Linear Structural Relations 8.8 (LISREL8; Jöreskog & Sörbom, 1996).

Two indicators of model-fit were used to evaluate the fit of models: the root mean square error of approximation (RMSEA) and the adjusted goodness of fit index (AGFI). A value of GFI or AGFI close to 1.00 indicates a good fit (Byrne, 1998). A RMSEA value that is less than 0.05 indicates a good fit, and values as high as 0.08 represent reasonable errors of approximation in the population. The path coefficients are standardized partial regression coefficients, which show the change measured in standard deviation units while controlling other variables in the model. The significance of path coefficients is judged by the same way as a z statistic, so a path coefficient has to exceed 1.96 to be considered reliably different from zero (Hoyle, 1995). These coefficients aid in the interpretation of the size of the effect, because they correspond to effect-size estimates (Hoyle, 1995). For more

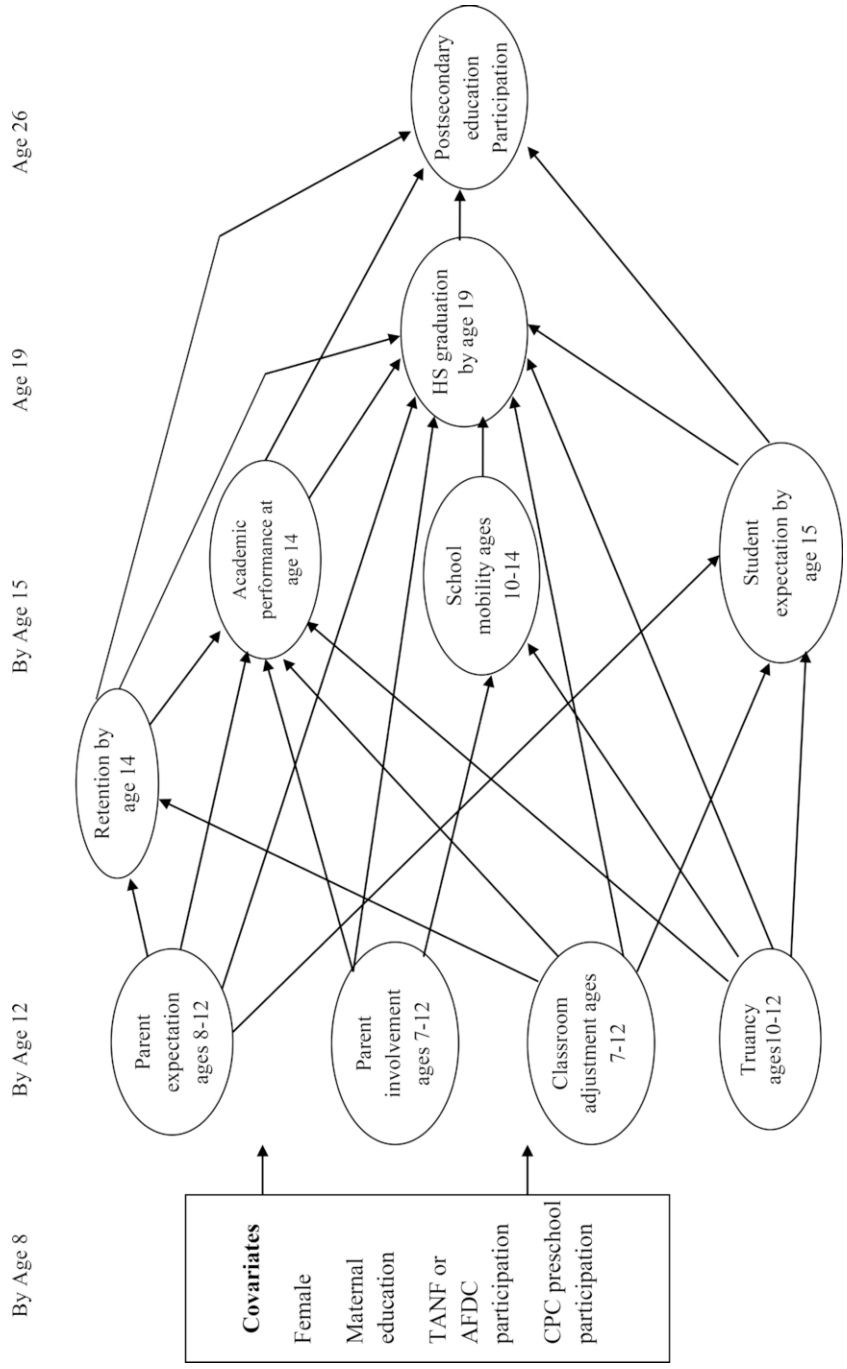

Figure 1. Hypothesized Model

information regarding data preparation and screening, model analyses, and model evaluation and specification, see Byrne (1998), Hoyle (1995), and Kline (1998).

RESULTS

In 2006, 58% of all 25–29 years olds had at least some college experience. When examined by race, 66% of Non-Hispanic White had at least some college experience, and 50% of Black had such educational experience (U.S. Census Bureau, 2007). Educational attainment at age 26 in the study sample was lower than the national average. About 40 percent of the study sample attended either a 2-year or 4-year college by age 26.

Any College Attendance

Figure 2 illustrates the results from LISREL for any college attendance. The coefficients showed in the figure are standardized and significant at the 0.05 level. This model explained 32% of variation in any college attendance ($R^2 = .32$). The goodness-of-fit statistics indicated a reasonable fit (RMSEA = .065, AGFI = .926).

Except parent involvement and academic performance at age 14, as hypothesized all factors were associated with high school graduation directly, and high school graduation was associated with college attendance ($b = .42$). Academic performance was associated with college attendance ($b = .11$), but grade retention and student expectation to attend college were not associated with college attendance. Parent involvement was associated with college attendance ($b = .09$) directly instead of going through high school graduation as hypothesized. This path was not hypothesized, but was added based on the model modification index. Other than the direct associations between factors and high school graduation, earlier factors were also indirectly associated with high school graduation through later factors as hypothesized. For example, parent expectation and classroom adjustment were associated with high school graduation through retention. Parent involvement and truancy were associated with high school graduation through school mobility. Parent expectation, classroom adjustment, and truancy were associated with high school graduation through student expectation to attend college. Some earlier factors were also indirectly associated with college attendance through academic performance at age 14. For example, parent expectation, classroom adjustment, and truancy were associated with college attendance through academic performance at age 14.

Four-Year College Attendance

Figure 3presents the results for 4-year college attendance. The model explained 31% of variation in 4-year college attendance ($R^2 = .31$). The goodness-of-fit statistics indicated a reasonable fit (RMSEA = .076, AGFI = .902).Fewer paths were significant in this model. Only 3 factors were associated with high school

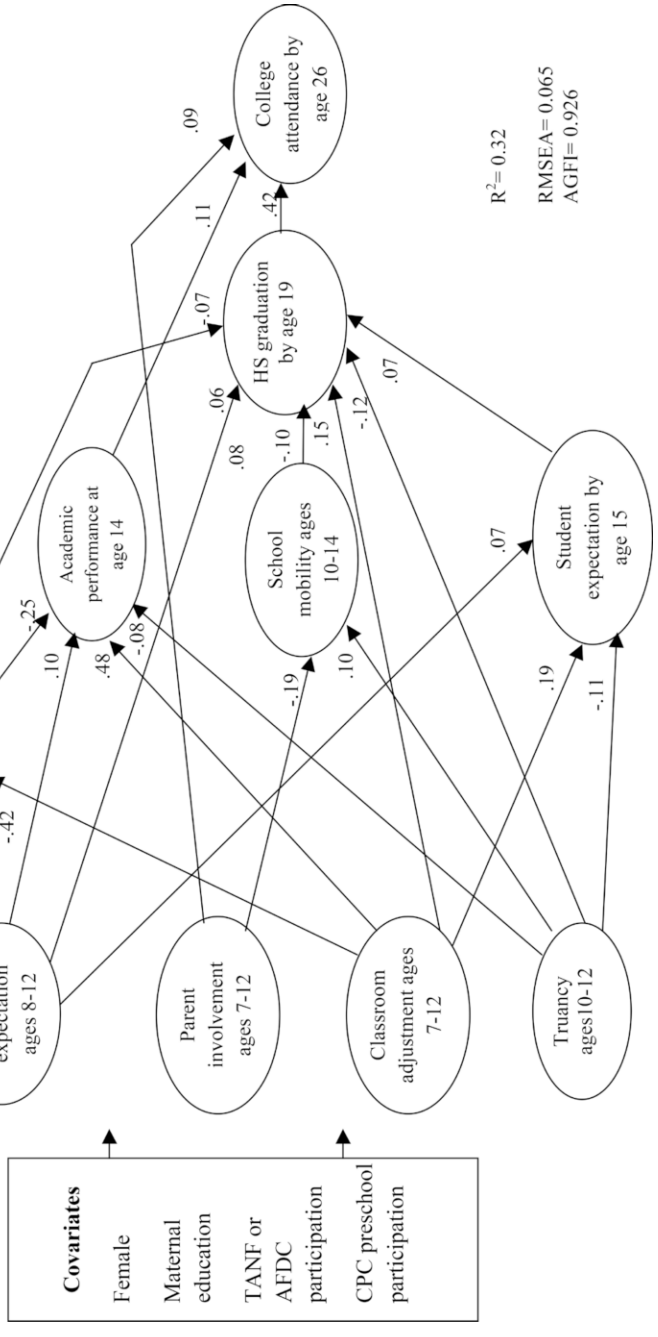

Figure 2. Path model for any college attendance
Note. Coefficients are standardized and significant.

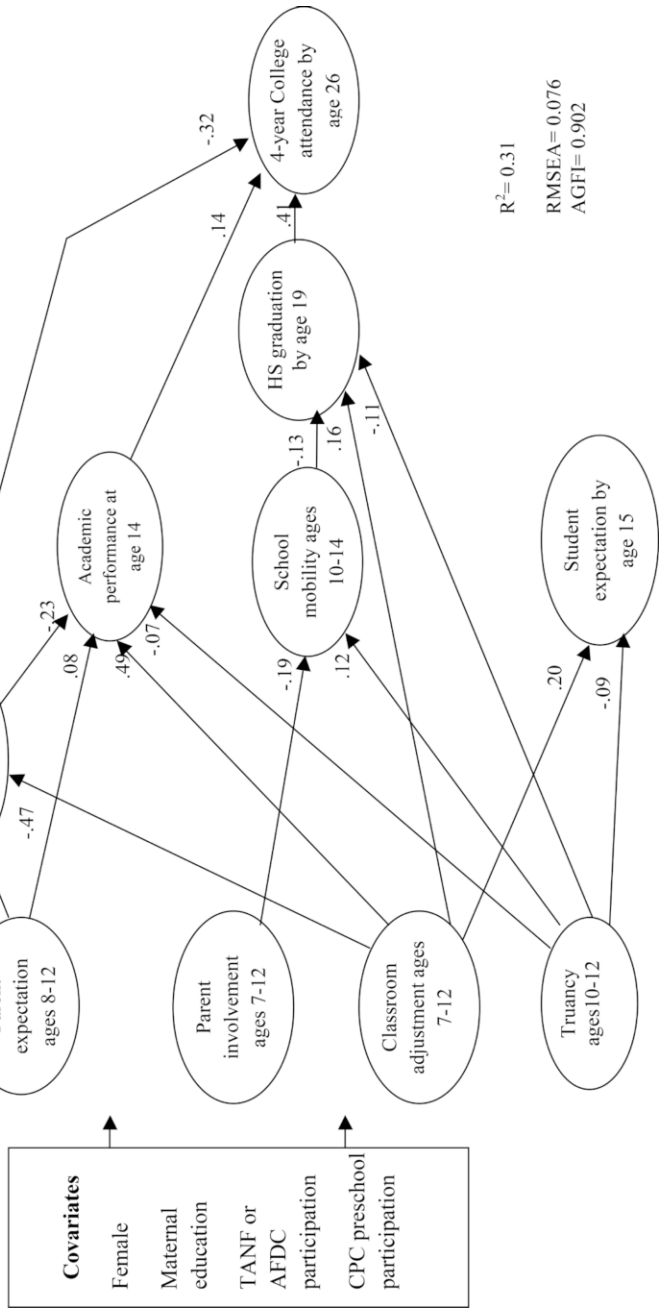

Figure 3. Path model for any 4-year college attendance
Note. Coefficients are standardized and significant.

graduation directly, and they were school mobility ($b = -.13$), classroom adjustment ($b = .16$), and truancy ($b = -.11$). High school graduation was associated with 4-year college attendance ($b = .41$). Grade retention and academic performance at age 14 were associated with 4-year college attendance ($b = -.32$ and $b = .14$, respectively). Parent involvement and truancy were indirectly associated with high school graduation through school mobility. Parent expectation and classroom adjustment were indirectly associated with 4-year college attendance through grade retention. In addition, parent expectation, classroom adjustment, truancy, and retention were indirectly associated with 4-year college attendance through academic performance.

BA Degree Completion

Figure 4presents the results for BA degree completion. This model explained 11% of variation in BA degree completion ($R^2 = .11$, RMSEA = .055, AGFI = .928). There were fewer significant paths in this model compared with the ones in any college attendance and 4-year college attendance. Classroom adjustment was the only factor associated with high school graduation ($b = .12$), and was also directly associated with BA degree completion ($b = .17$). Parent expectation, parent involvement, and truancy were associated with grade retention, academic performance, school mobility, or student expectation, but none of them leaded to high school graduation or BA degree completion.

DISCUSSION

Any College Attendance, 4-Year College Attendance, and Degree Completion

The three outcome measures, any college attendance, any 4-year college attendance, and BA degree completion, represent 3 levels of comparison. For any college attendance, the comparison is between people who attended any college (2 or 4-year college) and people who did not attend any college. For any 4-year college attendance, the comparison is between people who attended any 4-year college and people who did not attend any college. For BA degree completion, the comparison is between people who attended any college and completed BA degree and those who attended any college but did not complete BA degree. As the outcomes become more specific from any college attendance, 4-year college attendance, to BA degree completion, fewer paths are associated with high school graduation, the hypothesized gateway mediator between early factors and ultimate outcomes.

The findings on any college attendance are as hypothesized with only a few exceptions. For example, except academic performance and parent involvement, all factors are associated with high school graduation, and high school graduation is associated with any college attendance. Parent involvement is associated with any college attendance but is not associated with high school graduation, which indicates

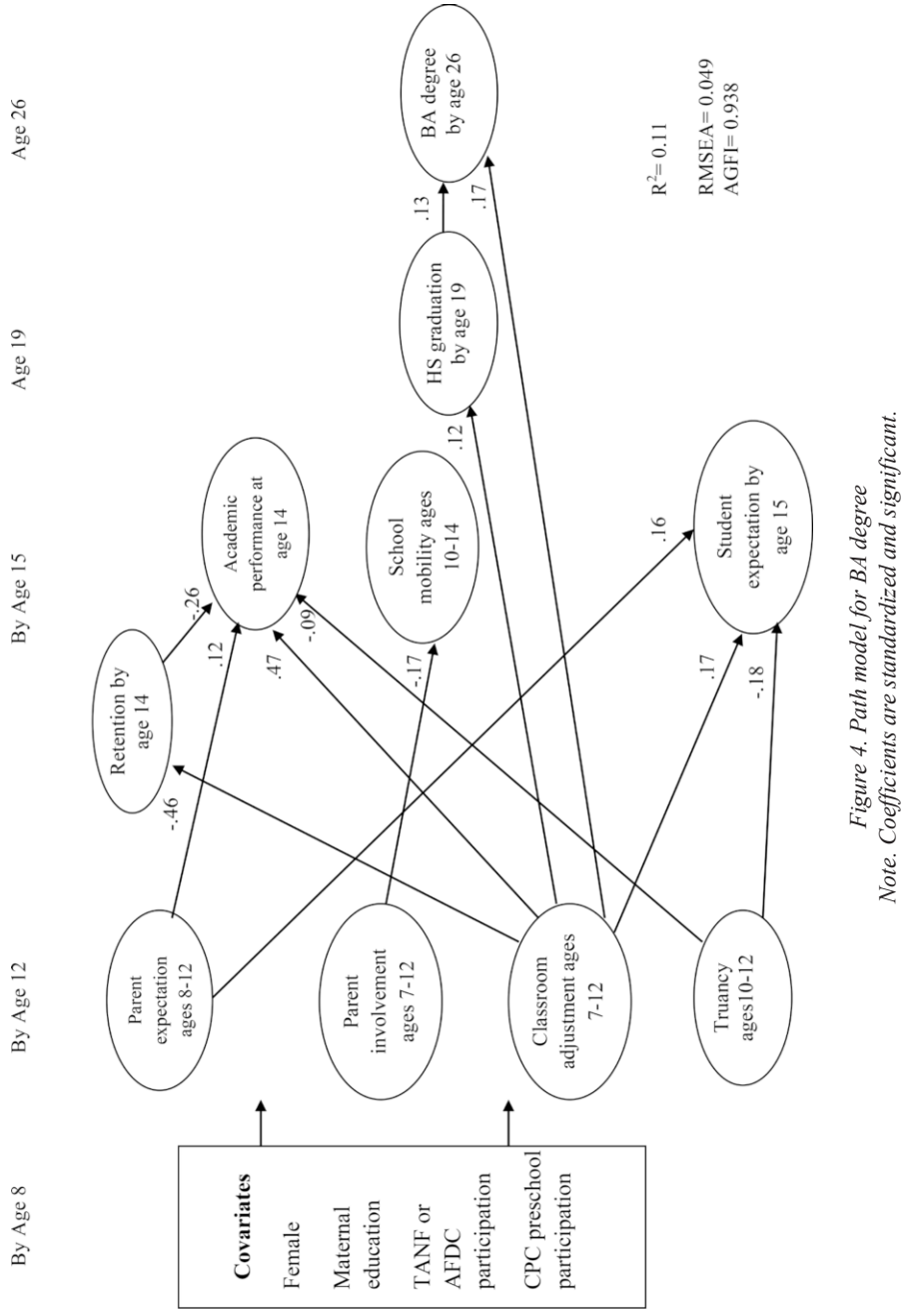

Figure 4. Path model for BA degree
Note. Coefficients are standardized and significant.

that parent involvement might play a more important role in college attendance than other factors.

4-year college attendance is one step narrower than any college attendance, as 4-year institutions are more difficult to access than 2-year institutions in terms of finance and academic requirement. Only three factors (school mobility, social adjustment, and truancy) are associated with high school graduation as hypothesized. Other than going through high school graduation, early factors are also connected to 4-year college attendance through grade retention or academic performance, which indicates that enhancement of such factors might increase the likelihood of 4-year college attendance indirectly. Although the model fit indicates a good fit for BA degree completion, the model explained only 11% of the variance of BA degree completion. The findings show that early factors have limited power in predicting BA degree completion. It is not surprising given that the process of degree attainment is complicated and institution factors may have more influence. Nevertheless, the positive association between classroom adjustment and BA degree completion provides insights for research on college retention. Improving individual's ability of classroom adjustment early on might increase the likelihood of degree completion later.

Non-Cognitive Factors

The connection between academic performance and college attendance is well established (Eccles et al., 2004; Ellwood & Kane, 2000). However, the connection between classroom adjustment in elementary grades and college attendance has been overlooked until recently. Classroom adjustment, truancy, student expectation, and retention can be classified as non-cognitive factors. Traditionally, attention has been given to cognitive factors rather than non-cognitive factors in educational studies as people tend to believe that cognitive abilities have major impact in whether individuals can obtain higher education.

Non-cognitive factors emphasizes on traits not measured by achievement tests, such as self-discipline, motivation, effort, interpersonal skills, help-seeking, organization, and learning strategies. Recent studies have found that non-cognitive abilities might have a greater effect on schooling and other outcomes than does cognitive abilities (Heckman & Rubinstein, 2001; Heckman et al., 2006), and students who had higher emotional and social competencies are more likely to persist in college (Jones et al., 2015; Parker, Hogan, Eastabrook, Oke, & Wood, 2006). Findings from the present study collaborate with recent studies on the significance of non-cognitive abilities.

In the present study, classroom adjustment and high school graduation are directly linked to BA degree completion, and both are non-cognitive factors. The roles of non-cognitive factors can play in the process of higher education shed light on the research of college persistence. Further research would help identify

powerful intervening points to promote degree completion for such disadvantaged group.

The relation between family resources and educational attainment is supported in previous studies (Ekstrom et al., 1986; Sandefur et al., 2006), and researchers have contributed such a relation to parental education level and family income according to social and cultural capital (Perna & Titus, 2005). See Bourdieu (1986) and Coleman (1988) for more information on social capital. Nevertheless, not all family resources have the same influence on higher education. For instance, parent expectations for child's education is linked to better academic performance and then lead to higher rates of college attendance and 4-year college attendance. Parent involvement in elementary grades is linked to college attendance directly, but it does not link to 4-year college attendance or BA degree completion. This suggests that parent expectations and parent involvement function differently and have different influence path on college attendance. Policy maker can target to increase parent expectations through promoting parents education or other strategies if the goal is to promote attendance on any college.

Grade retention is linked to lower rate of 4-year college attendance, which is consistent with previous research (Alexander, Entwisle, & Dauber, 2003; Ou & Reynolds, 2010; Temple, Reynolds, & Ou, 2004).The experience of grade retention could depress self-esteem and trigger a set of school experiences and adult expectations that lead to an increased risk of school dropout, and then lead to lower rates of postsecondary education (Ou & Reynolds, 2010).

LIMITATIONS

Several limitations of the present study need to be noted. First, the present study is limited by the availability of data. Potential confounding variables (e.g. characteristics of institutions) identified as predictors of college persistence in previous studies are not available in the data set. Second, factors addressed in the present study focused on experiences prior to high school, which might limit the explanation power of the models. Factors occurred in high school might have large influence in college attendance and degree completion as they are close to each other in terms of time. Third, the study investigates associations among variables rather than causal mechanisms. Although the longitudinal design increases confidence in the direction of the relations between the predictors and outcomes, caution should be exercised when making causal interpretations. Fourth, the CLS follows a selective sample of predominantly African American children who grew up in high-poverty neighborhoods in Chicago. Findings cannot be generalized to other populations. Finally, explanatory variables were measured through single indicators with estimations of measurement errors. The advantages of latent variables are not fully utilized. Future replications with multiple indicators of the explanatory concepts will increase the reliability of the findings.

IMPLICATIONS

Despite these limitations, findings have implications for schools, educators, and policy makers. First, non-cognitive skills, classroom adjustment in elementary grades, matter more to BA degree completion than cognitive factors measured by academic performance. This reinforces the importance of non-cognitive factors demonstrated in the growing body of literature (Farrington et al., 2012; Jones et al., 2015; Kautz et al., 2014). Studies have found that effective intervention in preschool and the early elementary years can improve children's non-cognitive skills (Bierman et al., 2010; Campbell et al., 2014; Durlak, Weissberg, Dymnick, Taylor, & Schellinger, 2011). Policymakers and program developers should target intervention to improve young children's non-cognitive skills, which would increase their chances to complete college.

Second, early influences from childhood can have lasting effects into emerging adulthood. The predictive power of the childhood precursors of college attendance provides justification for early intervention. As Heckman (2006, p. 1900) pointed out that life cycle skill formation is dynamic process in which early inputs strongly affect the productivity of later inputs, the process of educational attainment is a constant interaction between individuals and the environment, and altering factors in the process will have impacts on the trajectory. For example, family process factors can promote children's college attendance as parent involvement in school in elementary grades can lead to better chances of college attendance. Comprehensive early childhood intervention (Karoly, Kilburn, Bigelow, Caulkins, & Cannon, 2001; Schweinhart, Montie, Xiang, Barnett, Belfield, & Nores, 2005) and school reform models, such as Comer's School Development Program promote school-family partnerships, strengthen parenting practices, and increase parent involvement in school, have the chance to promote college attendance (Patrikakou, Weissberg, Redding, & Walberg, 2005).This example demonstrates how the findings from the present study can be applied to the design of intervention programs to increase individuals' possibility of college attendance. The early determinants can also be used to identify groups that are most in need of prevention programs.

CONCLUSION

The present study contributes to the growing literature on the importance of non-cognitive factors to future wellness. The factors investigated in the present study provide support to the potential benefits of early intervention programs can have on promoting college attendance and degree completion. Programs that identify children who demonstrate difficulties in classroom and provide services to help those children improve social adjustment might increase those children's chance of attending college in the future.

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APPENDIX

CORRELATION MATRIX FOR INDICATORS IN THE STRUCTURAL MODEL

Variable	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*
1. CPC preschool participation	1.00													
2. Girls	.070	1.00												
3. Mother not complete HS	−.176	.013	1.00											
4. AFDC participation	.033	.039	.372	1.00										
5. Parent involvement	.245	.142	−.303	−.181	1.00									
6. Parent expectation	.054	.119	−.273	−.167	.204	1.00								
7. Classroom adjustment	.183	.282	−.216	−.192	.531	.259	1.00							
8. Truancy	−.071	−.089	.154	.144	−.230	−.082	−.204	1.00						
9. Grade retention	−.197	−.246	.262	.169	−.431	−.311	−.577	.101	1.00					
10. ITBS reading score age 14	.179	.169	−.248	−.195	.388	.292	.579	−.196	−.630	1.00				
11. School mobility	−.240	−.072	.184	.162	−.267	−.104	−.212	.179	.263	−.224	1.00			
12. Student expect to attend college	.121	.174	−.207	−.080	.227	.184	.301	−.203	−.183	.351	−.237	1.00		
13. HS graduation by age 19	.117	.234	−.312	−.289	.368	.251	.415	−.281	−.395	.360	−.309	.288	1.00	
14. College attendance by age 26	.064	.211	−.313	−.248	.388	.223	.402	−.227	−.402	.380	−.195	.260	.693	1.00

Note. With the exception of gender, college attendance, and continuously variables (which were estimated as Pearson's correlations), correlations were estimated as polyserial/polychoric by PRELIS 2.5.

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18. NON-COGNITIVE CORRELATES OF EMIRATI ADOLESCENTS' MATHEMATICS PERFORMANCE

A Multilevel Analysis

Over the past three decades, much research investigating the non-cognitive factors associated with mathematics achievement has been conducted. A multitude of affective and attitudinal factors related to concepts such as anxiety, intrinsic and instrumental motivation, self-concept and self-efficacy have emerged as pertinent factors linked to achievement in mathematics among school children (e.g., Areepattamannil, 2014; Areepattamannil & Freeman, 2008; Ng, Lay, Areepattamannil, Treagust, & Chandrasegaran, 2012; Chiu & Xihua, 2008; Singh, Granville, & Dika, 2002).

Despite this widespread investigation of the associations between affective and attitudinal variables and mathematics achievement, there has been sparse consideration of the presence of such relationships within the Gulf region of Western Asia, and more specifically within the United Arab Emirates. The purpose of this study, therefore, was to provide a regional focus for an investigative analysis of the Organization for Economic Cooperation and Development's (OECD) Program for International Student Assessment (PISA) data, and thereby establish the presence or absence of an association between specific affective and attitudinal variables, namely mathematics related anxiety, intrinsic and instrumental motivation, self-concept and self-efficacy and achievement in mathematics in a sample of Emirati adolescent students. A general overview of the variables under study follows.

Mathematics Anxiety and Mathematics Achievement

The relationship between mathematics anxiety and mathematics performance and achievement has been well investigated (see Ashcraft & Moore, 2009, for a review). The findings of a large body of research has demonstrated that mathematics anxiety is negatively associated with both participation and achievement in mathematics (see Ashcraft, 2002; Hembree, 1990; Ma, 1999).

Although a number of genetic and environmental factors may account for variation in mathematics anxiety (see Wang et al., 2014), the negative association between mathematics anxiety and mathematics performance and achievement

M. S. Khine & S. Areepattamannil (Eds.), Non-cognitive Skills and Factors in Educational Attainment, 397–409.

is largely attributed to the crucial role that working memory plays in supporting school children's numerical cognition (see Maloney & Beilock, 2012). Because mathematics anxiety tends to compromise the functioning of working memory (Ashcraft & Krause, 2007; Young, Wu, & Menon, 2012), higher levels of mathematics anxiety might be associated with lower mathematics test scores (Wang et al., 2014). Nevertheless, studies have documented that higher levels of mathematics anxiety might not always be related to lower mathematics test scores due to the moderating effect of working memory capacity. For example, Owens, Stevenson, Hadwin, and Norgate (2014) found that adolescents in the United Kingdom with higher working memory capacity and higher levels of anxiety tended to perform better on the mathematics assessment than did their peers with lower working memory capacity and lower levels of anxiety.

Intrinsic Motivation and Mathematics Achievement

Intrinsic motivation is considered a significant indicator of students' success or failure in the classroom (Areepattamannil, Freeman, & Klinger, 2011; Hidi & Harackiewicz, 2000; Reeve, 1996; Ryan & Connell, 1989). Defined as the enjoyment of the learning process characterized by inquisitiveness and tenacity, academic intrinsic motivation is seen as playing a pivotal role in academic achievement because intrinsic pleasure experiences during the learning process are essential to developing cognitive processing and mastery level skills (Berlyne, 1971; Gottfried, 1985; Hunt, 1971; Nolen & Haladyna, 1990). Intrinsic motivation has been found to be related to various factors associated with learning, including active engagement, persistence, and positive emotional learning experiences (Elliott & Dweck, 1988; Pekrun, Goetz, Titz, & Perry, 2002; Ryan & Connell, 1989). Moreover, intrinsically motivated behaviors are behaviors grounded in the satisfaction of the behavior itself, rather than in reinforcements resulting from the behaviors (Ryan & Deci, 2002).

Academic intrinsic motivation has been shown to play a significant role in mathematics achievement; students with higher intrinsic motivation towards studies in mathematics tend to score significantly higher on tests and tend to achieve higher overall grades (Gottfried, 1985, 1990; Gottfried, Fleming, & Gottfried, 1994; Gottfried, Marcoulides, Gottfried, Oliver, & Guerin, 2007, Gottfried, Marcoulides, Gottfried, & Oliver, 2013). These findings support other studies that show significant and positive correlations of mathematics achievement with mathematics motivation and attitudes (e.g., Chen & Stevenson, 1995; O'Dwyer, 2005; Shen, 2002; Uguroglu & Walberg, 1979).

Instrumental Motivation and Mathematics Achievement

While intrinsic motivation has been shown to be associated with learning variables such as active and effortful engagement (Ryan & Connell, 1989) and positive learning experiences (Pekrum, Goetz, Titz, & Perry, 2002), instrumental motivation, that is

by definition extrinsic, is most commonly cast as driven by the short-term benefits of the learning process, linked to learning independent of interest (Grolnick & Ryan, 1987), excessive use of dependent help seeking (Butler, 1998), and self-handicapping (Urdan & Midgley, 2001). Additionally, extrinsically motivated students have been found more likely to have lower academic achievement, to engage in only surface level learning (Beck, McElvany, & Kortenbruck, 2010; Biggs, 1991; Lepper, Corpus, & Iyengar, 2005; Wolters, Yu, & Pintrich, 1996), have increased levels of anxiety, and are less able to deal with failure (Deci & Ryan, 2000; Wolters, Yu, & Pintrich, 1996).

However, the positive–negative nature of the intrinsic–extrinsic motivation issue is not a straightforward one. The alignment of internal beliefs with external reasons for behavior also has bearing on the association with negative outcomes (Lens, Vansteenkiste, & Matos, 2009). Therefore, it is useful to distinguish between extrinsic reasons for behavior that are in line with internal beliefs and hence may be considered instrumental to future success and extrinsic reasons for behavior that are not congruent with internal beliefs. In accordance with self-determination theory (Ryan & Deci, 2002) extrinsic motivation can be characterized by four types of behavioral regulation: external regulation, interjected regulation, identified regulation, and integrated regulation. These regulatory types reflect a dimension of increasing levels of identification with the externally decided origin of behavior. At one end of the continuum, external regulation effectively refers to coerced behavior, "I do because I have little choice" and at the other end integrated regulation refers to complete alignment between the internal world view and the external directive, "I am doing what I (believe in and would choose to) do anyway". Framing of extrinsic motivation in this manner renders a straightforward intrinsic-extrinsic distinction less relevant and a deeper exploration of congruence between sense-of-self and the reason for the behavior more relevant (Lens, Vansteenkiste, & Matos, 2009). Correspondingly, such considerations of instrumental motivation will necessarily have a bearing on the interpretation of the findings in this paper.

Mathematics Self-Concept and Mathematics Achievement

The association between academic self-concept and academic achievement has been widely investigated over a number of decades, but due to considered methodological issues (Marsh, 1990a; Marsh, 1990b) a fully acceptable causal relationship pattern has not yet been resolved. Consequently, different conclusions regarding causal direction have been drawn. Originally, based on the models put forward by Calsyn and Kenny (1977) one of two directions was suggested, first, the level of academic achievement determines the level of self-concept, i.e., a skill-development model and second, that self-concept determines academic achievement, whereby by virtue of a self-enhancement model, improvements in performance are the result of optimizing self-concept. More recently, however, researchers have also favored a compromise reciprocal effects model, wherein the two factors are mutually supportive (e.g., Guay, Marsh, & Boivin, 2003; Marsh, Byrne, & Yeung, 1999).

Nevertheless, despite the lack of a definitive and satisfactory conclusion, the association between self-concept and achievement is as stated well established. Moreover, in specific reference to academic self-concept and mathematics achievement, significant and positive relationships have been found (Parker, Marsh, Ciarrochi, Marshall, & Abduljabbar, 2014; Wang, 2007) and is under investigation in the present study.

Mathematics Self-Efficacy and Mathematics Achievement

Within the field of self-efficacy (e.g., Bandura, 1997; Schunk, 1995), the area of academic self-efficacy has engendered strong interest among both researchers and practitioners. Zimmerman (1995) describes academic self-efficacy as one's capabilities to organize and execute courses of action to attain designated types of educational performances. Much like general self-efficacy theory, academic self-efficacy involves judgments on capabilities to perform tasks in specific academic domains. In a classroom-learning environment, measures of academic self-efficacy assess students' perceptions of their ability to succeed at performing specific tasks.

Research studies have provided significant evidence that academic self-efficacy is positively correlated to academic motivation (e.g., Schunk & Hanson, 1985), memory performance (Berry, 1987), persistence (Lyman, Prentice-Dunn, Wilson, & Bonfilio, 1984), and academic performance (Schunk, 1989). In addition a meta-analysis, conducted by Multon, Brown, and Lent (1991) of 39 self-efficacy studies, revealed that academic self-efficacy is a consistent positive predictor of academic achievement. Schunk (1996) found the relationship between academic efficacy and both motivation and effort is reciprocal in that both motivation and effort influence, and are influenced by, academic efficacy. In a 2001 study, Dorman linked classroom environments with self-efficacy. His research showed that classroom environment was significantly associated with academic efficacy and that "…it is probable that academic efficacy acts as a mediating variable" (p. 255).

Given the growing evidence on the relationships between students' dispositions towards mathematics and their mathematics performance, it is crucial to examine whether or not similar relationships exist between these variables/measures in the context of the United Arab Emirates. The following research question addressed the purpose of the study: To what extent do intrinsic and instrumental motivation to learn mathematics, mathematics self-efficacy, mathematics self-concept, and mathematics anxiety predict mathematics achievement among Emirati adolescents? Based on prior Western-centric research, it was hypothesized that intrinsic motivation to learning mathematics, mathematics self-efficacy, and mathematics self-concept would be positively associated with mathematics achievement; and instrumental motivation to learn mathematics and mathematics anxiety would be negatively related to mathematics achievement.

METHOD

Data

Data for the study were drawn from the Organization for Economic Cooperation and Development's (OECD) Program for International Student Assessment (PISA) 2012 database. The focus of PISA 2012 was on mathematics; and reading, science, and problem solving were the minor areas of assessment (OECD, 2014). In 2012, over half-a-million 15-year-olds from 65 countries and economies took part in the fifth cycle of PISA (OECD, 2014). A total of 11500 adolescents from 458 schools in the United Arab Emirates participated in the PISA 2012 assessment. Of these, 5116 adolescents (Mean age = 15.86 years; *SD* = 0.28) from 384 schools were native Emiratis.

Measures

Mathematics achievement. The PISA 2012 overall mathematics scale (PVMATH) was the outcome measure in the study. Scores on the overall mathematics scale range from 0 to 1000, with a mean score of 500 and a standard deviation of 100 (see OECD, 2014). The average mathematics score of native Emiratis was 399.76 (*SD* = 74.07).

Intrinsic motivation to learn mathematics. The intrinsic motivation to learn mathematics scale included four items (INTMAT; e.g., "I do mathematics because I enjoy it"), and the scale had an internal reliability of 0.86. All items were rated on 4-point Likert-type scale, ranging from 1 (*strongly disagree*) to 4 (*strongly agree*).

*Instrumental motivation to learn mathematics***.** The instrumental motivation to learn mathematics scale comprised of four items (INSTMOT; e.g., "I will learn many things in mathematics that will help me get a job"), and the scale had an internal reliability of 0.87. All items were rated on 4-point Likert-type scale, ranging from 1 (*strongly disagree*) to 4 (*strongly agree*).

*Mathematics self-efficacy***.** The mathematics self-efficacy scale consisted of eight items, and each of these items asked the respondents to rate their confidence in performing various mathematical tasks (MATHEFF; e.g., Using a train timetable to work out how long it would take to get from one place to another). All items were rated on a 4-point Likert-type scale, ranging from 1 (*not at all confident*) to 4 (*very confident*). The scale had an internal reliability of 0. 83.

Mathematics self-concept. The mathematics self-concept scale included five items (SCMAT; e.g., "I learn mathematics quickly"), and the scale had an internal reliability of 0.80. All items were rated on 4-point Likert-type scale, ranging from 1 (*strongly disagree*) to 4 (*strongly agree*).

Mathematics anxiety. The mathematics anxiety scale comprised of five items (ANXMAT; e.g., "I get very nervous doing mathematics problems"), and the scale had an internal reliability of 0.77. All items were rated on 4-point Likert-type scale, ranging from 1 (*strongly disagree*) to 4 (*strongly agree*).

The OECD constructed all the six scales employing item response theory (IRT; see OECD, 2014). The OECD standardized all PISA scales, except the overall mathematics achievement scale, to a mean of 0 and standard deviation of 1 for all OECD-member countries. A positive mean value implies that the mean of the PISA scale is above the OECD average, and a negative mean value indicates that the mean of the PISA scale is below the OECD average (see OECD, 2014).

In addition to these measures, student demographic characteristics such as gender (ST04Q01; 0 = male; 1 = female), and economic, social, and cultural status (ESCS; an index derived from highest occupational status of parents, highest educational level of parents, and home possessions); and school demographic characteristics such as school type (SC01Q01; 0 = private; 1 = public), school location (SC03Q01; 0 = rural; 1 = urban), school enrolment size (SCHSIZE), student-mathematics teacher ratio (SMRATIO), quality of school's physical infrastructure (SCMATBUI; a scale constructed using three items; e.g., shortage or inadequacy of school buildings and grounds), and quality of school's educational resources (SCMATEDU; a scale constructed using six items; e.g., shortage or inadequacy of instructional materials) were included as covariates in the study.

RESULTS

The descriptive statistics for the main variables of interest and the bivariate correlations among them are reported in Table 1. To address the purpose of the study, multilevel modeling analyses were performed (MLM; see Raudenbush & Bryk, 2002). Multilevel regression not only accounts for hierarchical structure of the PISA data (i.e., students nested within schools) but also provides better statistical inference (see Raudenbush & Bryk, 2002). The fitted multilevel regression equation is given below.

$$\begin{aligned} PVMATH_{ij} = {} & \gamma_{00} + \gamma_{01}{*}SC01Q01_{j} + \gamma_{02}{*}SC03Q01_{j} + \gamma_{03}{*}SCHSIZE_{j} \\ & + \gamma_{04}{*}SCMATBUI_{j} + \gamma_{05}{*}SCMATEDU_{j} + \gamma_{06}{*}SMRATIO_{j} \\ & + \gamma_{10}{*}ST04Q01_{ij} + \gamma_{20}{*}ESCS_{ij} + \gamma_{30}{*}ANXMAT_{ij} + \gamma_{40}{*}INSTMOT_{ij} \\ & + \gamma_{50}{*}INTMAT_{ij} + \gamma_{60}{*}MATHEFF_{ij} + \gamma_{70}{*}SCMAT_{ij} + u_{0j} + r_{ij} \end{aligned}$$

All dichotomous variables were kept in their original metric. All student-level non-dichotomous measures were group-mean centered, while all school-level non-dichotomous measures were grand-mean centered (see Hofmann, 1998). Student- and school-level weights were used in the analyses, and the full information maximum likelihood (FIML) was the method of estimation (see Raudenbush & Bryk, 2002).

Table 1. Descriptive statistics and bivariate correlations

	1	*2*	*3*	*4*	*5*	*6*	*M*	*SD*
1. Mathematics self-efficacy	—						2.92	.63
2. Mathematics self-concept	.50***	—					2.80	.70
3. Intrinsic motivation to learn mathematics	.48***	.61***	—				2.84	.78
4. Instrumental motivation to learn mathematics	.45***	.48***	.71***	—			3.15	.74
5. Mathematics anxiety	−.11***	−.36***	−.16***	−.07***	—		2.64	.70
6. Mathematics achievement	.26***	.25***	−.03*	.06***	−.40***	—	399.76	74.07

*$p < 0.05$. ***$p < 0.001$.

The results of the MLM analyses (see Table 2), after accounting for student- and school-level demographic characteristics, suggested that mathematics self-efficacy ($B = 13.14$, $p < 0.001$), mathematics self-concept ($B = 15.32$, $p < 0.001$), and instrumental motivation to learn mathematics ($B = 4.29$, $p < 0.05$) were statistically significantly positively associated with mathematics achievement among native Emirati adolescents. In contrast, mathematics anxiety ($B = –16.60$, $p < 0.001$) and intrinsic motivation to learn mathematics ($B = –14.15$, $p < 0.001$) were statistically significantly negatively linked to mathematics achievement among native Emirati adolescents.

Mathematics anxiety had the strongest negative association with mathematics achievement ($\beta = –0.18$), followed by intrinsic motivation to learn mathematics ($\beta = –0.17$); whereas mathematics self-concept had the strongest positive association with mathematics achievement ($\beta = 0.16$), followed by instrumental motivation to learn mathematics ($\beta = 0.15$) and mathematics self-efficacy ($\beta = 0.15$).

DISCUSSION

The present study investigated the extent to which intrinsic and instrumental motivation to learn mathematics, mathematics self-efficacy, mathematics self-concept, and mathematics anxiety were associated with mathematics achievement among Emirati adolescents. Results indicated that mathematics self-efficacy, mathematics self-concept, and instrumental motivation to learn mathematics were significantly and positively related to mathematics achievement whereas, mathematics anxiety and intrinsic motivation to learn mathematics had significant but negative associations with mathematics achievement.

Table 2. Results of multilevel modeling analyses predicting mathematics achievement

	B	*SE*
Intercept	389.05***	9.58
Student-level		
Gender	14.00*	6.89
Economic, social, and cultural status	3.15	1.67
Intrinsic motivation to learn mathematics	−14.15***	2.26
Instrumental motivation to learn mathematics	4.29*	2.11
Mathematics self-efficacy	13.14***	2.63
Mathematics self-concept	15.32***	3.26
Mathematics anxiety	−16.60***	1.67
School-level		
School type	−13.99	8.52
School location	9.62	8.08
School enrolment size	0.02**	0.01
Student-mathematics teacher ratio	0.07	0.08
Quality of school's physical infrastructure	3.90	4.00
Quality of school's educational resources	5.07	4.24
Intercept variance ($\hat{\tau}_{00}$)	2135.74	
Level-1 variance ($\hat{\sigma}$)	3119.52	
Intra-class correlation coefficient ($\hat{\rho}$)	0.41	
Variance in achievement between schools explained	0.20	
Variance in achievement within schools explained	0.15	

**p < 0.05. **p < 0.01. ***p < 0.001.*

Mathematics Self-Efficacy and Mathematics Achievement

The analyses of the data for Emirati adolescents, established support of previous research (Bandura, 1977, 2000; Zimmerman, Bandura, & Martinez-Pons, 1992) that found that self-efficacy was positively associated with academic performance (Bong & Skaalvik, 2003; Multon, Brown, & Lent, 1991). Therefore, encouragement of educational environments that promote growth of Emirati students' mathematics self-efficacy would be of benefit to the overall raising of student mathematics achievement within the United Arab Emirates.

Appropriate self-efficacy raising instructional strategies include those that help students to set learning goals (Bandura, 1997; Schunk, 1991), provide

timely and explicit feedback (Bandura, 1997), encourage students to study harder (Siegle & McCoach, 2007), and use high achieving students as models (Bandura, 1986; Schunk, 1991; Siegle & McCoach, 2007). There was also support of a reciprocal relationship between self-efficacy and performance (Bandura, 1997; Schunk & Pajares, 2009); hence to further assist the Emirati students, teachers are recommended to pay as much attention to students' perceptions of capability as to the actual capabilities of the students, as these perceptions that may more precisely predict students' behavior (Pajares, 1996), thereby providing the prospect of success for students that, in turn, can lead to potential improvement in their sense of mathematics efficacy and therefore in their mathematics performance levels.

Mathematics Self-Concept and Mathematics Achievement

The results showed that the Emirati students as their peers in other parts of the world demonstrated a clear association between mathematics self-concept and mathematics achievement (Byrne, 1990; Hamachek, 1995), and therefore inculcation of a school and classroom environment that nurtures students' self-concept is a vital component of academic achievement. The reflection method that rewards with praise and provides constructive feedback on student's academic and non-academic performance and activity, is a considered a purposeful method by which schools can create a supportive climate for students to continuously improve their positive self-concept and hence be more likely to attain higher academic achievement (Hay, 2005; Roberson & Steward, 2006).

Mathematics Anxiety and Achievement

The study demonstrated a significant and negative relationship between mathematics anxiety and students' mathematics performance. These findings are consistent with previous research that stretches back decades (e.g., Hembree, 1990; Ma, 1999). However, establishing consistency with research does not remove the need to assist students whose performance may be affected by anxiety.

Research over the past decade investigating the potential disruptive effect of mathematics anxiety on memory (see Ashcraft, 2002) is intended to clarify the relationship between the two constructs and in doing so help students reduce the effect of mathematics anxiety on their performance. One direction highlighted in a recent study by Ramirez et al. (2013) that demonstrated the disruption of retrieval in high- and low-working memory students may yield potential strategies that can be used by students, e.g., avoidance of mental arithmetic use when anxious, to reduce potential disruption. Combining emergent strategies with approaches that point towards improving levels of mathematics self-concept and self-efficacy among students may better assist students reduce the debilitating effects of mathematics anxiety.

Motivation to Learn Mathematics: Intrinsic and Instrumental

In the present study, differing from numerous prior studies worldwide, intrinsic motivation within the Emirati adolescent population was significantly and negatively associated with achievement. Furthermore, in stark contrast to intrinsic motivation to learn mathematics, the results of the analyses showed that instrumental motivation to learn mathematics was significantly and positively associated with mathematics achievement among native Emirati adolescents. Initial examination suggests that Emirati students' consideration of the utility value of mathematics appears indicative of mathematics performance, whereas interest and enjoyment of mathematics do not appear to predict the students' performance and achievement.

This finding raises some interesting issues for the United Arab Emirates and poses questions for future research studies to examine regarding possible explanation of such a result. One potential direction is a consideration of motivation as a social construction (see Ushioda, 2006), and the role of sociocultural influences upon the development of an individual's motives to behave. Investigation of societal forces would seem relevant within collectivistic societies (see Triandis, 1995) such as the United Arab Emirates. The Emirati culture is one within which identification to sources external to the individual, such as family, religion and tradition are tightly bound to considerations of motivation, achievement and appropriate behavior; the connections with which, in keeping with ecological systems theory (Bronfenbrenner, 1974) must be examined if a fuller understanding of individual behavior is to be achieved. Furthermore, this rationale is aligned with the earlier mentioned distinction posited by Self-Determination Theory (Ryan & Deci, 2002), between extrinsic reasons for behavior that are in line with internal beliefs, and hence may be considered instrumental to future success and extrinsic reasons for behavior that are not congruent with internal beliefs.

Consequently, for teachers to help students develop motivation they need not only support students in their efforts to meet high expectations and in demonstrating higher levels of commitment for future success, but also encourage students to consider errors and challenges as learning opportunities with intrinsic worth, and hence seek pleasure and reward from the challenge of mathematics.

CONCLUSION

The major implications of the study for the Emirati classroom are drawn from the results regarding the relationship between Emirati students' dispositions towards mathematics and their mathematics achievement, and these are framed within both a general body of research and against the cultural context of the United Arab Emirates. The outcomes of the study agree with research that in general demonstrate a significant and positive relationship between mathematics self-concept and self-efficacy and mathematics achievement, and reinforce the need to provide a classroom environment that encourages growth of Emirati students' self-concept and

self-efficacy. In addition, the significant and negative relationship found in Emirati students between mathematics anxiety and mathematics achievement is indicative of the necessity for research to develop potential classroom strategies that can reduce the inferred deleterious effect of mathematics anxiety. However the results concerning the relationship between mathematics achievement and instrumental and intrinsic motivation do not agree with the current body of Western-centric research. As stated, however, in light of the socio-cultural construction of the United Arab Emirates, the seemingly counter-intuitive results may better be understood, in addition to the use of psychological theories such as Self-Determination Theory (Ryan & Deci, 2002), from the inclusion of sociocultural and ecological systems explanations that can contextualize the role of social influence on the development of Emirati students' dispositions toward the learning of mathematics.

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19. NONCOGNITIVE SKILLS

Intergenerational Transmission and Their Effect on Education and Employment Outcomes

INTRODUCTION

A growing literature shows that individual skills like perseverance, self-control or social competence play a prominent role on education, employment and health outcomes even after controlling for individual differences in cognitive ability (Almlund et al., 2011). These skills, among others, are labelled "noncognitive skills" and they appear to be, for some collectives, even more relevant predictors of observed individual differences in life-time outcomes than innate intellectual ability (Almlund et al., 2011; Lindqvist & Vestman, 2011).[1] Regarding their origin and malleability, Cunha and Heckman (2008) show that cognitive and noncognitive skills are jointly determined by parental environments and investments at different stages of childhood. They find that parental investments are more effective in raising noncognitive skills and that noncognitive skills promote the formation of cognitive skills, while causality does not run in the opposite direction. Additionally, the evidence from behavioral genetics shows that noncognitive skills are as heritable as cognitive skills.[2]

In this chapter we review recent contributions made to this literature that analyze the existence of a cultural component on the formation process of noncognitive skills. Culture is an ambiguous word. Fernandez and Fogli (2009) provide an operational definition of culture as the set of beliefs and preferences that conditions individuals' actions, that systematically vary across either socially or geographically defined groups and that are transmitted to successive generations. In the current setting culture refers to country differences in the noncognitive skills or qualities that parents pass on to their children through training or example. Since the effect of culture cannot be separately identified from those of economic and institutional factors in a between-country analysis, we take advantage of the differential "portability" of culture relative to economic and institutional factors (Fernandez, 2008). The idea behind this identification approach, named epidemiological approach, is that when individuals emigrate they may take some of the predominant beliefs and preferences regarding child qualities in their birthplace with them and transmit them intergenerationally. Thus, noncognitive skills may also vary across second-generation immigrants reflecting culture in their country of origin. These

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second-generation immigrants were born in the same country, they face the same markets and institutions, but their cultural heritage is likely to differ according to their parents' country of birth. This identification strategy is likely to provide a lower bound on the effect of culture since first-generation immigrants may not hold the preferences and values that are representative of their country's culture. Moreover, parents are not the only transmitters of culture and also the norms and beliefs of the host country matter.

Mendez (2015) was the first paper that applied the epidemiological approach to analyze the existence of a cultural component on the formation process of noncognitive skills. He found that the intergenerational transmission of noncognitive skills plays a prominent role in explaining variation in 15-years-old school children's scholastic performance in the Program for International Students Assessment (PISA). This is a relevant issue since scholastic performance predicts both entry into higher education and earnings at the individual level and economic growth at the country level (Hanushek & Woessman, 2011). Interestingly, Mendez (2015) reached to a qualitatively similar result for the seven host countries that he analyzed: Australia, Austria, Belgium, Finland, Luxembourg, Netherlands and Switzerland. Regarding the magnitude of the estimated effects, it turned out that a one standard deviation increase in the synthetic cultural variable would account to between 10% and 20% of the difference in student performance across ancestries in Austria, Belgium, Finland and Switzerland, depending on the subject considered. The effect of interest is largest in Australia and the Netherlands and lowest in Luxembourg, where it accounts to between 20% and 30% and to almost 5% of the difference in student performance across ancestries, respectively.

The estimates in Mendez (2015) suggest that the intergenerational transmission of some child qualities positively related to the conscientiousness personality factor like hard work, responsibility, perseverance and thrift favors the acquisition of cognition as measured by achievement tests. This result is coherent with the finding in Cunha and Heckman (2008), Heckman, Pinto and Savelyev (2013) and Borghans, Meijers and Weel (2008), among others, that the conscientiousness personality factor plays a powerful role in explaining educational performance. Along these lines, Gronqvist et al. (2010) find that educational attainment and labor market outcomes of children are strongly related to both parents' cognitive and noncognitive skills.

In a related setting, Mendez and Zamarro (2015) find that the intergenerational transmission of certain noncognitive skills plays a prominent role in determining individuals' educational level and employment status during adulthood. In particular, they find that individuals whose cultural heritage considers the qualities positively associated to the conscientiousness personality factor thrift and particularly so hardworking as higher valued qualities to encourage in children have higher educational levels and, in particular, are more likely to complete college after finishing high school. Additionally, they also find that the lower the weight that the respondent's cultural heritage places on hard work, the lower the probability that, conditional on being employed, he is in a high-skilled occupation (i.e. management,

business and financial occupations or professional and related occupations) and the lower the probability that he earns a higher wage, but only for wages above the median of the wage distribution. These findings are in line with the large body of evidence summarized in Almlund et al. (2011) showing that personality measures related to the conscientiousness personality factor, like hardworking, predict educational attainment and other outcomes in adulthood.

Mendez and Zamarro (2015) also analyze the relevance of the noncognitive skills embodied in the concept of civic capital, introduced in Guiso, Sapienza and Zingales (2010) and defined as the set of beliefs and values that help cooperation in society. Guiso, Sapienza and Zingales (2010) showed that civic capital is differentiated from human capital, that it satisfies the properties of the standard notion of capital, and that it helps to explain why differences in economic performance across countries persist over centuries. In this work, the authors obtain a synthetic measure of civic capital as the first principal component of the variation across ancestries of the responses to four questions of the WVS where respondents were asked to tell how justifiable the following behaviors were: "Claiming government benefits to which you are not entitled", "Avoiding a fare on public transport", "Cheating on taxes if you have a chance" and "Accepting a bribe in the course of their duties".

The estimates in Mendez and Zamarro (2015) show that individuals with a higher inherited civic capital also have higher educational levels and a higher probability of completing college after finishing high school, although the latter effect is lower than that estimated for the transmission of child qualities associated with conscientiousness. However, they do not find an effect of inherited civic capital on employment outcomes, once educational attainment is controlled for. This, in turn, suggests that a certain level of both inherited civic capital and hardworking (conscientiousness) are relevant for educational success whereas only the inherited stock of conscientiousness matters for achieving success in the labor market.

As in Mendez (2015), the size of the estimated effects is relevant. In particular, they found that the transmission of child qualities positively associated to conscientiousness like hard work and thrift and of civic capital account for 64% and 36% of the standard deviation of average education attainment across ancestries, respectively. Additionally, they also find that a one standard deviation increase in the percentage of citizens from the respondent's country of ancestry that value those qualities as a relevant for children accounts for, at least, 66% of the standard deviation of the share of high-skilled workers across ancestries.

Both Mendez (2015) and Mendez and Zamarro (2015) approximate students' cultural heritage by using the first two waves of the World Values Survey (WVS), carried out around 1982 and 1990, respectively, and, in particular, the responses provided by citizens from the respondent's country of ancestry to the following question: "Here is a list of the qualities that children can be encouraged to learn at home. Which, if any, do you consider to be especially important? Please choose up to five". There were eleven child qualities in the list: good manners; independence; feeling of responsibility; hard work; imagination; tolerance and respect for other

people; thrift, sparing money and things; determination, perseverance; religious faith and unselfishness.

The outline of the chapter is as follows. Sections 2 and 3 review the literature and present the identification strategy commonly used in this literature, respectively. In Section 4 we review the correspondence between the child qualities in the WVS and the personality factors in the Big Five, the most frequently used taxonomy of personality skills, presented in Mendez (2015). Section 5 presents and discusses the main results obtained in Mendez (2015) and Mendez and Zamarro (2015) and, finally, Section 6 concludes.

LITERATURE REVIEW

The idea that culture affects individual behavior and, thus, economic outcomes, goes back to at least Max Weber who, in his classical work "The Protestant Ethic and the Spirit of Capitalism" (Weber, 1905), argued that a particular culture, the "Protestant Ethic", played a major role in the development of capitalism in its early phases. In recent decades, the economic literature has provided us with the tools for showing, in a quantitative fashion, that culture matters. We now have an operational definition of culture and an identification strategy, the so-called epidemiological approach (Fernandez, 2008), that separately identifies the effect of culture from those of market variables and institutions by studying the behavior of second-generation immigrants of different origins living in the same host country. The evidence summarized in this chapter belongs to this literature that empirically tests the cultural hypothesis.

Among the closely related definitions of culture in the economic literature we choose that in Fernandez and Fogli (2009) since it captures the three ingredients of culture, that is, that it conditions individuals' actions, that it systematically varies across either socially or geographically defined groups, and that it is transmitted to successive generations.[3] We now have large evidence that culture matters for relevant economic outcomes. A non-exhaustive list of outcomes includes female work and fertility (Fernandez & Fogli, 2009), trust and trade (Guiso, Sapienza, & Zingales, 2009), economic growth (Guiso, Sapienza, & Zingales, 2010; Tabellini, 2010), children's living arrangements (Giuliano, 2007), employment patterns of different demographic groups (Algan & Cahuc, 2005), the design of labor market institutions (Algan & Cahuc, 2006), gender roles (Alesina, Giuliano, & Nunn, 2011), home production, female labor force participation and geographical mobility (Alesina & Giuliano, 2010), risk and trust attitudes (Dohmen et al., 2012), student performance in PISA (Mendez, 2015) and education and labor outcomes in adulthood (Mendez & Zamarro, 2015).[4]

Central to this literature is the use of quantitative variables measured in the second-generation immigrant's country of ancestry as a proxy for culture. Although these aggregate variables reflect country differences in economic, institutional and cultural factors, the only reason why they might affect the behavior of second-generation immigrants, born and raised in a different country, is because of its

cultural component. It is also common to extract the first principal component and to use it as the main cultural variable if there are several cultural indicators. That is the case, among others, in Alesina and Giuliano (2010), Guiso, Sapienza and Zingales (2010), Tabellini (2010), and also in Mendez (2015) and Mendez and Zamarro (2015) since they have valuations of eleven child qualities in the student's country of ancestry as proxies for culture. Moreover, many of these papers and, in particular, the latter ones, use the World Values Survey to obtain their cultural indicators.

We are also interested in an even more recent literature on the economic consequences of individual personality or character skills. The review in Almlund et al. (2011) shows that other skills different from cognitive ability affect relevant economic outcomes like achievement test scores, educational attainment and also employment and health status in the adulthood. These skills are labelled "noncognitive skills" and they include attributes, dispositions, social skills, attitudes and intrapersonal resources, independent of intellectual ability (U.S. Department of Education, 2013). Lundberg (2012) shows, using data from the German Socio-economic Panel Study, that personality traits also play a major role in explaining selection into marriage.

Noncognitive skills appear to be, for some collectives, even more relevant predictors of observed individual differences in life-time outcomes than innate intellectual ability. For example, Lindqvist and Vestman (2011) find, using data from the Swedish military enlistment on cognitive and noncognitive skills based on personal interviews conducted by psychologists, that noncognitive skills have a much stronger effect on labor market outcomes at the end of the earnings distribution. Conversely, they find that cognitive skills are a stronger predictors of wages for skilled workers and of earnings above the median. Almlund et al. (2011) show that personality skills, and in particular those related to the conscientiousness personality factor ("the tendency to be organized, responsible, and hardworking"), are more relevant in explaining variation in longevity and achievement test scores than innate intellectual ability. Lundberg (2013) examines the effect of cognitive and noncognitive skills on college graduation in a recent cohort of young Americans and she finds that the returns to noncognitive skills are highly context-dependent, with the effect of personality skills varying by family background. Also, Cebi (2007) finds that locus of control, which measures the extent to which an individual believes she, as opposed to luck, controls her life, has no effect on educational achievement but it is rewarded in the labor market later in life.

Regarding the origin and malleability of noncognitive skills, Cunha and Heckman (2008) show that cognitive and noncognitive skills are jointly determined by parental environments and investments at different stages of childhood. They find that parental investments are more effective in raising noncognitive skills and that noncognitive skills promote the formation of cognitive skills, while causality does not run in the opposite direction. Cunha, Heckman and Schnnach (2010) and Borghans, Meijers and Weel (2008) provide evidence that noncognitive skills influence cognitive tests performance.

Additionally, the evidence reviewed in Heckman and Kautz (2013) shows that noncognitive skills can also be enhanced in a lasting and cost-effective way by means of high-quality early childhood and elementary school programmes. In particular, they find that many programmes beneficially affect later-life outcomes without improving cognition. In a related setting, Diamond and Lee (2011) review the programmes that have been shown to help young children develop noncognitive skills and, in particular, executive functions, the cognitive control functions needed to concentrate, ignore distractions, retain and use new information, plan actions and revise plans as needed, and inhibit impulse behavior (self-control, self-regulation). The successful interventions that they analyze include computerized training, noncomputerized games, aerobics, martial arts, yoga, mindfulness and school curricula programmes.

In this chapter we summarize the existing evidence that results from combining these two literatures, the one that test the cultural hypothesis and that on noncognitive skills.

METHODOLOGY AND DATASETS

To analyze the effect of culture on the outcome of interest it is common to propose the following regression model:

$$Y_{ijt} = \beta_0 + \beta_1 X_{it} + \delta Z_j + \tau_t + \varepsilon_{ijt} \quad (1)$$

where Y_{ijt} is the outcome of interest, i.e. achievement test score and education and labor outcomes in adulthood in Mendez (2015) and Mendez and Zamarro (2015), respectively, of second-generation immigrant i of ancestry j interviewed in year t and X is a set of control variables. The main explanatory variable is the cultural proxy Z_j obtained as the first principal component of the cultural indicators if there are several indicators. Equation (1) is estimated by ordinary least squares or by discrete choice models depending on the nature of the outcome variable on a sample of second-generation immigrants living in the same host country. To control for the possibility of common group error terms that would bias the estimates, it is necessary to use a clustered-robust standard error where each ancestry is interpreted as a cluster. This is a relevant issue since the outcome variable varies at the individual level but the cultural proxies do so only at the country-of-ancestry level.

Mendez (2015) uses the 2003, 2006, 2009 and 2012 reports of the Program for International Students Assessment (PISA), coordinated by the OECD, to obtain information on students' performance in reading, mathematics and science and to characterize their family and schooling environments. The 2000 report is excluded from the estimation because it does not inform on the country of birth of the student's parents. The complex sampling design of PISA is taken into account when computing the standard error of the estimates by using the "unbiased shortcut" procedure described in OECD (2009). Mendez (2015) presents evidence for seven

host countries: Australia, Austria, Belgium, Finland, Luxembourg, the Netherlands and Switzerland. These are the countries for which PISA informs on the country of parents' birthplace and whose sample of second-generation immigrants comprises at least four ancestries that participated in at least one of the first two waves of the WVS. Most papers in the economic literature on culture analyze only one host country, typically the United States. The advantage of using several host countries is that it can be tested whether the results hold independently of the economic, institutional and cultural characteristics of the host country and of the immigrant groups living there. The host countries considered in Mendez (2015) differ to a great extent in the design of their educational systems, a dimension that affects student performance (Hanushek & Woessmann, 2011). According to Dronkers and De Heus (2012), Switzerland is an example of a highly stratified educational system, i.e. a system in which educational choices are made at a relatively early age, whereas Luxembourg and Australia are moderately and hardly stratified educational systems, respectively.

The estimates in Mendez (2015) control for individual and familiar characteristics like the student's sex and age, the highest education level of the parents, their occupational status in the current or previous job, if any, the number of books at home and whether the language that the student speaks at home most of the time is the test language or not. Regarding the school they attend: whether it is private or not, the size of the community in which it is located, whether the school capacity to provide instruction is hindered by a shortage or inadequacy of qualified teachers or instructional materials, whether the school has the main responsibility for selecting teachers for hire, determining teachers' salary increases or formulating the school budget, whether students are grouped by ability or not in at least one class and the average index of economic, social and cultural status of the students enrolled in the same school as the respondent.

The empirical analysis in Mendez and Zamarro (2015) is performed on the pooled 2005–2012 March Current Population surveys (CPS). After 1994, the March CPS informs on the place of birth of each respondent and his parents. They focus on respondents aged 25 to 35 years old since most of them have already finished their formal education. They do not consider older individuals since the hypothesis that the cultural measures were recorded in the respondent's country of ancestry at the time his father lived there would not be very realistic. For the same reason they do not use CPS data collected before 2005. As before, they consider a large set of controls in X: the respondent's gender, age, age squared, perceived health status, marital status, number of children under six years of age in the household and per-capita family income excluding respondent's wage and salary earnings. For married respondents, they also control for his spouse's immigration status (first, second-generation or none of them), employment status and educational level (less than high school, high school, some college and college degree). All the estimates control for interview year, state of residence and metropolitan area effects.

Both Mendez (2015) and Mendez and Zamarro (2015) obtain their cultural variables by using data from the first two waves of the World Values Survey (WVS), carried out around 1982 and 1990, respectively. They pool data from these two waves together in order to attain a sufficiently large number of ancestries and they analyze the responses provided by citizens from the respondent's country of ancestry to the following question: "Here is a list of the qualities that children can be encouraged to learn at home. Which, if any, do you consider to be especially important? Please choose up to five". There were eleven child qualities in the list: good manners; independence; feeling of responsibility; hard work; imagination; tolerance and respect for other people; thrift, sparing money and things; determination, perseverance; religious faith and unselfishness.

Since the valuation of the different child qualities are correlated across respondents and ancestries, they use the first principal component of the variation in the valuation of the qualities as the main cultural variable. This cultural variable is thus expected to proxy for the prevalent beliefs and preferences regarding child qualities in the student's country of ancestry at the time his parent lived there. In particular, they extracted three principal components, those with associated eigenvalues greater than one. The comparison of the coefficients associated to the different principal components in the estimation of equation (1) informs on the effect of different combinations of intergenerationally transmitted child qualities on the outcome of interest since the principal components correlate differently with different child qualities.

Following Guiso, Sapienza and Zingales (2010), Mendez and Zamarro (2015) also estimated a second synthetic cultural variable as the first principal component of a factor analysis of the responses to four questions of the WVS where respondents were asked to tell how justifiable the following behaviors were: "Claiming government benefits to which you are not entitled", "Avoiding a fare on public transport", "Cheating on taxes if you have a chance" and "Accepting a bribe in the course of their duties". Responses ranged from 1 to 10, where 1 and 10 meant that such behavior was "never justifiable" or "always justifiable" for the respondent, respectively. The coefficient associated to this synthetic cultural variable informs on the effect of the inherited stock of civic capital. The estimates in Mendez and Zamarro (2015) simultaneously control for the cultural variables coming from the child qualities and from the civic capital indicators.

CHILD QUALITIES AND THE BIG FIVE

Mendez (2015) establishes a correspondence between the child qualities in the WVS and the personality factors in the Big Five, the most frequently used taxonomy of personality skills. This allows to connect his findings and, more generally, those obtained using the child qualities in the WVS, to those in the literature on the consequences of personality skills. The Big Five was derived from factor analysis of

measurements of personality from different sources and it comprises the following personality factors: conscientiousness, openness to experience, extraversion, agreeableness and neuroticism.

Table 1 defines the five personality factors and resumes the expected correspondence between the child qualities in the WVS and the personality factors as presented in Mendez (2015). The last column informs on the sign of the expected correlation, if any, between the child qualities in the WVS and the personality factors in the Big Five according to the review of the economic and psychological literatures. As discussed in Almund et al. (2011), many narrowly defined traits or behaviors used to assess personality traits can be mapped into one or more of the dimensions of the Big Five.

Qualities like hard work, responsibility, thrift and perseverance are expected to be tightly related to the conscientiousness factor. Obedience and good manners are also expected to be positively associated to conscientiousness. The same holds for obedience and agreeableness in its compliance facet. Religiosity in general and particularly so, open and mature religion, and spirituality are expected to be positively related to agreeableness and conscientiousness. Imagination and tolerance are found to be positively associated to the openness to experience factor as described in Mendez (2015), while unselfishness and good manners are positively related to the agreeableness factor. Independent children are a priori less likely to act in a cooperative manner (A) or to be oriented toward the outer world of people and things (E). Finally, tolerance is expected to be related to almost all the personality factors.

ESTIMATES

This section summarizes the estimates for the effect of the intergenerational transmission of noncognitive skills on student performance, education and labor outcomes in Mendez (2015) and Mendez and Zamarro (2015), respectively.

Culture and Student Performance

The estimates in Mendez (2015) suggest that the intergenerational transmission of some child qualities positively related to the conscientiousness personality factor like hard work, responsibility, perseverance and thrift favors the acquisition of cognition as measured by achievement test. The opposite holds for tolerance, religious faith and obedience. These results are coherent with the finding in Cunha and Heckman (2008), Heckman, Pinto and Savelyev (2013) and Borghans, Meijers and Weel (2008), among others, that the conscientiousness personality factor plays a powerful role in explaining educational performance. The estimates also suggest that the intergenerational transmission of the child qualities independence and imagination, related to the openness to experience and agreeableness personality factors, respectively, improves student performance.

Table 1. The Big Five domains and their expected correlation with the child qualities

Big Five factors	American Psychology Association Dictionary	Facets (and correlated trait adjective)	Related Traits	Childhood Temperament Traits	Expected correlation with child qualities
Conscientiousness	"the tendency to be organized, responsible, and hardworking"	Competence (efficient) Order (organized) Dutifulness (not careless) Achievement striving (ambitious) Self-discipline (not lazy) Deliberation (not impulsive)	Grit Perseverance Delay of gratification Impulse control Achievement striving Ambition Work ethic	Attention/(lack of) distractibility Effortful control Impulse control/ delay of gratification Persistence Activity*	Hard work Responsibility Thrift Perseverance Religious faith (–) Obedience
Openness to Experience	"the tendency to be open to new aesthetic, cultural, or intellectual experiences"	Fantasy (imaginative) Aesthetic (artistic) Feelings (excitable) Actions (wide interests) Ideas (curious) Values (unconventional)	–	Sensory sensitivity Pleasure in low intensity activities Curiosity	Imagination Tolerance
Extraversion	"an orientation of one's interests and energies toward the outer world of people and things rather than the inner world of subjective experience; characterized by positive affect and sociability"	Warmth (friendly) Gregariousness (sociable) Assertiveness (self-confident) Activity (energetic) Excitement seeking (adventurous) Positive emotions (enthusiastic)	–	Surgency Social dominance Social vitality Sensation seeking Shyness* Activity* Positive emotionality Sociability/affiliation	Tolerance Independence (–)

Agreeableness	"the tendency to act in a cooperative, unselfish manner"	Trust (forgiving) Straight-forwardness (not demanding) Altruism (warm) Compliance (not stubborn) Modesty (not show-off) Tender-mindedness (sympathetic)	Empathy Perspective taking Cooperation Competitiveness	Irritability* Aggressiveness Willfulness	Good manners Independence (-) Tolerance Religious faith (-) Unselfishness Obedience
Neuroticism/ Emotional Stability	Emotional stability is "predictability and consistency in emotional reactions, with absence of rapid mood changes." Neuroticism is "a chronic level of emotional instability and proneness to psychological distress."	Anxiety (worrying) Hostility (irritable) Depression (not contented) Self-consciousness (shy) Impulsiveness (moody) Vulnerability to stress (not self-confident)	Internal vs. External Locus of control Core self-evaluation Self-esteem Self-efficacy Optimism Axis I psychopathologies (mental disorders) including depression and anxiety disorders	Fearfulness/ behavioral inhibition Shyness* Irritability* Frustration (Lack of) soothability Sadness	Tolerance (-) Obedience (-)

Notes: All the columns but the last one are taken from table 1 in Heckman (2011). Facets specified by the NEO-PI-R personality inventory (Costa & McCrae, 1992). Trait adjectives in parenthesis from the Adjective Check List (Gough & Heilbrun, 1983).
** These temperament traits may be related to two Big Five factors*

Mendez (2015) shows that the effect of culture is not heterogeneous in the student's sex but, as expected under the cultural hypothesis, it is larger if both the father and the mother were born in the same foreign country. Moreover, he finds that the father's culture is more significant and has a greater impact on test achievement than the mother's culture in almost all the host countries analyzed. Along these lines, Fernandez and Fogli (2009) also find that the effect of the husband's culture is more relevant than that of the wife in explaining the work behavior of the wife in a sample of second-generation married woman born in the United States.

The paper also addresses some relevant concerns like, among other, omitted variables bias (family size and country-of-ancestry level of development) and whether the estimates were indeed driven by the largest ethnic group within each host country. It also shows that, as expected under the cultural hypothesis, the effect of culture is larger the larger is the share of students of the same ancestry in the school. Fernandez and Fogli (2009) showed that the greater the average density of an ethnic group on the neighborhood, the greater the impact of culture on a woman's work and fertility outcomes. As they argue, this social component of culture might emerge because a high proportion of coethnics in the same neighborhood makes it easier to punish behaviors that are different from the social norm, or it might make it easier for individuals of the same ancestry to obtain role models or to diffuse their believes about how individuals should act.

Additionally, Mendez (2015) provides two additional pieces of evidence in favor of the hypothesis that culture drives his results. First, he shows that the estimates of interest remained qualitatively unchanged when alternatively using the preferred child qualities of different collectives of citizens from the student's country of ancestry to obtain the principal components: men; women; younger (under 30 years), middle-aged (30 to 45 years) and older (over 45 years) citizens. This is relevant since central to the economic and anthropological definitions of culture is the assumption that culturally determined beliefs and preferences are shared by a large majority of the group members. That is the case in the definition taken from Fernandez and Fogli (2009) and also in a well-known anthropological consensus definition of culture by Hofstede (2001) that runs as follows: "the collective programming of the mind (i.e. thinking, feeling and acting) that distinguishes the members of one group or category of people from another", where groups are usually defined by countries. Second, Mendez (2015) shows that qualitatively identical results are obtained when using more recent waves of the WVS to obtain the main cultural variables. This is coherent with the characterization of culture as a slow moving institution (Roland, 2004).

Mendez (2015) reaches to a qualitatively similar result for the seven host countries analyzed: Australia, Austria, Belgium, Finland, Luxembourg, Netherlands and Switzerland. Regarding the magnitude of the estimated effects, it turns out that a one standard deviation increase in the synthetic cultural variable would account to between 10% and 20% of the difference in student performance across ancestries in Austria, Belgium, Finland and Switzerland, depending on the subject considered.

The effect of interest is largest in Australia and the Netherlands and lowest in Luxembourg, where it accounts to between 20% and 30% and to almost 5% of the difference in student performance across ancestries, respectively.

Culture and Education

Equivalently, the findings in Mendez and Zamarro (2015) support the hypothesis that the intergenerational transmission of both civic capital and of some child qualities positively related to the conscientiousness personality factor like hard work and thrift favors educational attainment. These results are coherent with the finding in Cunha and Heckman (2008), Heckman, Pinto and Savelyev (2013) and Borghans, Meijers and Weel (2008), among others, that the conscienciousness personality factor plays a powerful role in explaining educational performance. Moreover, these estimates are also coherent with the finding in Mendez (2015) that the intergenerational transmission of child qualities positively associated to conscientiouness favors the acquisition of cognition as measured by achievement tests. According to their preferred estimates, an increase of one standard deviation in the synthetic cultural variable would account to 64.2% of the standard deviation in average educational attainment across ancestries. The corresponding number for the intergenerational transmission of civic capital is 35.6%. It should be stressed however that these estimates are likely to provide a lower bound on the effect of interest since the so-called epidemiological approach tends to underestimate the effect of culture (Fernandez & Fogli, 2009).

As in Mendez (2015), a major concern with the results in Mendez and Zamarro (2015) is that some omitted variable exists. As Fernandez and Fogli (2009) pointed out, unobserved differences in human capital, broadly defined, embodied either in the individual or in his ethnic network is a major suspect. That is the case since human capital may well have an unobserved component that depends on the human capital of the respondent's parents, information that is not available to us as the March CPS only informs on parent's educational level for those co-residing.

To control for that possibility they use the 1970 U.S. census 1% sample that collects information on individuals' country of birth and educational level. In particular, they obtained summary measures of educational attainment for first generation men and women immigrants, from the respondents' country of ancestry, and aged 20 to 40 years old in 1970. This is the collective that most likely resembles the characteristic of the CPS respondents' parents at the time they arrived to the U.S. The resulting variables are aggregate ethnic human capital measures that are likely to affect current educational levels of CPS respondents not only because they approximate their parents' educational attainment but because as Borjas (1992, 1995) showed, there might be also ethnic externalities in the human capital process. Additionally, they also calculated the average number of children born alive to women at the end of their fertile period from the respondent's country of ancestry using the data from the 1970 census because the March CPS does not inform on

the respondent's number of siblings and, as Chiswick (1988) showed, differences in schooling across racial and ethnic groups in the U.S. are consistent with a child quality investment model in which group differences in fertility and female labor supply determine the price of quantity relative to quality of children. Their results remained qualitatively unchanged.

Mendez and Zamarro (2015) reports separate estimates for men and women. As in Mendez (2015), they find that the effect of the intergenerational transmission of child qualities on educational attainment is not different for second-generation men and women. However, the effect of the intergenerational transmission of civic capital is larger for men than it is for women. They also find that the intergenerational transmission of child qualities positively associated to conscientiousness is more effective at increasing the probability of getting a college diploma, for those who have finished high school, than it is the transmission of civic capital. In particular, for men they find that a one standard deviation increase in the intergenerational transmission of child qualities and of civic capital accounts for 26.8% and 12.7% of the standard deviation of the probability of holding a college diploma across countries, respectively. The corresponding numbers for women are 29.8% and 16.4%, respectively.

Culture and Labor Outcomes

Mendez and Zamarro (2015) also identify the effect of the intergenerational transmission of noncognitive skills on adult employment outcomes, controlling for the respondent's educational level. They find that neither inherited child qualities or the inherited stock of civic capital affect the probability of employment during adulthood. Conversely, they find that those respondent's whose country of ancestry placed a lower value on hard work have a lower probability of being in a top occupation if employed, and, given occupational status, they also perceive lower wages if employed. These results are robust to the correction of sample selection biases in women's estimates using Heckman (1978)'s approach.

Finally, to further learn about the effect of culture on wages Mendez and Zamarro (2015) estimate a quantile regression model that attests that the stock of civic capital transmitted from parents to children does not affect the wage earned if employed, no matter the percentile of the wage distribution considered. However, they find that the lower the weight that the respondent's cultural heritage places on hard work, the lower the probability that he earns a higher wage but only for wages above the median of the wage distribution. The latter effect is larger the higher is the percentile considered. Additionally, the results of the intergenerational transmission of noncognitive skills on labor market outcomes go also in line with the results of Cawley, Heckman and Vytlacil (2001) who found that once educational attainment or cognitive ability is controlled for, personality traits still present a correlation with

earnings but this correlation is weaker as noncognitive skills seem to operate mostly through schooling attainment.

CONCLUSIONS

This chapter summarizes the content of two recent contributions made to the incipient literature that test for the existence of a cultural component on the formation process of noncognitive skills. We find that the intergenerational transmission of noncognitive skills plays a prominent role in explaining international variation in schoolchildren's scholastic performance, educational attainment, employment status and wages.

According to Mendez (2015), a one standard deviation increase in the inherited stock of noncognitive skills positively associated to the conscientiousness personality factor like hardworking, thrift and perseverance would account to between 103 and 20% of the difference in student performance across ancestries in Austria, Belgium, Finland and Switzerland. The effect of interest is largest in Australia and the Netherlands and lowest in Luxembourg, where it accounts to between 20% and 30% and to almost 5% of the difference in student performance across ancestries, respectively. Equivalently, the estimates in Mendez and Zamarro (2015) show that individuals whose cultural heritage considers the qualities thrift and particularly so hardworking as higher valued qualities to encourage in children have higher educational levels and, in particular, are more likely to complete college after finishing high school. Additionally, they also find that the lower is the weight that the respondent's cultural heritage places on hard work, the lower the probability that, conditional on being employed, he is in a high-skilled occupation (i.e. management, business and financial occupations or professional and related occupations) and the lower the probability that he earns a higher wage, but only for wages above the median of the wage distribution.

Mendez and Zamarro (2015) also analyze the relevance of the noncognitive skills embodied in the concept of civic capital, introduced in Guiso, Sapienza and Zingales (2010) and defined as the set of beliefs and values that help cooperation in society. They find that individuals with a higher inherited civic capital also have higher educational levels and a higher probability of completing college after finishing high school, although the latter effect is lower than that estimated for the transmission of child qualities associated to conscientiousness. However, they do not find an effect of inherited civic capital on employment outcomes, once educational attainment is controlled for. This, in turn, suggests that a certain level of both inherited civic capital and hardworking (conscientiousness) are relevant for educational success whereas only the inherited stock of conscientiousness matters for achieving success in the labor market. In particular, they find that the transmission of child qualities positively associated to conscientiousness like hard work and thirft and of civic

capital accounts for 64% and 36% of the standard deviation of average education attainment across ancestries, respectively. Additionally, they also find that a one standard deviation increase in the percentage of citizens from the respondent's country of ancestry that value those qualities as relevant for children accounts for, at least, 66% of the standard deviation of the share of high-skilled workers across ancestries.

These findings confirm that noncognitive skills are transmitted from parents to their children and they affect their decisions, particularly so regarding the inherited stock of qualities associated to the conscientiousness personality factor. This, in turn, means that conventional estimates of the benefits of the programmes and interventions aimed at enhancing noncognitive skills are likely to underestimate the real benefits since they do not account for the likely intergenerational transmission of the enhanced skills. Finally, the relevance of noncognitive skills calls for further research on how to incorporate noncognitive skills within a schoolwide curriculum.

NOTES

[1] Following Heckman and Kautz (2013), we use the term "skills" instead of "traits" throughout the paper to highlight the fact that noncognitive skills change with age and with instruction.

[2] Bouchard and Loelhin (2001) show that heritability estimates for personality traits are relatively stable across the life cycle at about 40–60%.

[3] See Tabellini (2010) for an interesting discussion on the economic meanings of culture.

[4] See Fernandez (2011) and Guiso, Sapienza and Zingales (2006) for an exhaustive review of the relevance of culture for economic outcomes.

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20. NON-COGNITIVE VARIABLES AND ACADEMIC SUCCESS

What Factors Influence Mathematics Achievement?

INTRODUCTION

The past several decades of research in education has suggested that students' attitudes, interests, beliefs, and values are important to educators and such affective dispositions are often predictor of students' subsequent behaviour which leads to academic success (Popham, 2005). Voluminous studies have been conducted in the field of mathematics education, to examine the attitudes toward mathematics at various levels and also the relationship between mathematics attitudes and mathematics achievements (Hemmings, Grootenboer, & Kay, 2011). Results of these studies have indicated that attitudes have significant positive correlations with achievements.

Educational researchers are interested to measure the attitudes of students, since this manifestation is correlated with achievement (Aiken & Dreger, 1961; Ma & Kishor, 1997). Literature focusing on students' attitude to mathematics suggests that there is a strong relationship between attitudes and achievement (Tapia & Marsh, 2004; Hannula, 2002). Many decades ago Aiken (1970) reviewed the empirical research on attitudes, anxiety, interests and other personal and social factors affecting achievement in mathematics. He reported strong correlations between attitudes and anxiety, and suggested that instructional methods for coping with negative attitudes and anxiety toward mathematics can help students. A study conducted by Singh, Granville and Dika (2002) found positive relationships among motivation, attitude and academic achievement.

When measuring attitudes toward mathematics, a number of affective constructs have been identified including achievement, motivation, career expectations, influence of parents and teachers, parental education and occupation, enjoyment of mathematics, self-esteem within mathematics, mathematics stereotypes, mathematics relevance, teacher expectations, and locus of control. Some researchers have suggested that development of attitudes towards mathematics may occur at a fairly early age and it is important to nurture students starting from the primary grades. Whitin (2007) noted that students' attitudes toward mathematics influenced their ability and willingness to work harder. Bouchey and Harter (2005) examined the relationship among adolescents' perceptions of parents', teachers', and classmates' support for, valuing of, and beliefs about their competence in mathematics and

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science, and reported that students' perceived mathematical confidence was a good predictor of mathematical achievement.

The constructs of interest in our study were enjoyment of mathematics and students' self-perceptions about their mathematics ability. According to Adelson and McCoach (2011), mathematics self-perceptions refer to "a person's perceptions of self as a mathematical learner, including beliefs about his or her ability to learn and perform well in mathematics". Mathematics enjoyment refers to an individual's positive or negative experience of mathematics and how he or she generally likes or dislikes tasks and activities related to mathematics (Adelson & McCoach, 2011).

For several years, researchers have believed that students' positive self-perceptions of their ability have great effect on their academic achievement (e.g., Bandura, 1994; Harter, 1981). In a longitudinal study, Skaalvik and Skaalvik (2006) examined the relationship between mathematics self-perception and achievement. 246 middle school students participated in the study. The results indicated that students' self-perceptions strongly predicted subsequent achievement over and above the prediction that could be made from prior achievement. However, there was no evidence that the effect of self-perceptions on subsequent achievement was mediated through students' interest, goal orientation, or their self-esteem. Another study by Stringer and Heath (2008) initially tested 155 students on reading, arithmetic, and academic self-perceptions. A year later, the students were tested again. Their results showed no difference in academic self-perceptions at the beginning of the study nor changes in self-perceptions over time predicted changes in academic performance.

Shen (2000) conducted a study based on the analyses of data from the 1995 Third International Mathematics and Science Study (TIMSS) by examining the relationship between students' self–perceived competence with academic achievement. Their results showed a positive relationship between student achievement and self–perceived competence for both mathematics and science, at grades 3, 4, 7, and 8 within country data. However, an opposite relationship occurred when they examined the relationship between countries. They noted that low academic expectations and standards in low performing countries and high academic expectations and standards in high performing countries may be the explanation.

The early history of mathematics records that Arabic speaking scholars made significant contribution to the development of mathematics (Struik, 1987). Joseph (1987, p. 17) noted that "we owe to the Arabs in the field of mathematics, the bringing together of the technique of measurement…", "…with the remarkable instrument of computation (our number system), which originated in India, and finally supplementing these strands with a systematic and consistent language of calculation which came to be known by its Arabic name, algebra." But in the past centuries, achievements in the mathematics have been declining at alarming rate in the Arab countries. The TIMSS 2011 international results indicated that country average mathematics scores in the Arab Gulf states including Bahrain, United Arab

Emirates, Qatar, Saudi Arabia, Oman, and Kuwait were significantly lower than the centre point of the TIMSS 4th grade scale (Mullis, Martin, Foy, & Arora, 2012).

Review of literature has indicated that few studies have been conducted in the above mentioned countries in relation to mathematics education in general and attitudes and performance in particular. This justifies the need to develop an instrument to measure attitudes toward mathematics in Arabic language and validate the instrument in Arabic speaking countries. It is believed that such instrument can be useful to measure the current state of students' attitudes towards mathematics and could be helpful in promoting positive attitudes toward mathematics among students.

Objective of the Study

The purpose of this study was to:

i) Validate an Arabic version of a survey that measures attitude towards mathematics for use with elementary school students in a Gulf state.
ii) Investigate the relationship between attitude towards mathematics and mathematics achievement among elementary school students.

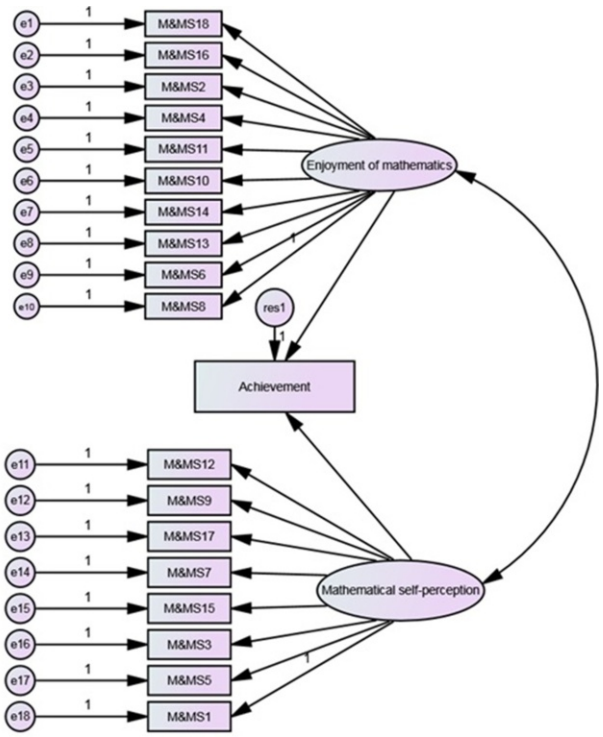

Figure 1. Research model (Math and Me scales and achievement)

Research Model

We proposed a research model for our study, which is presented in Figure 1. The research model hypothesises that enjoyment of mathematics and mathematical self-perceptions will each be related to academic achievement in mathematics.

METHODS

Participants

The sample for our study involved a total of 1039 elementary school students from a Gulf state. 294 were in grade four, 266 were in grade five and 479 were in grade six. Also, 454 were male and 585 were female and their ages ranged from 10 to 13 years. The students were briefed by their respective class teachers and consents were obtained from their parents to participate in the study. They were also told that there were no right or wrong answers in the survey and participation in the study will not affect their studies and grades. It was clearly indicated to the students that all what the researchers wanted was their opinion.

Instruments

The Math & Me survey (M&MS) was originally developed by Adelson and McCoach (2011) in English. The survey comprises 18 items and covers two domains, namely, enjoyment of mathematics (10 items) and mathematical self-perceptions (8 items). As mentioned earlier, the enjoyment of mathematics scale assesses student's positive or negative experience of mathematics and how he or she generally likes or dislikes tasks and activities related to mathematics. The mathematics self-perceptions scale assesses a student's perceptions of self as a mathematical learner, including beliefs about his or her ability to learn and perform well in mathematics.

The response format for both scales involve a five-point frequency scale of strongly disagree, disagree, neither, agree, and strongly agree. A typical item in the enjoyment of mathematics scale is "I hate math". An example from mathematics self-perceptions scale is "I am really good at math".

According to Bragg (2012), achievement tests are the primary sources of data collection for most educational institutions, although they are not without their critics, they are generally accepted measures of achievement. Therefore in order to examine the relationship between attitudes towards mathematics and achievement, midterm semester test and final semester test of the participants were used.

Translation

The original English version of the M&MS developed by Adelson and McCoach (2011) was translated into Arabic by a qualified professional translator. The Arabic

preliminary translation was carefully evaluated by two bilingual psychologists to check the comparability in terms of meaning. They were requested to compare the original items in English with the Arabic items. Based on their recommendations, minor changes were made in the translated version. After this process, Arabic version was translated back to English to check the accuracy of English into Arabic translation. The back-translated English version was compared against the original English version to see the equivalency between source-language and target-language. This allows maximum quality of the translation process with an interest in accuracy of content meaning (McGorry, 2000).

RESULTS

Descriptive Analyses

Since maximum likelihood estimation assumes multivariate normality of the observed variables, we examined the data with respect to univariate and multivariate normality (Tabachnick & Fidell, 2013). Upon consideration of multivariate non-normality of the data, the hypothesized model was estimated using maximum-likelihood (ML) methods with AMOS 22.

The mean score ranged from 3.56 to 4.26 and all the items of the M&MS had a mean score above the midpoint of 3.00, indicating that the participants exhibited a strong response for the M&MS. All the standard deviations (SD) were above 1.00, indicating a large spread of item scores around the mean. All the items showed a skewness or kurtosis value less than the cut-offs recommended by Kline (2010), and this supported the univariate normality in the items.

The value of the Mardia's coefficient obtained in this study, using AMOS 22, was 107.581 and this satisfied the requirement of multivariate normality recommended by Raykov and Marcoulides (2008).

Exploratory Factor Analysis

The suitability of the data set for factor analysis was first verified. The Kaiser-Meyer-Olkin (KMO) value was .95, exceeding the recommended value of .6 (Kaiser, 1974) and Bartlett's Test of Sphericity (Bartlett, 1954) indicated that $\chi^2 = 8608.30$ and was statistically significant ($p < .001$), confirming the suitability of the data for further analysis.

Principal component analysis (PCA) of the 18 items revealed the presence of three factors with eigenvalues exceeding 1 (7.81, 1.55, and 1.01). These three components explain a total of 57.64% of the variance. When the screeplot (Catell, 1966) was inspected, it was decided to retain two factors for further investigation. This was further supported by the results of parallel analysis, using the Monte Carlo PCA for parallel analysis (computer software) developed by Watkins

(2000). The results showed only two components with eigenvalues exceeding the corresponding criterion values for a randomly generated data matrix of the same size (18 items × 1039 respondents). Considering the results of the parallel analysis, which agreed with the number of factors, suggested by the scree test, it was decided to retain two factors for further analysis.

After Oblimin rotation, the two factors showed a moderate intercorrelation (r = .55). Inspection of the pattern matrix (Table 1) showed a relatively clear two-factor solution which replicated Adelson and McCoach's (2011) enjoyment of mathematics and mathematical self-perceptions factors. When we analysed the structure matrix, there was indication of good discrimination between the factors.

The communalities, also presented in Table 1 gives information about how much of the variance in each item is explained, with low values (less than 0.3), indicating that the item does not fit well with the other items in the component (Pallant, 2013). All the items of the M&MS had communalities ranging from .31 to 63. This showed a clear two-factor solution in line with the developers of M&MS (Adelson & McCoach, 2011), with enjoyment of mathematics (10 items) and mathematical self-perceptions (8 items) factors.

We conducted an analysis to determine the consistency of the items within each scale. The negatively worded scored items (MMS4, MMS7, MMS9, and MMS13) were reversed and the recoded items were used in the reliability analysis. The resulting Cronbach alpha value for the 18-item M&MS was .92. The reliability analysis of the Enjoyment of Mathematics scale (10 items) was .88 and the Mathematical self-Perceptions scale (8 items) was .81. All the Cronbach alpha values exceeded the recommended value of .70 (Nunnally, 1978), indicating adequate internal consistency.

Convergent Validity

Confirmatory factor analysis (CFA), involving structural equation modeling (SEM) was used to assess the measurement properties. The convergent validity and discriminant validity of the 18 items of the MMS were examined.

As suggested by Fornell and Larcker (1981), convergent validity was assessed by calculating item reliability of each measure, composite reliability of each construct, and the average variance extracted (AVE). Item reliability was assessed by the loadings for each individual item (i.e. the correlation of the items with their respective constructs). According to Hair, Black, Babin and Anderson (2010), Cronbach's alpha tends to understate reliability and so the composite reliability was used instead of the Cronbach's alpha. Regarding reliability at the item level, the minimum requirement suggested for factor loading is .70 (Barclay, Higgins, & Thompson, 1995; Chin, 1998; Hair et al., 2010; Hulland, 1999). The item loadings, composite variance and the average variance extracted are reported in Table 2. Nunnally and Bernstein (1994) recommended a minimum alpha reliability of .70 at the construct level to reflect adequate reliability. Table 2 shows that all the two constructs met the suggested minimum value of .70.

The final criterion for convergent validity used was a measure of the average variance extracted (AVE) for each factor. Fornell and Larcker (1981) and Nunnally and Bernstein (1994) recommended a minimum value of .50 for AVE. Results of the analysis showed that the AVE values for all the scales were above .50. Therefore, the measurement properties satisfied all three necessary criteria of convergent validity.

Discriminant Validity

Testing for discriminant validity was the next step in the assessment of the measurement properties. Discriminant validity assesses the degree to which the constructs are empirically different. As suggested by Barclay et al. (1995), discriminant validity is present when the variance shared between a construct and any other construct in the model is less than the variance that construct shares with

Table 1. Pattern and structure matrix of two factor solution of Math & Me Survey items

	Pattern		*Structure*		
Item	*Enjoyment*	*Self-perceptions*	*Enjoyment*	*Self-perceptions*	*Communalities*
M&MS18	**.76**	−.07	**.78**	−.37	.62
M&MS16	**.73**	−.13	**.78**	−.42	.63
M&MS2	**.72**	−.13	**.77**	−.41	.61
M&MS4	**.71**	−.11	**.75**	−.39	.58
M&MS11	**.71**	.01	**.70**	−.27	.49
M&MS10	**.69**	−.15	**.75**	−.42	.58
M&MS14	**.73**	−.07	**.74**	−.37	.49
M&MS13	**.72**	−.19	**.73**	−.45	.57
M&MS6	**.71**	−.12	**.72**	−.37	.46
M&MS8	**.71**	.23	**.71**	−.01	.32
M&MS12	−.02	**.76**	−.32	**.77**	.59
M&MS9	−.09	**.76**	−.21	**.72**	.53
M&MS17	−.09	**.73**	−.38	**.76**	.59
M&MS7	−.08	**.71**	−.36	**.74**	.55
M&MS15	.09	**.70**	−.18	**.66**	.44
M&MS3	−.11	**.70**	−.38	**.71**	.50
M&MS5	.08	**.65**	−.18	**.71**	.38
M&MS1	−.03	**.64**	−.28	**.70**	.42

Note. Bolded items indicate major factor loadings for each item.

Table 2. Item loadings, composite variance and average variance extracted

Latent variable	*Item*	*Factor loading*	*Average variance extracted (AVE)*	*Composite reliability (CR)*
	MMS18	.76		
	MMS16	.73		
	MMS2	.72		
Enjoyment	MMS4	.71	.75	.92
	MMS11	.71		
	MMS10	.69		
	MMS14	.73		
	MMS13	.72		
	MMS6	.71		
	MMS8	.71		
	MMS12	.76		
	MMS9	.76		
	MMS17	.73		
Self-Perceptions	MMS7	.71	.72	.90
	MMS15	.70		
	MMS3	.70		
	MMS5	.65		
	MMS1	.64		

its measures. Table 3 reports the inter-construct correlations and square root of average variance extracted. The results in (Table 3) support the discriminant validity because, for each construct, the square root of the AVE is larger than inter-construct correlation. Hence the discriminant validity was achieved.

Table 3. Inter-construct correlations and square root of average variance extracted

Construct	*Mathematics enjoyment*	*Mathematical self-perceptions*
Enjoyment of Mathematics	**(.86)**	
Mathematical Self-Perceptions	.77**	**(.85)**

***p < 0.01*
The elements in bold and parentheses in the main diagonal are the square roots of average variance extracted.

Measurement Model

CFA was conducted on the sample using AMOS Version 22 (Arbuckle, 2007) to evaluate the model fit. As recommended by Hair et al. (2010), Harrington (2009) and Kline (2010), several fit indices were used to measure model fit. According to Brown (2006), fit indices are classified into three categories: (1) absolute fit indices, (2) parsimony indices, and (3) comparative indices. Absolute fit indices measure how well the proposed model reproduces the observed data (Teo, Ursavas, & Bahcekapili, 2012). The most common fit index is the model chi-square (χ^2). According Carmines and McIver, 1981, for a model to be assessed as a good fit, the chi-square normalized by degrees of freedom (χ^2/df) should not exceed 3.00. Standardized root mean square residual (SRMR) is another absolute fit index commonly referred to. For the SRMR, value of less than .05 would indicate a well-fitting model (Byrne, 2010).

The next category of fit indices is the parsimonious indices. It is similar to the absolute fit indices except that it takes the model's complexity into account. An example is the root mean square error of approximation (RMSEA). The RMSEA should not exceed .08, although values of less than or equal to .05 would indicate a closer approximate fit (Kline, 2010). Finally, comparative fit indices were used to evaluate a model fit relative to an alternative baseline model (Harrington, 2009; Teo et al., 2012). Examples of comparative fit indices include the comparative fit index (CFI) and Tucker-Lewis index (TLI). According to Byrne (2010), Hu and Bentler (1999), and McDonald and Ho (2002), TLI and CFI should both be greater than or equal to .90.

The research model in Figure 1 was tested using structural equation model (SEM) approach, using AMOS 22.0. The results of the model fit of this study reported in Table 4 indicated that the research model fits the data fairly well.

Table 4. Fit Indices for the research model

Fit indices	χ^2	χ^2/*df*	*TLI*	*CFI*	*IFI*	*GFI*	*AGFI*	*RMSEA*	*SRMR*
Values	480.80, $p < .001$	3.41	.95	.96	.96	.95	.93	.048	.033
Recommended guidelines	Non-significant	< 5	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90	< .08	< 0.05

**Hair et al. (2010)*

Associations between enjoyment of mathematics, mathematical self-perceptions and academic achievement were explored by means of SEM. The research model specifying three correlated latent variable; a second order enjoyment of mathematics and mathematical self-perceptions and also academic achievement was tested (see Figure 1). As indicated in Table 4, the model had

good fit to the data (χ^2 = 480.80, CFI = .96, TLI = .95, RMSEA = .048 and SRMR = .033). There was a strong positive correlation between enjoyment of mathematics and mathematical self-perceptions (r = .77, n = 1039, $p < .01$) and a medium positive correlation between academic achievement and enjoyment of mathematics (r = .38, n = 1039, $p < .01$) and also academic achievement and mathematical self-perceptions (r = .49, n = 1039, $p < .01$). The correlations are displayed in Table 5.

Table 5. Correlations among mathematics enjoyment, mathematical self-perceptions and academic achievement

	Mathematics enjoyment	*Mathematical self-perceptions*	*Achievement*
Mathematics Enjoyment	1		
Mathematical Self-Perceptions	.77**	1	
Achievement	.38**	.49**	1

***p < .01*

Testing the Structure Model

The resulting path coefficients of the proposed model (Figure 1) reported in Table 6, indicated that mathematical self-perceptions was significantly and positively related to achievement (β = .79, $p < .001$) and also enjoyment of mathematics was significantly and negatively related to achievement (β = –.32, $p < .001$).

Table 6. Path coefficient

Path	*Path coefficient*	*t*
Mathematical Self-Perceptions → Achievement	.79	8.00***
Enjoyment of Mathematics → Achievement	–.32	–3.40***

****p < .001*

One endogenous variable was tested in the research model. Achievement was found to be predicted by enjoyment of mathematics and mathematical self-perceptions, resulting in an R^2 of .28. This means that enjoyment of mathematics and mathematical self-perceptions explained 28% of the variance in achievement.

DISCUSSION

In our study, we substantiated the construct validity of the M&MS developed by Adelson and McCoach (2011). We collected and analysed data from a sample

of elementary school students in a Gulf state. Exploratory factor analysis and confirmatory factor analysis were carried out to confirm the validity of the M&MS.

Our results suggested that enjoyment of mathematics and mathematical self-perceptions might be associated with mathematics achievement, and also those students who exhibit adequate or strong mathematical ability are more likely to enjoy mathematics and acquire increased mathematical self-perception. Overall, our results have supported the M&MS's factorial validity and reliability for assessing enjoyment of mathematics and self-perception about mathematics of elementary students.

The findings of our study may be useful for mathematics educators and researchers in Arab Gulf countries where Arabic is the medium of instruction in schools. Using the M&MS, mathematics educators may be able to identify students' with low self-perception about mathematics and enjoyment of mathematics, and will be able to provide help. For mathematics teachers it is important to realize that enjoyment of mathematics and self-perception about mathematics can play on students' interest in the subject and affect their performance in mathematics. Early encouragement in elementary school to learn and master the concepts of mathematics will provide a foundation as students progress to higher level. The analysis of the properties of the translated version of attitudes toward mathematics shows that this survey can be used in primary schools with high validity and reliability. A number of studies can be done using this survey. Future research can explore the relationships between attitudes and other variables and achievements in Arabic speaking countries.

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