Myint Swe Khine
Tine Nielsen *Editors*

Academic Self-efficacy in Education

Nature, Assessment, and Research

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Part I
Introduction

Chapter 1
Current Status of Research on Academic Self-efficacy in Education

Myint Swe Khine and Tine Nielsen

Abstract Academic self-efficacy is a psychological construct that deals with an individual's belief about capabilities to learn or perform educational activities at designated levels. Academic self-efficacy is a critical component in theories of motivation and learning. Studies show that academic self-efficacy is domain-, context- or task-specific and associated with student engagement, study habits, learning styles, and personality. It can also predict and explain a wide range of students' activities and achievements in culturally and linguistically diverse educational contexts. This introduction provides an overview of the chapters, describes the unique approaches and innovative methods in assessing academic self-efficacy, and synthesizes the studies reported in this book.

Keywords Academic self-efficacy · Self-regulation · Self-concept · Achievement · Learning styles

Introduction

According to Bandura (1997), self-efficacy, self-concept, and self-regulation are beliefs that students can control on their own to maximize learning in and out of school settings. Self-efficacy influences choice of activities, effort, and motivation. Zimmerman, Bonner and Kovach (1996) also noted that the students have the power to become successful learners if they use a self-regulatory process to study more effectively. Self-evaluation and monitoring are the fundamental principles of self-regulated learning. Derived from self-concept and rooted in social cognitive theory, academic self-efficacy is a psychological construct that deals with an individual's beliefs about his/her own capabilities in relation to learning or performing educational activities at designated levels. Academic self-efficacy is a crucial component in

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theories of motivation and learning. Measurement and research on academic self-efficacy are receiving increasing recognition as it influences the educational outcomes. A substantial body of literature has consistently shown that academic self-efficacy is associated with student engagement, study habits, learning styles, and personality and predicts and explains a wide range of students' activities and achievements. Many investigations have been conducted and disseminated in the literature, and studies related to the role of academic self-efficacy are growing steadily. This book aims to document recent attempts to conduct systematic, prodigious, and multidisciplinary research in the role of academic self-efficacy and share their findings and identify areas for future research directions. The book also presents the outstanding and exemplary works by educators and researchers in the field, highlighting the recent advances, creative and unique approaches, and innovative methods in culturally and linguistically diverse educational contexts. The contributions stem from 12 countries around the world, namely Australia, Denmark, Finland, Germany, Italy, Kingdom of Bahrain, Mexico, New Zealand, Spain, Taiwan, The United States of America, and the United Kingdom.

This book is divided into five parts. This introductory chapter in Part I contextualizes and presents an overview of the chapters to inform the readers about the premise of the book. Part II covers chapters on assessment and measurement of academic self-efficacy in different contexts. The empirical studies on what shapes academic self-efficacy and studies related to the influence of academic self-efficacy are described in Part III and Part IV of the book. Finally, the concluding chapter in Part V synthesizes the various threads of discussion and potential areas of future research.

Assessment and Measurement of Academic Self-efficacy

Four chapters in Part II of this book cover self-efficacy assessment and measurement methods. This part begins with Chap. 2, in which DiBenedetto and Dale Schunk describe novel approaches to assessing self-efficacy. The possible assessment methodologies include surveys, diaries, case studies, traces, videos, think aloud, and microanalyses. The authors discuss the reliability and validity, strengths and limitations of each of these methods with vivid examples. The authors also made recommendations on how these methodologies can be used to measure academic self-efficacy in education.

The question of how to nurture learner self-efficacy beliefs in STEM education through the citizen science approach is discussed in Chap. 3 by Hiller and Kitsantas. The authors describe the types and aspects of citizen science programs that can support science self-efficacy. Citizen science is known for the process in which communities and individuals are involved in designing a research question, observing experiments, and collecting data with the involvement of volunteers. In this chapter, the authors review the empirical research on self-efficacy in citizen science programs and present the current trends in this area. They note that integrating various methods such as questionnaires, microanalytical measures, interviews, observational notes,

and student artifacts is needed to assess the impact of citizen science programs on student achievement and motivation. The authors then present a sample model of a citizen science intervention program with the aims of improving student motivation and achievement in a specific science topic.

Sánchez-Escobedo's subject for Chap. 4 is grid-type measures where item stems are rated across diverse domains or subjects measuring self-efficacy. The chapter reports on the design, development, and validation of the Mexican Self-efficacy Grid Scale (MSEGS), and its psychometric properties, advantages, and limitations are discussed. The data were collected from 1460 high-school students, and the analysis showed high validity and reliability across four subjects, namely English, Maths, Science, and Spanish. Confirmatory factor analysis (CFA) also indicates a good model fit. The author concluded that measuring self-efficacy using a grid-type instrument is cost-effective and able to differentiate self-efficacy in relation to different subjects.

In Chap. 5, Nielsen, Martínez-García, and Alastor present the psychometric properties of the Spanish translation of the Specific Academic Learning Self-efficacy Scale (SAL-SE) and the Specific Academic Exam Self-efficacy Scale (SAE-SE). The original versions of the instruments show high reliability and fit to the Rasch model with a sample of Danish Psychology students. The translated questionnaires were administered to 866 psychology students from two Spanish universities, and data were analyzed using DIGRAM software and R packages. The results showed less optimal measurement properties for the Spanish translation than in the original study, as both scales contained locally dependent items and evidence of differential items functioning was also found with both scales. Reliabilities were satisfactory. The results suggest that the instruments can be used for pedagogical purposes in improving teaching and learning practices and didactic methodologies to enhance student self-efficacy. The authors suggest using a mixed-method approach where focus group interviews are conducted to obtain qualitative data.

Empirical Studies on What Shapes Academic Self-efficacy

Part III of the book consists of six chapters that describe the empirical studies on what shapes academic self-efficacy. This part begins with Chap. 6 by Macakova and Wood, which chapter explores the factors that shape academic self-efficacy. The authors review the literature and identify factors that can potentially link academic self-efficacy and academic achievement. Among these factors are: mindset, basic psychological needs, satisfaction, attachment, and parental and social supports. The authors highlight that for young learners, the social support of parents impacts academic self-efficacy. Some evidence was also found that parents' educational ambitions can positively influence teenage children's academic self-efficacy. The authors suggest that these findings have implications in designing intervention strategies to promote academic self-efficacy among learners.

In Chap. 7, Liu, Cheng, and Chen review recent literature on how culture or cross-culture experience can influence or be influenced by students' academic self-efficacy. The chapter begins by discussing academic self-efficacy, referring to the cultural dimension model postulated by renowned researchers Hofstede and Oyserman et al. The authors note that students' academic self-efficacy in the collectivistic countries in the East is lower, and in individualistic countries in the West is higher. However, the authors emphasize that it is important to define what the cultural dimensions are.

Peura, Aro, Räikkönen, Viholainen, and Aro explore children's academic self-efficacy in reading and reading development and present their findings in Chap. 8. Using Bandura's (1997) theory, the authors classify the self-efficacy beliefs at three levels—general, intermediate, and specific. While the general level refers to beliefs about one's capabilities at the general level, the intermediate level refers to certain competencies and sub-skills. The specific level of self-efficacy belief refers to one's capacity to perform a particular task. In their chapter, the authors focus on four sources of self-efficacy and children's reading skills and present some examples of how self-efficacy can be supported. The authors highlight that self-efficacy beliefs should be monitored and different strategies such as differentiated instruction for different groups should be used for improvement.

The role of motivation, positivity, and resilience in developing self-efficacy is the topic of discussion in Chap. 9. The research project by Wood, Tramontano, and Hemsley set out to examine the extent to which children's self-efficacy (academic, emotional, and social) can be explained by individual differences in motivation, positivity, and resilience. The study also explores whether the age and gender of pupils influence these patterns. The study involved 3799 students in Key Stage 2, years 3, 4, 5, and 6 in the UK schools. The 47-item Wellbeing and Attitudes to Learning Survey was administered to the children to measure the levels of motivation, positivity, and resilience. The authors found that positivity and resilience were contributing to the children's self-efficacy beliefs. The results also indicate that intrinsic motivation contributed to the children's emotional and academic self-efficacy only, and extrinsic motivation contributed to social self-efficacy alone. The authors suggest that findings will be helpful to plan intervention strategies in developing self-efficacy among students.

In Chap. 10, Stephen and Rockinson-Szapkiw discuss the importance of online students' persistence in their study and suggest strategies to promote online learning self-efficacy. The authors draw on an extensive literature review to define online learning self-efficacy and suggest high-impact practices (HIPs) to improve student success and persistence. HIPs are active learning practices, and ten practices that can promote student success through engagement are identified. One of the practices is first-year seminars, and the authors elaborate on the content of the seminar and how such activity can be organized. Some recommended practices for instructors are also provided.

Empirical Studies on Influence of Academic Self-efficacy

Part IV of the book consists of four chapters that describe the empirical studies on the influence of academic self-efficacy on academic achievement. This part begins with Chap. 11, in which Afari and Eksail present their findings on the mediating role of academic self-efficacy and its association with learning environment constructs, such as involvement and mathematics achievement. Their study used an eight-item Academic Self-efficacy Scale based on Morgan-Jinks Student Efficacy Scale (MJSES). Another eight-item questionnaire was used to measure the level of involvement in their lessons. To assess students' mathematics achievement, their final exam scores in that semester were considered. Structural equation modeling was used to determine the structural relationships between involvement, academic self-efficacy, and mathematics achievement. The resulting model suggests that 25.4% of the variance of academic self-efficacy was explained by involvement. The results furthermore suggest that students' academic self-efficacy could mediate the relationship between students' involvement and mathematics achievement.

In Chap. 12, Lin, Longobardi, and Bozzato provide the results from their study on the impact of academic self-efficacy on academic motivation. The study involves 1008 undergraduate students in a university in Italy. The participants completed the online questionnaire with the Italian versions of the Perceived Academic Self-efficacy Scale, the Academic Motivation Scale, and the Future Education Scale of the Prospective Life Course Questionnaire. Path analysis showed that academic self-efficacy positively predicted future orientation when controlling for age and academic subjects. Students' future orientation played a fully mediating role between academic self-efficacy and extrinsic motivation and amotivation and played a partial mediating role between academic self-efficacy and intrinsic motivation. The authors suggest how improvement of students' future orientation can affect their motivation to study.

Every third student in the OECD countries drops out from studying, and most of them are lost in their first year of higher education. It has previously been shown that academic self-efficacy is a strong predictor for dropout intentions. Petri and Braun (Chap. 13) use a longitudinal design to explore further the role of academic self-efficacy in dropout from higher education. Their study involves 424 freshmen and examines the trajectories of self-efficacy during their course of study. With the use of the 13-item Freshmen Self-efficacy (FSE) Scale, data were collected at three points—beginning of the first semester, end of the first semester, and finally at the end of the second semester a period that spans nine months. The students were also asked about their intentions to drop out of the study. The results show that repeated measurements of academic self-efficacy can provide useful information toward reducing dropout rates, and Freshmen Self-efficacy can be a reliable predictor of dropout.

In Chap. 14, Dixon and Ward discuss academic self-efficacy and its influence on teachers' postgraduate study experiences in the New Zealand context. The authors posit that postgraduate study expectations are significantly different from undergraduate courses and demand a higher degree of academic self-efficacy. The research is situated within the interpretivist paradigm and collected the qualitative data from

27 master graduates who are practicing teachers. The study is based on six focus group interviews conducted to enable researchers to understand the individual's belief, feeling, and their behavior. The study contributes to the knowledge of the postgraduate students' perspectives on how strong beliefs in themselves and their capabilities were a significant motivational force toward getting their teacher qualification. The authors outlined some of the practical ways lecturers can take to support the development of robust academic self-efficacy beliefs in the students.

In the final chapter (Chap. 15), the editors examined and summarized the future directions for research in academic self-efficacy as these arise from the volume chapters addressing assessment and measurement of academic self-efficacy, what shapes academic self-efficacy, and what academic self-efficacy influences. The editors also addressed the specific issues associated with research designs, models, and analyses presented in the volume chapters, and these might be addressed further in future research on academic self-efficacy. The chapter consolidates understandings about academic self-efficacy and explains the trends and future research directions on this important topic.

Conclusion

In summary, each of the studies in this book not only makes a significant contribution to the existing literature on academic self-efficacy but also provided an impetus for further studies in this area. The authors in this book critically examined the role and influence of academic self-efficacy in diverse settings, shared their findings, and suggested further research. Together, these studies indicate that academic self-efficacy influences student motivation, study habits, and achievement in academic subjects. As noted by Schunk and Pajares (2002), teachers and instructors must find their way to develop and sustain self-efficacy among students. It is hoped that the book is an informative, insightful, and indispensable resource for those who wish to study academic self-efficacy.

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Part II
Assessment and Measurement of Academic Self-efficacy

Chapter 2
Assessing Academic Self-efficacy

Maria K. DiBenedetto and Dale H. Schunk

Abstract Academic self-efficacy is a dynamic motivational belief that influences the goals we set, how hard we persist, and the amount of effort we employ. There is a great deal of research supporting the link between self-efficacy and student achievement yet educators grapple with finding ways to increase students' capability beliefs to enhance motivation for learning and performance. Traditionally, self-efficacy has been assessed using surveys administered as pre and posttests to a learning event. While these measures provide valuable information, there are several concerns about measuring self-efficacy using surveys such as that learners are reporting on future or past events, they may not fully understand or anticipate task demands at the time of pretest or over and under estimate their performance during the posttest. More recently, research has demonstrated there are other methods of assessing self-efficacy during a learning event referred to as real time such as the microanalysis, think-aloud, diaries, and trace measures. This chapter will focus on these novel approaches to assess self-efficacy and make recommendations on the ways these methodologies can be used among educators.

Keywords Academic self-efficacy · Motivational beliefs · Student achievement · Real time · Metacognition

Introduction

Self-efficacy, which is grounded in Bandura's (1986, 1997) social cognitive theory, refers to one's perceived capabilities to learn or perform actions at designated levels. Self-efficacy is predicted to influence motivation, learning, achievement, and self-regulation (Schunk & DiBenedetto, 2020; Usher & Schunk, 2018). Although there are multiple motivational variables that are linked to achievement (e.g., intrinsic interest,

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goal orientation, and outcome expectations), in this chapter, our focus is on self-efficacy. Self-efficacy has seen wide application in diverse fields such as education, business, athletics, and health. Because of its predictive power and widespread use, it is important to find valid and reliable ways to assess self-efficacy across different types of contexts and activities.

The purpose of this chapter is to discuss various self-efficacy assessment methodologies. We begin with a description of the theoretical framework of social cognitive theory including the role of self-efficacy in achievement. This is followed by a discussion of self-efficacy assessments, educational implications of these assessments, and recommendations for future research. Our hope is that this chapter will help to expand research on assessing self-efficacy.

Theoretical Framework

Triadic Reciprocity

Social cognitive theory is grounded in a model of triadic reciprocality comprising three sets of interacting processes: personal; behavioral; and environmental (Bandura, 1986). Personal processes include cognitions, beliefs, perceptions, and emotions. They help to instigate and sustain motivational outcomes. Goals, values, outcome expectations, attributions, emotions, cognitions, and self-efficacy are examples of personal processes that influence behavior and the environment and are influenced by them.

Behavioral processes are actions and verbalizations; environmental processes include influences from the physical and social environments. Importantly, social cognitive theory stresses the idea that people use vicarious, symbolic, and self-regulatory processes to strive for a sense of *agency*, or the belief that they can exert a large degree of control over important events in their lives.

The reciprocal nature of these influences can be illustrated with self-efficacy—a personal process. With respect to the interaction of self-efficacy and behavior, research shows that self-efficacy instigates achievement behaviors such as task choice, effort, persistence, and use of effective strategies (Usher & Schunk, 2018). These behaviors affect self-efficacy. As students work on tasks and observe their progress, their self-efficacy for continued learning is enhanced.

The link between personal and environmental processes can be shown with students with learning disabilities, many of whom hold low self-efficacy for learning (Schunk & DiBenedetto, 2014). People in their environments may react to them based on their common attributes (e.g., low competencies) rather than on their actual capabilities. Environmental feedback can influence self-efficacy, as when teachers provide encouragement.

The interaction of behavioral and environmental processes can be seen in instruction when teachers announce for students to direct their attention to a display. They

may do it without much conscious attention. The influence of behavior on environment is evident when learners fail to grasp important concepts, after teachers reteach content rather than moving on.

Dimensions and Sources of Self-efficacy

Social cognitive theory postulates that self-efficacy varies on several dimensions that have important implications for understanding how it operates during student learning (Bandura, 1997). Self-efficacy differs in *level*—the nature of the task demands, in *generality*—a wide range of activities or only a specific activity, and in *strength*—the degree to which one feels self-efficacious to perform an activity successfully. For example, Tabatha may feel self-efficacious about preforming well in a jazz recital but terrified about performing well at her ballet recital. The level in this situation is the capability to perform certain movements at an expert level in jazz versus ballet. Tabatha's feelings are not general, they are specific in that she feels capable of dancing jazz and not ballet. The strength of her self-efficacy is high for jazz and low for ballet. In designing an instrument to assess learners' motivation, researchers must have an understanding of what it takes to succeed at the task.

Self-efficacy does not emerge from nowhere but rather is a cognitive process where learners use information sources to create their self-efficacy beliefs (Schunk & DiBenedetto, 2020). These sources can be vicarious experiences, forms of social persuasion, physiological and emotional indexes, and mastery experiences (Usher & Pajares, 2008). Social cognitive theory postulates that by observing a successful model, one's self-efficacy can be raised, just as it can be lowered by observing someone fail. Forms of social persuasion include verbal statements and feedback from others (e.g., a coach telling a student she can catch the ball during a game of baseball). Physiological and emotional indexes can also affect self-efficacy. Feeling the thrill of going downhill on skis without falling can enhance a beginner's self-efficacy beliefs for repeating the activity successfully.

While these three sources of self-efficacy influence a learner's capability beliefs, the most enduring source is what one can accomplish (Usher & Pajares, 2008; Zimmerman & DiBenedetto, 2008). Learners' appraisal of their self-efficacy beliefs based on their past achievements and failures influences their self-efficacy for future similar activities (Bandura, 1986). Students who experience success at completing a complicated science experiment, for example, are likely to feel self-efficacious in performing well on similar future laboratory experiments. Self-efficacy is dynamic in that it develops and changes as students become more capable and achieve at higher levels (DiBenedetto & Schunk, 2018).

Usher and Pajares (2008) examined the sources of self-efficacy across quantitative and qualitative school-based studies and found that while mastery experiences were the most influential source of self-efficacy, other contextual factors must be taken into consideration. In the following section, we expand on the various measures that have been used to assess self-efficacy and recommend employing real-time measures.

Self-efficacy Assessment Methods

Since Bandura's (1986) seminal book discussing self-efficacy, developing reliable and valid assessments of self-efficacy has been an important issue. In this section, we discuss several methodologies for assessing self-efficacy and have grouped them within two categories. In the first category, we have organized *traditional* instruments for assessing self-efficacy. We are calling traditional assessments those instruments that require learners to reflect on a learning event and recall from memory. These assessments are usually administered after a learning event has taken place and typically are outside of the learning context; for example, administering tenth graders a survey asking questions about how self-efficacious they felt about computing long division problems after they completed a test on long division.

Traditional assessments may also refer to instruments that require learners to respond to questions that are asked in anticipation of an activity. These are also based on prior self-efficacy experiences and beliefs and assessed outside of the learning event; for example, administering a survey to fifth graders about their self-efficacy to earn 100% on an upcoming World War II history exam. Regardless of whether students are rating their motivation based on a past event or on the expectation of performance on a future event, self-efficacy beliefs are assessed using questionnaires that are completed outside of the realm of the learning context.

In the second category, we refer to *real-time assessments,* methodologies used during a learning event. These assessments often occur within the context of an authentic learning situation, in other words, while the learning is taking place. Real-time assessments do not require the learner to recall a previous learning event or to anticipate a future learning event; for example, asking students during a gymnastics exercise how self-efficacious they feel about being able to walk across the high beam without falling off while they are walking on the high beam.

We begin each category with a description of self-efficacy assessment methodologies we deem to fall within that category. Following the description, we provide an example, discuss the reliability and validity, and then, the strengths and limitations of that approach. While we describe several approaches, we make a case for using real-time assessments of self-efficacy, a recommendation also made by Bandura (1997) Table 2.1.

Traditional Assessments of Self-efficacy

Surveys

A common method for assessing self-efficacy is the use of surveys, inventories, or questionnaires where students respond to questions using some form of a Likert

Table 2.1 Summary of Self-Efficacy and Self-Regulated Learning Assessment Methodologies

Self-Efficacy and self-regulated learning measurement methods	Traditional versus real time	Characteristics	Strengths	Limitations
Surveys	Traditional	• Questions typically on a Likert scale • May include other variables related to self-efficacy and all three phases of self-regulated learning • Self-report based on recall	• Cost and time effective • Ease in administration and analysis • Flexibility in delivery • Larger sample size permits greater generalizability • Typically easy to establish reliability and validity	• Questions may not capture level, strength, and specificity of context • Questions may not reflect understanding of task demands • No opportunities provided for elaboration • Dependent on students' memories and ability to recall • Retrospective assessment questions • Reliability frequently established; questionable construct validity due to the nature of the survey development and the domain specificity

(continued)

Table 2.1 (continued)

Self-Efficacy and self-regulated learning measurement methods	Traditional versus real time	Characteristics	Strengths	Limitations
Diaries	Traditional	• Open-ended responses as participants write about their thoughts, feelings, and behaviors • Typically focused on the forethought and self-reflection phase • Self-report based on recall	• Easy to use and familiar to most participants • Provide data rich in qualitative information • Flexibility in administration • Students can elaborate in their entries • Reliability and validity can be established and strengthened through triangulation	• Younger students may have difficulty articulating thoughts, feelings, and behavior • Data analysis can be complicated and time consuming • Diaries administered over extended periods of time may affect student motivation to participate • Sample sizes tend to be small • Performance phase measures not taken • Dependent on students' memories and ability to recall • Retrospective results • Issues of reliability and validity require triangulation adding addition time, effort, and cost

(continued)

Table 2.1 (continued)

Self-Efficacy and self-regulated learning measurement methods	Traditional versus real time	Characteristics	Strengths	Limitations
Case Studies	Both	• Involve closely studying a participant or participants • Include a holistic approach that uses other assessment instruments such as those described in this table • Attempt to answer the how and why of behavior	• Provide in-depth understanding about participants • Allow for a combination of real-time and traditional measures • Can assess and make inferences on the dynamic changing nature of self-efficacy over time • Can be done to include all three phases of self-regulated learning and multiple iterations of the cycle during learning events • Reliability and validity can be established and strengthened through triangulation	• Do not have a standard protocol for administration resulting in concerns of sloppiness, bias, and inability to replicate • Require long periods of time and large amounts of data causing issues of time, cost, analysis, and labor intensity • Samples tend to be small leading to challenges in generalizing of results • Difficulty estimating reliability and validity on its own since data from case studies frequently come from multiple sources; ecological validity

(continued)

Table 2.1 (continued)

Self-Efficacy and self-regulated learning measurement methods	Traditional versus real time	Characteristics	Strengths	Limitations
Traces	Real Time	• Involve technology recordings of students' behavior during a learning event • Consist of an unobtrusive way to assess learning • Inferences can be made about students' cognitions and motivational beliefs based on tracking	• Assessment conducted during real-time learning event • Can be used to "teach" or coach students toward more positive outcomes • Can be adapted to learner's capability to problem-solve • Lack of interference in protocol assures participant is not distracted or influenced by questioning • Provide rich data	• May be expensive due to the cost of technology and program to implement • Generate large amounts of data that need to be streamlined for interpretation and analysis • Self-efficacy is difficult to assess in traces • Generalizability to other learning situations and learners is questionable • Reliability and validity frequently estimated through triangulation
Think-Alouds	Real time	• Participant thinks aloud while engaged in a learning task • Occurs in a one-on-one setting • Vocalizations, movements, and eye behavior are recorded simultaneously while learning • Able to assess several of the processes in the three phases of self-regulated learning	• Include a standard protocol which is repeatable • Assessment occurs during real-time learning event • Researcher can provide practice simulations so that learner understands the protocol prior to taking place • Provide diagnostic value for intervention	• Concern of reactivity effect to learning prompts • Best when used with other measures of self-efficacy and other covert processes • Typically a small sample size • Artificial setting such as a laboratory • Triangulation recommended to establish reliability and validity

(continued)

Table 2.1 (continued)

Self-Efficacy and self-regulated learning measurement methods	Traditional versus real time	Characteristics	Strengths	Limitations
Microanalyses	Real time	• Participants are asked fine grained questions targeted at each of the processes in the three-phase cycle during a learning event • Students respond to closed and open-ended questions • May be conducted one-on-one or in small groups • Can be conducted in a classroom or laboratory	• Include a standard protocol with questions that assess covert and overt behavior • Provides both quantitative and qualitative data • Provide diagnostic value for intervention • May be used with small- or medium-sized samples • Easy to implement and provides a moderate amount to data • Little financial cost is associated with this assessment • Assessment occurs during real-time learning event • Have demonstrated reliability and validity as an assessment instrument	• Limited studies in academic contexts have been conducted using this methodology • Most studies conducted have been with high school or university students—need research on younger populations • Interrupting students during learning events may influence outcomes • Limited information on the reliability and validity since this assessment methodology is in its infancy

scale (Wolters et al., 2011; Wolters & Won, 2018). Surveys are self-report assessments whereby the students respond to prompts that are designed to elicit information regarding their thoughts, beliefs, perceptions, attitudes, feelings, and knowledge (Wolters & Won, 2018).

Prior to the construction, preliminary information on the task demands should be identified to develop reliable and valid scales (Bandura, 2000). This information can be obtained by focus groups, piloting questionnaires, and conducting open-ended interviews. This step is critical in survey construction because the surveys are asking participants to judge their capability to complete a task and researchers may not be experts on the subtle gradations of difficulties for task completion. It also ensures the survey is domain and task specific and not generalized across content. For example, asking an 11th grader to rate his self-efficacy beliefs for earning a 90 on an upcoming French vocabulary test is different than asking him to rate his self-efficacy for earning a 90 in French at the end of the school year.

Example. DiBenedetto and Bembenutty (2013) examined the dynamic nature of self-efficacy over the course of a semester in 113 undergraduate students enrolled in intermediate-level science courses. Surveys assessed students' self-efficacy beliefs for learning and performing well in their science courses and were administered at the beginning of the semester and then again at the end. Students were also asked questions about their socialization experiences in childhood and adolescence. Findings revealed that students' self-efficacy beliefs declined at the end of the semester and that these beliefs more positively predicted final science grades than earlier appraisals of self-efficacy.

Reliability and Validity. In survey construction, researchers seeking to estimate reliability typically use test–retest, alternate-form, or measures of internal consistency (Litwin, 1995). Test-retest typically involves having the same group of students take the same survey at two different points in time to determine how stable the responses. Correlation coefficients are then obtained to determine how consistent the responses are and should be 0.70 or higher. Alternate form involves creating two surveys with different questions to measure the same attribute or using a simpler approach such as changing the order of the questions and the responses. These two forms are administered to the same group of students but at different points of time. Analysis of this approach involves using the split-halves method whereby one compares the random selection of one half of one survey to a random selection of one half of the alternate-form survey.

The third approach to ensuring reliability is obtaining a measure of internal consistency. Internal consistency involves determining how well different questions assess the same issue (Litwin, 1995). Internal consistence is typically measured using Cronbach's coefficient alpha. Typically, a score of 0.70 or higher is an indication that the different questions are measuring the same variable. For example, in the study cited earlier by DiBenedetto & Bembenutty (2013), Cronbach's coefficient alphas for self-efficacy were 0.79 and 0.72 for pre- and post-assessments suggesting each self-efficacy questionnaire was a reliable instrument.

Face, content, criterion, and construct (both, convergent and discriminant) validity are ways in which one may determine if the survey created is assessing what it is supposed to be (Litwin, 1995). Face validity refers to a more casual approach, for example, developing a survey on self-efficacy for learning algebra and then asking a friend to review the survey to determine if it appears to be assessing self-efficacy for learning algebra.

Content validity is also a subjective approach to assessing validity (Litwin, 1995). In this approach, a researcher may ask colleagues or other experts in the field to review the survey to determine if it appears to be assessing the content at-hand. While this approach can be helpful in providing revisions to the questions, it also not considered scientific. The third approach, criterion validity, involves determining how the survey compares to other instruments assessing the same construct and obtaining a correlation coefficient. If the correlation is high, it suggests the survey has high criterion validity. Lastly, construct validity refers to five types of evidence that are based on the content, response processes, internal structure, relations to other variables, and consequences of testing (Litwin, 1995; Wolters & Won, 2018). Construct validity provides information about how meaningful the survey is when put into practice. Discriminant validity refers to evidence that two similar constructs are actually different from one another.

Lent et al. (1997) examined the discriminant and predictive validity of academic self-efficacy along with mathematics-specific self-efficacy and academic self-concept among 205 university students who completed a survey. Findings supported the previous research indicating that self-efficacy was a strong predictor of math-related choice and achievement when it is specifically matched to a task and that it is different from academic self-concept.

Studies have also been conducted to estimate the reliability and validity of self-efficacy scales for learning across disciplines as well as the sources of self-efficacy (Usher & Parajes, 2008).

Strengths. There are several advantages to using surveys that explains their wide use. They are easy to develop and administer, require little effort on the part of the participants, and are time and cost effective. Students may complete the surveys at any physical location (such as the classroom, auditorium, at home), and they may be administered through paper and pencil instruments, or online using electronic forms (Wolters & Won, 2018). Another significant strength of surveys is that they allow researchers to reach a larger sample of students than would be possible using other methodologies. For example, a principal wanting to know whether students in her school feel self-efficacious about using a particular computer program to complete school assignments may administer a survey to all students in her school at one time in her gymnasium; or a researcher interested in learning about student motivation for online learning may administer a survey to all students enrolled in undergraduate psychology courses in the country.

Surveys also lend themselves to allowing researchers to obtain information on variables that may influence motivation. Many surveys have questions that ask for demographic information such as age, gender, race, ethnicity, parental education, and extracurricular activities that allow researchers to study the association between these

variables with student motivation. These additional variables, while self-reported, are much easier to obtain using a survey than through going through student records in a school. For several of these reasons, surveys are among the most widely used methodology for obtaining information on student motivation and learning.

Limitations. Surveys have important limitations. Bandura (2000) emphasized the importance of not using a "one measure fits all" approach when developing scales to assess self-efficacy. Because surveys tend to be easy to develop and administer, they are often crafted in a way that has limited connection to specific context. Without conducting focus groups, piloting questions, or open-ended interviews, researchers may have an ambiguous understanding of the task demands, which affects whether the questions are accurately capturing the level, strength, and specificity dimensions of self-efficacy. An additional disadvantage is that surveys tend to rely on students' memories and the ability to recall past experiences in an unbiased, honest way (Bandura, 1997; Winnie & Perry, 2000). Bandura (1997) emphasized the validity of surveys in their demonstrated success in predicting the triadic factors of social cognitive theory. Unfortunately, self-efficacy scales are administered, results are reported, and wide array of assumptions is often made based on the findings including a lack of support for the predictability of self-efficacy for future learning and performance.

An additional limitation stems from the nature of the format of surveys. Because surveys are structured, they do not provide opportunities for students to elaborate, explain, or qualify their responses (Wolters & Won, 2018). Participants are often not able to ask for clarification, and responses are based entirely on students' interpretations of the questions and memories over time and context. Because surveys are so widely used, the necessity of estimating the reliability and validity and piloting the survey prior to administration falls on the survey developer and may often be overlooked or unreported.

Diaries

Diaries, often referred to as journaling, have been a useful tool for assessing self-efficacy and in highlighting gradual within person changes in self-efficacy beliefs (Schmitz et al., 2011; Wallen & Adawi, 2017). Because diaries are kept over a period of time, they have been found to help increase students' self-efficacy beliefs because they can reflect small daily increments in skill (Schmitz et al., 2011). Diaries may also help researchers examine differences across participants, their trajectories, and what processes or events may underlie these changes (Iida et al., 2012). Diaries may be unstructured, allowing the students the freedom to record their thoughts or feelings without any prompts or guidance from the instructor (Fritson, 2008). Students may also receive prompts of what to record in their diaries. For example, learners can be instructed to use diaries to record learning processes and reflections on learning outcomes. Baleghizadeh and Mortazavi (2014), for example, used journaling to see if the impact of teacher or peer feedback influenced students' self-efficacy beliefs for learning English as a second language and found that both types of journaling

improved students' self-efficacy as compared to students who did not receive any feedback. Regardless of the style of journaling, the primary purpose is to get students to think, reflect, and record their thoughts and feelings (Fritson, 2008). Traditionally, diaries are associated with teenagers writing their secret feelings in a book (Schmitz et al., 2011); however, in scientific research, diaries can be used to measure processes that occur over a short intervention period or over an extended period of time using paper and pencil journals or online tools.

Example. Fritson (2008) conducted a study on college-level psychology students' use of journaling on self-efficacy beliefs and feelings about locus of control. One class of students received a ten-minute discussion on cognitive behavioral strategies such as self-talk, visual imagery, and distorted thinking and was provided with a journal entry template encouraging students to write about their thoughts and feelings. The students in the other class did not receive the instruction or template and were simply told to record their impressions, beliefs, and thoughts about the course content. Students in both courses showed an improvement in self-efficacy beliefs over the semester, and the author suggested that the practice of writing in the journals had a positive impact on students' self-efficacy, regardless of whether they received additional information on cognitive behavioral strategies.

Reliability and Validity. Because diaries are often used immediately following a learning activity, their accuracy should be higher than surveys (Schmitz et al., 2011). The two most common approaches to estimating reliability involve establishing internal consistency and test–retest. Internal consistency can be estimated by stopping several times during the school year, for example, to examine within person data entries or responses to prompts. Diaries can also be tested for reliability using the test–retest approach or split-half reliability approach to test the stability of time series data (Iida et al., 2013; Schmitz & Skinner, 1993). In the test–retest approach, diaries are examined at two different points in time but before instruction or an intervention has taken place and then they correlated with one another (Iida et al., 2013). In the split-half approach, the diaries can be broken down in the first half and the second half of the diary collection period, or into even and odd days to examine consistencies in feelings, thoughts, and reflections (Schmitz & Skinner, 1993).

Face validity and convergent validity are two approaches used to estimate validity in diaries (Iidia et al., 2013). Others have examined the construct validity of diaries by comparing them to other measures (Carp & Carp, 1981). Schmitz et al. (2011) also indicate that diaries would be predicted to have ecological validity because when students write in their journals, they are typically closer in time to the learning event and thus require less retrospective than surveys.

Carp and Carp (1981) examined the reliability, validity, and generalizability of diary data over a one-day period in which participants responded to interview questions and a one-week period in which diaries were kept. Participants were retired residents, ages 60 and over, and interview questions targeted at ascertaining the number of times the participants left their home and for what purposes. Findings

revealed that the one-week diaries had construct validity for salient activities and were less influenced by retrospective bias than were interview data.

Strengths. There are several advantages to using diaries. Diaries are easy to use as most students are familiar with the use of diaries as a means of recording feelings or record keeping. Diaries provide sequential information which makes it possible to capture changes that occur in student motivation over time. They provide researchers with a richness of information from the students' perspective as they may elaborate on their motivation, feelings, and thoughts regarding the learning events. Diaries also provide information on students' problem-solving strategies (Fogarty & McTighe, 1993) and may provide insight into students' trajectories (Schmitz et al., 2011).

Diaries may also be administered using paper and pencil or Web-based methodologies making them accessible in various environments. Diaries are flexible and allow for both cross-sectional and longitudinal data to be analyzed (Schmitz et al., 2011). Finally, teachers and students may complete diaries simultaneously and use them to develop and refine intervention techniques that may help build self-efficacy beliefs.

Limitations. Diaries are typically used with students who are in middle school and older because they must be able to articulate their thoughts and feelings into words to enter them into the diaries. Younger students, therefore, may have difficulty using diaries to describe motivational processes in relation to learning events. Diaries are likely to involve a much smaller sample size, tend to be more time demanding on the both the students and the researchers, and rely heavily on self-reports. Another limitation concerns the willingness and motivation of the students in filling out the diaries which may affect the quality of the data obtained (Schmitz et al., 2011).

A common recommendation to compensate for these limitations in addition to promoting reliability and validity is to use other sources of information for triangulation that can lead to additional cost, time, and effort for both learners and researchers (Carp & Carp, 1981). Lastly, and most importantly, while diaries may be completed close to the actual learning event, they are not completed during a real-time learning event and are based on the students' cognitions and feelings after the event has occurred.

Case Studies

The case study methodology is used when researchers want to gain an in-depth understanding of students within an authentic context (Butler & Cartier, 2018; Yin, 2014). Case studies provide a wide breadth of information that can include a variety of methodologies to measure motivation and learning such as observations, interviews, student performance measures, diaries, surveys, think-aloud protocols, the microanalysis, and stimulated recalls. Stimulated recalls involve video recording the participant while learning, then while viewing the recording asking the participant questions about the processes of self-regulated learning such as their self-efficacy beliefs (Schunk, 2020).

Because case studies attempt to provide a "holistic" view of participants, they seek to explain the *how* and *why* questions about a contemporary set of events in a situation in which the researcher has little or no control (Yin, 2014, p. 14). According to Yin (2014), when conducting a case study, one must have a set of case study questions and its propositions, identified participants or entity (such as a classroom), an understanding of the data to be obtained, and a criterion for interpreting the findings. Versland and Erickson (2017), for example, conducted a case study on a principal of a high achieving but impoverished high school to examine whether his self-efficacy for achievement influenced the collective self-efficacy of the teachers and students. Findings revealed the principal's high self-efficacy beliefs motivated teachers and students and impacted their self-efficacy for success.

As in the example above, case studies can be designed to capture the individual processes such as self-efficacy, metacognition, and strategy use (Butler & Cartier, 2018). Because self-efficacy is dynamic and changing, case studies that are conducted over extended periods of time can capture these changes within naturalist learning contexts as they develop and evolve. This can provide researchers with information on subtle changes in self-efficacy beliefs, as well as the relationship between these changes and instruction and performance. While we placed case studies under the traditional instrument category, one could argue they capture real-time measures, particularly if part of the case studies involves the structured interview, think-aloud, and microanalytic methodologies where students are asked questions during learning.

Example. Scott (2011) conducted a study exploring the impact of self-efficacy and self-regulated learning instruction on students with varying levels of achievement, including students with disabilities. Seven students working on literacy tasks were observed while their teachers implemented supportive instruction. These students who were in either inclusive, supportive, or pull-out classes for literacy instruction were part of the case study analysis along with four teachers. The four teachers in the study were supportive of implementing self-regulated learning instruction in their classrooms. Multiple data collection measures such as observations, running records, interviews, and probes were obtained to ensure a more holistic view. Findings revealed that students' self-efficacy varied across literacy tasks and was related to personal factors such as past reading difficulties and environmental factors such as their perceptions about the writing task.

Reliability and Validity. Reliability of case studies is often estimated by using a standard case study protocol and through establishing measures of evidence (Yin, 2014). Developing a standard protocol consists of asking questions that get at the issues under investigation, are unbiased, and generate data that can be interpreted. Data from case studies may come from multiple sources. Maintaining a strict protocol can ensure consistency across cases. Examining multiple sources of data provides evidence through triangulation. Patton (2002) describes four different sources of data that can be used to estimate reliability: multiple data sources, multiple investigators conducting cases studies on the same students, agreement of the theoretical applications by the investigators to the data, and standard methodology for conducting the case study.

Musyoka et al. (2017) conducted a case study on 40 teachers' perceptions of their capability to teach students who are hard of hearing with additional disabilities. Thirty-one of the teachers had certification in teaching students with deafness, the remaining 9 had at last one student who was hard of hearing in their classes. Teachers were administered a survey that included comprehensive open-ended questions in addition to closed-ended questions using a Likert scale. Reliability was established using triangulation with other data sources and intercoder reliability. Overall findings revealed that teachers did not feel prepared due to lack of information on various disabilities.

Validity can be estimated through construct validity, internal validity, and external validity (Yin, 2014). Construct validity can be examined using multiple sources of evidence; internal validity can be found by examining patterns and rival explanations to explain outcomes; and external validity can be estimated through the application of theory in single-case studies or replication logic in multiple-case studies.

Ruokonen (2018) conducted a case study on tenth grade students' self-efficacy and social skills through an arts education program over a one-year period. Twenty students from four participating schools participated in the arts program, while another twenty, also from four participating schools, remained in the control group. Data were collected using students' evaluations before and after the school year using Likert scale surveys with previously established validity, along with teachers' responses to open-ended questionnaires to provide insight and explanation to students' responses. The focus of the arts project was for students to create their own life stories using artistic projects such as videos, painting, dance, drama, or music and included instruction from artists as well as several visits to museums and cultural arts centers. Students who participated in the arts program showed no significant differences in self-efficacy and but some significant differences on socialization skills. The author suggests that these findings may be due to a lack of full support by the schools' administrations.

Strengths. Case studies have the potential to provide a comprehensive picture of participants in their natural settings. Different types of data collection methods may be used to help inform the understanding of student learning and motivation. In addition, one may also include students' records, feedback from teachers, parental information, medical information, previous learning experiences, and any other relevant material to help inform the data analysis. Unlike diaries that do not capture learning while it is occurring, case studies provide the opportunity to observe multiple motivational and learning processes such as self-efficacy and strategy use as they unfold (Butler & Cartier, 2018).

Another advantage of using case studies is that they provide diagnostic information about where in instruction a future intervention may be used to help build students' self-efficacy beliefs. An additional strength of case studies is that it may be possible to make inferences about changes in self-efficacy over time. For example, in observing a first grader over the school year learn to write in cursive one may witness an increase in her self-efficacy by her mannerisms, excitement, flair when writing, or changes in the way she holds her pen. Overall, case study designs that include

real-time assessments have the potential to provide rich qualitative and quantitative data on student self-efficacy and self-regulated learning.

Limitations. Yin (2014) indicates that unlike other assessment methodologies, case studies typically do not have a standard systematic protocol to follow which results in concern over sloppiness, not following systematic procedures, or the potential for bias in analyzing the results and in drawing conclusions. Another limitation is the confusion on what exactly a case study is and what data should be collected as part of the study. Case studies tend to require long periods of time during which the researcher acquires large amounts of data to sort through and analyze which can be overwhelming, complex, and confusing. While case studies have the potential of providing a wealth of information critical to understanding the dynamic nature of self-efficacy, findings from case studies are difficult to interpret and generalize to other populations because they are typically specific to the student, classroom, or school and based on observations by the researcher which may involve issues of subjectivity.

Real-Time Assessments of Self-efficacy

Traces

One approach to assessing student motivation is through the use of technology. Technology can be designed in a way that captures multiple forms of inputs such as students' selection of menu options, dropdown bars, navigation, clicks, eye movements, use of online coaches, time spent on and off task, facial expressions, physiological changes, among others (Azevedo et al., 2018; Bernacki, 2018). When learners use technology to complete learning events, these data sources can be traced and recorded in a log that contains a transcript that is referred to as trace data. (Bernacki, 2018).The trace data are then interpreted and analyzed in ways to understand the learner's use of motivational, cognitive, and affective processes to foster learning during a real-time event and when incorporating the use of Webcams can provide additional rich information through video recordings. (Azevedo et al., 2018). Traces include marks students make in texts, such as when they underline, highlight, circle key words, or write notes in margins. These traces can also be captured through technology.

Traces can be used to examine the amount of effort and persistence a student puts into an assignment or toward reaching a goal (Winne & Stockley, 1998). When a student continues to conduct research on a topic even though she has repeatedly not found what she is searching for on the Web, she is engaging in effort and persistence as compared to another student who surfs the Web and after a few minutes of unsuccessful searches gives up. Bandura (1986) indicated that learners who are self-efficacious will apply effort and persist when pursuing goals. Traces

allow researchers to examine cognitive monitoring as they observe learners apply different tactics online to regulate their learning (Winne & Stockley, 1998).

Example. Bernacki et al. (2015) examined changes in self-efficacy among ninth grade students studying algebra using an intelligent tutoring system that traced and recoded their behaviors. The trace log information included attempts at problem-solving, use of tools available related to the content, and responses to pop-up prompts designed to assess students' self-efficacy and problem-solving skills. Self-efficacy prompts that consisted of questions asking students to report on their level of efficacy for completing similar mathematics problems in the future were presented using a Likert scale. Findings revealed that self-efficacy changed in response to learning. In addition, as students' math solutions became more accurate, not only did their self-efficacy improve, but their use of help-seeking also declined.

Reliability and Validity. While traces can only be interpreted in terms of the learning context, they tend to be reliable because they refer to objective measures. Traces can also be estimated as reliable using triangulation. A trace study conducted by Winne and Jamieson-Noel (2002) involved collecting trace measures of study strategies from undergraduates while they learned about lightning. Trace data were recorded by instructional software as students studied material. Traces recorded students' behaviors such as scrolling through text and opening windows. Students also completed a self-report measure of strategies used, and the trace data were matched as closely as possible to the self-report items such as those assessing planning a method for studying, creating notes, and reviewing objectives. Through triangulation of data, the results showed that students tended to self-report overuse of study strategies, especially for planning a method for studying, highlighting, copying text verbatim into a note, and reviewing figures. For example, students reported having reviewed figures 26% more than traces indicated, which suggests that students' beliefs about their study strategies were not calibrated with the actual behavior reported in the traces.

Traces can also provide both face and ecological validity and an unobtrusive approach to assessing learning processes such as self-monitoring and strategy use. Azevedo and his colleagues (Azevedo et al., 2018) have done extensive research using advanced learning technologies (such as intelligent tutoring systems, simulations, and virtual reality) to assess and foster learning processes in domain-specific contexts. His findings suggest that data obtained from trace measures may be used to scaffold, coach, and teach explicit learning and study strategies thus ultimately building self-efficacy and success. Winne (2020) emphasized the importance of the connection between theory and traces and the inferences made from them when examining the validity of trace measures. Bernacki (2018) suggested that think-alouds (discussed in the subsequent section) can provide concurrent validity to traces because they provide self-reports of the learning event as it is being traced.

Strengths. Traces are real-time assessments because they track students' actions during learning while providing rich sources of data on the processes students engage in. In addition, the use of advanced learning technologies can enhance achievement by

"teaching" or guiding students who may be struggling or faltering in their learning, to engage in different strategies by providing immediate feedback in the form of explanations and suggestions for alternative ways to improve learning and foster self-efficacy. Trace measures provide researchers with the opportunity to observe how students work on a task and study without interference, in real-time rather than retrospectively, and can be adapted to fit the learners' ability to problem-solve comprehensively and contextually (Bernacki, 2018). This methodology also allows for a larger sample size than case studies as long as access to technology is available to the participants during the study.

Limitations. Limitations of trace measures include the cost of technology and program design. The logs also produce large quantities of complex information, which might be overwhelming and difficult to interpret if the knowledge sought is not narrowed down in the program development stage and summarized coherently, and if researchers are not provided with sufficient training to interpret the logs. Bernacki (2018) highlighted the challenge in demonstrating adequate validity and reliability of the inferences made from the log transcripts without triangulating the logs with assessment measures such as surveys or think-aloud protocols. Because trace measures capture student learning in a nonobtrusive protocol, without supplemental information from other sources such as surveys or interviews, researchers may not have an understanding of students' self-efficacy beliefs during learning or why students are behaving as they are during a learning situation (Bernacki, 2018). Self-efficacy is difficult to assess without directly asking a student how self-efficacious he or she feels to learn or perform well on a task. Another limitation is the generalizability of the findings to other learning situations and other learners as well as the replicability of the study using standardized trace measure designs on learners of various ages and across various domains.

Think-Alouds

The think-aloud methodology requires participants to verbalize what they are "thinking" as they engage in a learning task (Moos & Azevedo, 2008). The think-aloud involves using a set of instructions that are provided to participants prior to beginning the learning activity and specific instructions for how participants should be prompted during the learning event to ensure consistency across participants (Greene et al., 2018). One of the most important points for consideration during the think-aloud is to provide as little amount of interference as possible with the learner as he or she engages in a task to not interrupt the learning processes. Participants are instructed to think out loud as they work on problem-solving activities typically, in a one-on-one setting with the researcher and participant in a laboratory environment (Ericsson & Simon, 1994). The researcher records the verbalizations, and it assumed that the thought processes follow a sequential order as the student works through the learning event. Researchers have used different methods to record participants'

verbalizations such as taking notes, eye tracking, video recordings, and audio tapings, which are then transcribed and analyzed (Greene et al., 2018).

Moos and Azevedo (2008) argue that the think-aloud protocol provides a powerful way to assess self-efficacy, especially through the use of hypermedia. Hypermedia is a computer-based environment that contains videos, text, diagrams, and audio. Hypermedia provides the flexibility of a "rich interactive" learning environment that can capture self-efficacy as a student engages in a learning event (Moos & Azevedo, 2008). One of the benefits of using hypermedia is that it can provide scaffolds that can assist students when they are learning a task that is just beyond their capability thus impacting self-efficacy and performance.

Example. Moos and Azevedo (2008) conducted a study examining the effects of scaffolds on self-efficacy and self-regulated learning using the think-aloud methodology within a hypermedia learning environment. Using hypermedia, thirty-seven college education majors were randomly assigned to two conditions: conceptual scaffolding or no scaffolding. Participants were assessed three times using a Likert scale on their self-efficacy beliefs to learn about the circulatory system to examine fluctuations in motivational beliefs while learning. Students were also assessed on their self-regulatory processes as they worked through the hypermedia and at the end of the learning event. Both groups were asked to think-aloud. Prior to beginning the experiment students were given a pretest to assess their knowledge on the circulatory system, followed by a five-minute training session on how to use the hypermedia, and the first self-efficacy assessment. The second self-efficacy scale was administered during the 30-min learning event, followed by the last one immediately after learning. Results indicated that both groups of students had higher levels of self-efficacy before beginning the hypermedia which was explained by the lack of familiarity and experience using hypermedia.

Reliability and Validity. Reliability of the think-aloud can be estimated depending on the approach for assessing self-efficacy. For example, in Moos and Azevedo's (2008) study described above, because participants completed a Likert scale, the researchers examined internal consistency using Cronbach's alpha on each administration of the questionnaire. In approaches that do not have questionnaires embedded, researchers may opt to use interrater reliability. Greene et al. (2018) suggest a few different approaches for participants' responses recorded manually or by tape recordings. The first approach involves selecting a subset of data and checking for interrater reliability on that subset. Another approach suggests that interrater reliability is estimated on several subsets of data, while a third approach is to estimate reliability on the entire data set.

Predictive validity may be estimated by examining performance and achievement measures (Greene & Azevedo, 2009). Triangulation is also recommended to demonstrate validity for think-aloud measures, particularly with regard to covert processes such as academic motivation (Greene et al., 2018). Greene et al. (2018) indicated that some studies have demonstrated discriminant validity, but few have examined the construct validity of the coding schemes in using the think-aloud.

Strengths. The think-aloud protocol has many advantages. Learners are assessed during a learning event, thus providing real-time measures of self-efficacy. Researchers may gain information on what students are thinking as they work through an academic task—providing potential opportunities for specific and targeted interventions. Bandura (1986) indicated that assessments of self-efficacy should be targeted toward specific learning tasks or within specific learning contexts. Since think-alouds occur while students are working on a domain-specific task, reported self-efficacy beliefs should be predictive of learning outcomes once reliability and validity have been established. Think-alouds can assess motivation and learning processes with little to no interruptions, thus providing insight during an authentic learning event (Moos & Azevedo, 2008).

Limitations. A major concern of the think-aloud protocol has been the "reactivity" effect on student performance because when students are asked or prompted to explain their cognitions, they may engage in additional cognitive processing that might not have taken place otherwise and that may affect performance (Ericsson & Simon, 1994). Ericsson and Simon (1994) recommend resisting the urge to ask participants to explain their cognitions and to provide explicit instructions and practice opportunities prior to the assessment so that students have a clear understanding of the protocol procedures. Another challenge with administering the protocol is that during the learning events, students may forget to think-aloud or chose not to do so (Greene et al., 2018). Ericsson and Simon (1994) suggest that researchers use simple, neutral language such as "keep talking" to remind learners to think-aloud. These reminders, however, can interrupt a student's cognitive processing or strategy use. In addition, because the think-aloud is typically administered in a one-on-one setting such as a laboratory to eliminate any potential distractions, sample sizes tend to be small, and the setting is an artificial one which limits the ecological validity of the methodology.

Microanalyes

The microanalytic methodology is an approach to assessing fine grained measures of student motivation and self-regulated learning during authentic learning contexts (Cleary, 2011; DiBenedetto & Zimmerman, 2010). The microanalytic protocol has been used to assess self-efficacy and the processes of the three phases of self-regulated learning by asking specific questions targeted at the processes while learning is taking place. Questions are asked of students *prior* to learning, *while* learning, and *after* learning during the three phases of self-regulated learning. While typically conducted on a one-on-one basis, the microanalysis can be conducted in small groups (Cleary et al., 2008).

The microanalysis differs from the think-aloud in several ways. In the microanalysis, specific questions targeting the learning processes such as self-efficacy, goal setting, strategy use, metacognitive monitoring, and attributions are prepared in advance of the session. Then, at key points in time during the learning session,

students are asked one of the questions aimed at understanding what the student is doing and why. Students typically respond by pointing to a Likert scale or by providing a short open-ended response which is then recorded by hand, tape, or video. To be able to develop these questions, one must be able to understand the nature of the task and the task demands prior to implementing the microanalysis (Cleary & Callan, 2018). As indicated earlier is this chapter, Bandura (1997) emphasized the necessity of having knowledge and understanding of the task to accurately assess it and recommends using a microanalytic approach.

Example. DiBenedetto and Zimmerman (2010) examined self-efficacy and the use of self-regulated learning among students who were at-risk, average achievers, and advanced level performers in science. Fifty-one high school juniors were individually assessed using the microanalysis. Participants were presented with a three-page document on the development and destructive power of tornadoes and were instructed to read, study, and prepare for a test to be administered at the end of the session. Students were provided with paper, pencils, highlighters, index cards, and a variety of other materials they could use to study. Participants were instructed to study as long as needed and to indicate to the researcher when they felt prepared enough to take the test. During the protocol, the researcher used the microanalysis to assess self-regulated learning processes including self-efficacy for learning and performing well on the tornado knowledge test. Upon test completion, the researcher graded the student's exam and asked additional questions to assess students' feelings and beliefs and his or her performance. Findings revealed that high achievers had lower levels of self-efficacy than low achievers and that all students' test scores were inversely related to their self-efficacy beliefs. Possible explanations are that low achieving students may not be able to judge their self-efficacy accurately or they may not fully understand the task demands whereas high achieving students may underestimate their capability or worry the task will be too difficult for them to perform at the level they are accustomed to performing at (DiBenedetto & Zimmerman, 2010).

Reliability and Validity. The microanalytic methodology has demonstrated reliability and predictive and construct validity in various academic, music, athletic, and medical contexts (Artino et al., 2014; DiBenedetto & Zimmerman, 2013; Kitsantas & Zimmerman, 2002). Reliability has been established by examining the relationship among the variables as well as through interrater reliability on open-ended questions and has been found to be quite high (DiBenedetto & Zimmerman, 2010; Kitsantas & Zimmerman, 2002).

Convergence of the microanalytic assessment protocol and other measures such as teacher rating scales and self-report surveys has shown support for validity of the microanalysis (Cleary & Callan, 2018). DiBenedetto and Zimmerman (2013) studied the construct and predictive validity of the microanalysis and found the microanalysis to be a stronger predictor of learning processes than another previously established measure of learning. More research is needed that focuses specifically on the microanalytic assessments of self-efficacy.

Strengths. The microanalysis provides the opportunity to understand the cognitions and affects of students during authentic learning activities. This real-time measure includes both quantitative and qualitative measures of self-efficacy and self-regulated learning and because the measures are phase-linked, they have a potential diagnostic value for guiding instructional interventions (Cleary & Callan, 2018; DiBenedetto & Zimmerman, 2013). For example, when assessing students' self-efficacy, the point at which students indicate they are not self-efficacious about their capability to complete a task would be a time to intervene. This could prevent students from struggling or performing poorly, thus building mastery and increasing self-efficacy.

An additional strength is that the microanalysis is easy to implement and analyze and may be used with small- and or medium-sized samples. The microanalysis enables researchers to examine the dynamic nature of motivational and learning processes in a context-specific setting and provides researchers with a window in which to view students' thinking, feelings, and actions while learning (Cleary, 2011).

Limitations. Perhaps the most significant limitation of the microanalytic methodology is that it is in its infancy stage. Additional research is needed to examine the effectiveness of measuring students' motivation and learning in other academic contexts and among younger students who may have difficulty articulating what they are thinking or why they are doing what they are doing when learning. Research is also needed to determine whether question students during a learning event influences the outcomes. Additional research that supports the implementation of interventions would make a significant contribution. For example, if the microanalysis was used as a diagnostic measure, then during an intervention, and then again as a post assessment, it would provide information on where and when motivation and self-regulated learning processes shift in a positive direction for the learner (Cleary & Callan, 2018).

In the following sections, we describe the educational implications of obtaining real-time measures and offer suggestions for future research.

Educational Implications

Each of our educational implications aligns with our recommendations for future research described below. One of the major reasons why it is so critical for assessment instruments to establish psychometric properties is for use in the classroom. Practitioners may use assessment instruments to help them reach students who are struggling with motivation and academically. Through professional development opportunities, educators can be taught how to use assessment instruments, interpret their findings, and develop intervention strategies that are useable in their daily activities.

With the knowledge and understanding about the ways to assess self-efficacy and learning, practitioners could make decisions about data collection. For example, it would not be practical for a teacher to have her class do a think-aloud all at once; however, she may be able to arrange for students to be assessed individually using

the library or counseling office with the help of a substitute teacher covering her class. Through professional development, educators may also use multiple sources of information to help guide instruction and intervention such as a combination of diaries and surveys administered at key points such as before, during, and after a new unit.

Finally, an important educational implication lies within the sources of self-efficacy. Through professional development opportunities, educators can learn to assess self-efficacy beliefs and develop intervention strategies that capture the vicarious, persuasive, physiological/emotional, and mastery experiences that foster student motivation. Most educators offer students words of encouragement (*I know you can do this!),* but for example, through the use of trace measures, a practitioner may decide to use modeling. After administering a trace assessment of students' studying a chapter in a novel, the teacher realizes students are highlighting almost every line in the chapter. She interprets this as problematic for two reasons: The students are unable to distinguish what is important from unimportant; and by underlining too much, the students are overwhelmed with how much to remember for the quiz. The teacher notices that her high achieving students seem to be able to differentiate what is important to highlight from what is not and asks those students to work with others in small groups and to model the strategy of highlighting, followed by note taking, and rehearsing. In this simple example, the teacher is using modeling to help students succeed leading to a mastery experience, thus ultimately increasing their self-efficacy.

Future Directions

A major concern for educational psychologists and educators has been how best to assess student motivation and learning in reliable and valid ways so that the results can be used to predict student behavior and performance. While Bandura (2000) provided guidance on how to develop surveys to best measure self-efficacy, we recommend similar guidelines for the other assessment options described above. Ensuring the reliability and validity of the instruments will mean that when assessments are conducted, regardless of which measurement instrument is used, findings will be consistent across instruments. This research dedicated to the measurement properties of the assessment instruments should vary across academic content areas and grade levels.

Along the same line of ensuring that the psychometric properties of instruments are met, we recommend more research dedicated to the administration, analysis, and communication of the assessment methodologies. Through a standardized protocol, replications of the studies may take place across age level and content area—thus rather than examining the effectiveness of the instrument's ability to assess motivation, researchers will be able to examine the differences across various populations and domains.

Additional research is needed demonstrating how the use of multiple assessment instruments can be used to increase our knowledge and understanding about the dynamic nature of self-efficacy. There is evidence that self-efficacy changes over time (DiBenedetto & Bembenutty, 2013). The use of multiple methodologies could help provide insight into these changes, whether they are subtle or significant, and provide information on how and where in the classroom interventions may impact self-efficacy.

Assessing self-efficacy in school settings can have powerful results. Motivation is not a static process; rather it is dynamic and constantly changing due to personal, behavioral, and environmental variables. Thus, we recommend that assessment of motivation is studied in real-time contexts such as in classes while instruction is proceeding. Studying teacher and student behaviors in these settings will require methodologies that capture moment-to-moment changes, such as traces, think-aloud verbal protocols, and microanalytic methods that involve frequent measurements of key variables. Collecting data in real time will allow researchers to determine the antecedents and consequences of changes in motivation and provide practitioners with insights on how to help their students succeed and feel self-efficacious to do so!

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Chapter 3
Nurturing Learner Self-efficacy Beliefs in STEM Through Citizen Science: Theory, Assessment, and Applications

Suzanne E. Hiller and Anastasia Kitsantas

Abstract A widening area in educational research is the assessment of self-motivational beliefs and STEM achievement within the context of citizen science programs. These initiatives promote the inclusion of hobbyists and/or students interested in scientific work in a range of activities from research design, data collection and interpretation, and dissemination of findings, depending on the type of citizen science framework. Self-efficacy is a pivotal construct in these situations as students learn to mirror the behaviors of professional scientists, who often serve as field experts and training facilitators. Notably, self-efficacy for scientific observation skills, an essential aspect of data-interpretation, is a central issue in the development of STEM-oriented careers. Synthesis of the literature reveals multifaceted approaches to researching and measuring self-efficacy as part of student citizen science endeavors. The purpose of the current chapter is to discuss the types and aspects of citizen science programs which support science self-efficacy; present a social cognitive theory approach to citizen science design and research; review trends in citizen science research for student self-efficacy; and suggest new avenues for researching student achievement and self-motivational beliefs with a sample study. Implications for research and practical applications for stakeholders interested in promoting outdoor/environmentally oriented learning are discussed.

Keywords Citizen science · Motivation · Self-efficacy · Scientific observation skills · STEM

Introduction

A compelling consequence of recent technological innovations is the ease in which members of the global public are able to contribute to authentic initiatives to improve

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health, societal, and environmental conditions. *Citizen science* (CS) is the participation of community volunteers who engage in realistic problems in the natural world by using scientific protocol and procedures through informal science learning and inquiry, data collection, and observation (Bonney et al., 2009; Crall et al., 2011; Grudens-Schuck & Sirajuddin, 2016; Phillips et al., 2019). The level of volunteer cooperation in professional scientific work has a dual capacity in advancing professional science and encouraging volunteers' content knowledge, community engagement, science literacy, and motivation (Bonney et al., 2016; Brossard et al., 2005; Condon & Wichowsky, 2018; Kermish-Allen et al., 2019), often during studies of large-scale biological and/or environmental factors. CS programs are becoming widespread and applicable to academic curriculum with topics such as ants, shore crabs, seal populations, and pollution from stream sediments (DiBenedetto & Schunk, 2019; Vermeiren et al., 2016; Wege et al., 2020; Weigelhofer et al. 2019). While CS participation has been more common for adults, educators and researchers have noted the extensive benefits of incorporating these types of programs for school-aged students on STEM career motivation and achievement (Bracey, 2019; Hiller et al., 2019; Hiller & Kitsantas, 2014; Koomen et al., 2019; Wallace & Bodzin, 2017, 2019).

In terms of motivation, one of the greatest benefits of CS is the impact on student science self-efficacy beliefs in which an individual gauges their capabilities for a specific task (Bandura, 1997), such as taking a measurement or classifying an organism (Hiller & Kitsantas, 2014, 2016). As self-efficacy is specific to skill sets or subject knowledge, researchers have found that CS activities have positive implications for self-efficacy of science content knowledge and literacy, scientific observational skills, and/or stewardship (Condon & Wichowsky, 2018; Hiller & Kitsantas, 2015; Meinhold & Malkus, 2005; Sutton, 2009). Students who report high levels of self-efficacy beliefs are more likely to apply greater effort toward science activities, persist when difficulties arise, and seek out additional opportunities to engage in science activities (Hiller et al., 2019). Consequently, self-efficacy beliefs are a powerful assessment of one's motivation.

The purpose of the following chapter is to (1) discuss the types and aspects of CS program design that support student science self-efficacy, (2) present a social cognitive theory perspective that guides program design in CS contexts, (3) review the literature on citizen science and self-efficacy, (4) outline current trends in assessing student self-efficacy in CS settings with a model study, and (5) discuss implications for educators while offering suggestions for further research.

Enhancing Student Science Self-efficacy Beliefs Through Citizen Science Program Design

Individuals' experiences during CS depend on the role of the citizen scientist; the project design and goals; and the interactions with mentors, teachers, and scientists. Enduring elements of CS (protocol training, scientific observation skills, and mentorship) can manifest as profound influences on student self-efficacy beliefs about scientific activities.

Types of Citizen Science Program Designs

While there are several methods to classify types of CS, a prevalent way is to consider the role and level of volunteer participation. In this light, there are three main types of CS programs: participatory, collaborative, and co-created (Bonney et al., 2009; Pandya & Dibner, 2018; Rushton & Parker, 2019). Most common are participatory programs in which volunteers collect data for pre-designed studies. An example would be the *Spring Cloud Challenge* conducted in 2018 by the NASA Global Learning and Observations to Benefit the Environment (GLOBE, n.d.) program. Citizen scientists collected over 55,000 ground observations of clouds through the GLOBE mobile app (Robles et al., 2020).

Collaborative CS programs are when volunteers are part of many aspects of the program beyond data collection including data analysis and interpretation of findings (Bonney et al., 2009; Pandya & Dibner, 2018; Rushton & Parker, 2019). Weigelhofer et al. (2019) described a collaborative CS program for high school students in Austria to study the impact of agriculture on stream sediments and nutrient retention. Students conducted laboratory experiments to study the level at which stream sediments absorb or desorb inorganic phosphorous (P), a substance which can expedite eutrophication (dissolving of oxygen in streams), thereby threatening plant and animal wildlife. Students were involved in all elements of the research design, analysis, and interpretation of findings.

The third type of CS, co-created, is less common, particularly for school-aged students. In this regard, citizen scientists are stakeholders in all elements of the program from design to dissemination. An example of co-created CS would be activities facilitated by the Institute for Research in Schools (IRIS). The aim of these programs is to include teachers and students as co-creators to make authentic contributions to society. *Well World* is one such program where high school-aged students design, conduct, and report on biodiversity in conjunction with scientists from the Museum of Zoology and a biology teacher. Students who have participated in IRIS programs have presented at conferences and published in professional journals (Rushton & Parker, 2019).

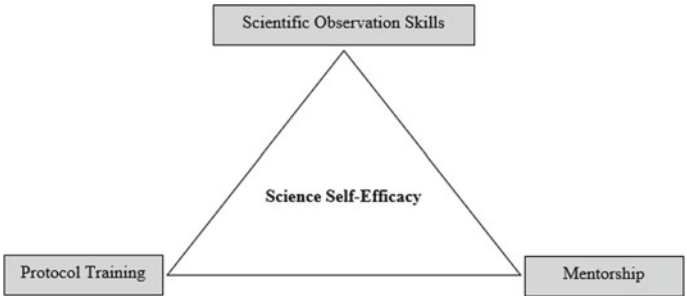

Fig. 3.1 Citizen science aspects and science self-efficacy

Aspects of Citizen Science Program Designs and Self-efficacy

With the primary concern of maintaining scientific credibility, effective CS activities have fundamental cogs in the program design, which include (a) protocol training, (b) a focus on scientific observation skills, and (c) a mentorship component (Hiller et al., 2019; Hiller & Kitsantas 2015). These three aspects are integral to facilitating citizen scientists to utilize finely tuned scientific observation skills to address the needs of a study through protocol training. The mentor/facilitator/naturalist guides the citizen scientists to coordinate their skill sets as accurately as possible to enrich the quality and integrity of the study outcomes. As shown in Fig. 3.1, these three aspects of CS program design ultimately shape student science self-efficacy.

Protocol Training

Regardless of the age of the volunteers, protocols are put in place to provide consistency in data collection as a basis for high-quality studies (Hulbert et al., 2019). Protocol training is contingent on project aims and drives sound interpretations. Each CS study has unique specifications as is the case with *Reef Check Australia* (RCA, n.d.), which monitors the health of the Southeast Queensland and Great Barrier Reefs. The program tracks the reefs each year over the course of 5-month increments, with differing time spans for each reef. Volunteer scuba divers visit sites annually based on GPS coordinates and circle a 5 m belt at 20 m transects to assess the health of the site in terms of substrate percent cover (e.g., sand); the abundance of fish and invertebrates; and the influence of bleaching, demise, and scaring. Typically, citizen scientists work in teams either scuba diving or snorkeling to collect data. Considerations include availability of divers, weather conditions, and funding (Bauer-Civiello et al., 2018). As with all CS programs, unique features and parameters of the program inform the training of volunteers.

Mentorship Component

When guiding individuals to follow protocol and use scientific observation skills, interactions with field experts and scientists can be pivotal experiences for individuals who develop fine-grained skills and learn to mimic the behavior of scientists (Eberbach & Crowley, 2009). These interactions can positively impact student self-motivational beliefs, including self-efficacy (Hiller & Kitsantas, 2014; Jeanpierre et al., 2005). Koomen et al. (2016) highlighted the benefits of student interactions with mentors in a study of four students' citizen science research, Grades 7-8. Koomen et al. concluded that having an educator who is both a practitioner and a master in the subject gives the students a mentor whom they can trust and gain insight from, as well as shapes students' self-identities as members of the scientific field while learning about community engagement.

Scientific Observation Skills

Professional scientists rely on scientific observation skills as a framework for interpreting information (Cartwright, 1989). Nuanced, expert scientific observation skills take experience, practice, and mentorship opportunities with professional scientists while focusing on counting, collecting, classifying, and measuring. The level of sophistication required for scientific endeavors in each of these areas does not develop naturally; students require guidance on how to use these skills within the parameters of a study (Cartwright, 1989; Eberbach & Crawley, 2009; Hiller & Kitsantas, 2015).

Eberbach and Crowley (2009) outlined four specific categories that field experts can focus on when training individuals to transition from novice to expert levels in scientific work: noticing, expectations, observation records, and productive dispositions. For instance, as a form of noticing, a student can learn to distinguish two animals apart. As they improve their skills, they may notice more specific features or patterns of an organism. In the expert phase, students are able to discern when features are relevant or irrelevant for classification purposes (Eberbach & Crowley, 2009; Hiller & Kitsantas, 2015).

There is a three-way exchange between protocol training, scientific observation skills, and mentorship. Each facet works in tandem to create high-quality research studies. From an educational perspective, these dynamics are instrumental in building student self-efficacy as individuals develop advanced skill sets while working with a mentor. The needs of the study drive whether there is a greater emphasis on scientific outcomes, impacts on citizen scientists, or a joint focus on informing scientific knowledge while considering the ways individuals benefit personally.

Self-efficacy

The trifold reliance on protocol training, mentorship, and scientific observation skills can be impactful in terms of student self-efficacy. Bandura (1997) indicated that there are four sources of self-efficacy: (a) mastery experiences, (b) vicarious experiences, (c) social persuasion experiences, and (d) physiological factors. When citizen scientists receive protocol training, they are having multiple opportunities to practice a skill, which is reflective of mastery experiences. Volunteers often work in teams to collect data which serves as a source of social persuasion when verbal and nonverbal messages from peers can be very potent in developing overall self-efficacy. As individuals refine their scientific observation skills with guidance from experts (vicarious experiences), they are engaged in additional mastery experiences (Hiller & Kitsantas, 2015). With positive mastery, social persuasion, and vicarious experiences, negative physiological states such as stress and anxiety are minimized (Schunk & DiBenedetto, 2020) (Fig. 3.2).

Protocol training, scientific observation skills, and mentorship are important factors of CS to maintain standards for scientific rigor. Motivational perspectives shape the ways these types of CS initiatives can bolster student self-efficacy and achievement in science.

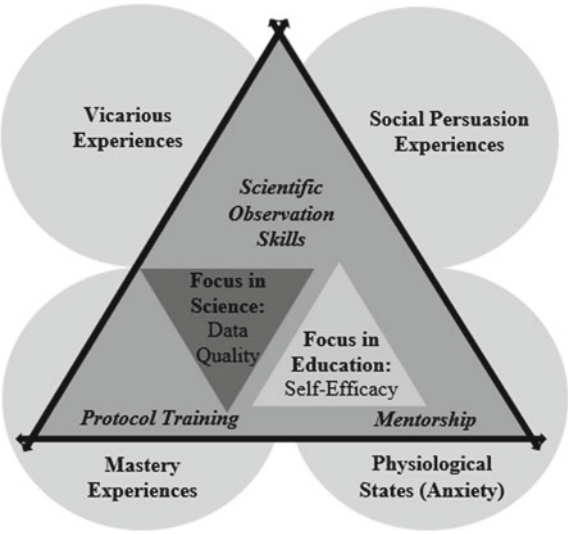

Fig. 3.2 Sources of self-efficacy and aspects of citizen science

A Social Cognitive View of Program Design in Citizen Science

Framing CS programs and research from a theoretical perspective greatly enhances a program facilitator's ability to develop student self-efficacy and to measure the impact of these types of enterprises. Social cognitive theory is one theoretical perspective often cited when studying student motivation via self-efficacy within CS contexts.

The basis of social cognitive theory as it relates to self-efficacy originated with the work of Bandura throughout the 1960s–1980s (Zimmerman & Schunk, 2003), and was further extended with the work of Zimmerman and colleagues (Schunk & DiBenedetto, 2020; Zimmerman, 2013; Zimmerman & Kitsantas, 1997, 1999). *Social cognitive theory (SCT)* centers on strategies individuals use to be proactive with the purpose of developing highly self-efficacious learners who plan, monitor, and reflect on their learning strategies to reach a preset goal. Three broad frameworks comprise SCT: (a) triadic reciprocality, (b) multi-level training model, and (c) the cyclical self-regulatory feedback loop.

Bandura (1997) coined the term "triadic reciprocality" to reflect the socially bound influence between a person, their environment, and their behavior; in other words, an individual's actions are reflective of their environmental surroundings and exchanges with peers and mentors. As a CS example, students identifying macroinvertebrates in a stream work in teams and consult classification keys to identify specimens with reinforcement from naturalists and teachers. Positive interactions and supportive contexts have the potential to increase student self-efficacy (Bandura, 1997).

In the multi-level training model, the second aspect of SCT, learners form a collaborative partnership with mentors to transform skill sets from beginner level to high levels of expertise (Zimmerman, 2013). There are four levels in the multi-training model including *observation*, *emulation*, *self-control*, and *self-regulation.* In the first two levels, the mentor has a more pronounced role as the learner watches a skill or strategy and then tries to duplicate the behavior. In the third and fourth levels, the learner is less reliant on the mentor, first in self-control doing the skill with automaticity. In the self-regulation level, the learner adopts a unique style (DiBenedetto & White, 2013; Zimmerman & Kitsantas, 1997, 1999). This process is particularly relevant for developing scientific observation skills as a field expert trains volunteers to transcend their observations beyond everyday skill sets (Hiller & Kitsantas, 2015).

The third feature of SCT is the cyclical, self-regulatory feedback loop model, with the purpose of training students to be self-regulated learners (Zimmerman, 1989, 2013). The process entails three phases known as forethought, performance, and self-evaluation. Each phase is subdivided into two processes. In the forethought phase, individuals make plans to reach goals and develop strong motivational beliefs. These beliefs include self-efficacy, interest, outcome expectations, and goal orientations. It is particularly crucial that students have strong self-efficacy at this phase to persevere, focus on strategy selection, and avoid blaming uncontrollable outside factors

like genetics (Cleary & Labuhn, 2013). In the performance phase, students use self-control and self-observation to monitor their techniques during the process. Finally, in the self-evaluation phase, students gauge self-satisfaction and self-judgments. The cyclical, self-regulatory feedback loop is useful in CS to increase the sophistication level of data collection, analysis, and interpretation skills (Hiller & Kitsantas, 2015). SCT serves as the basis for CS which considers both student achievement and motivation. These theoretical perspectives incorporate not only cognitive gains for students and changes in environmental attitudes but how social interactions and program structure increase science self-efficacy.

A Review of Empirical Research on Self-efficacy in Citizen Science Programs

While there is evidence that there are positive CS outcomes for educational and motivational purposes, less work has considered impacts in both areas. The following review outlines initial student-based CS research and the shift to studies which target both achievement and motivation.

Preliminary student-based research focused on student knowledge and attitudes for the environment. For example, Brossard et al. (2005) engaged in a summative evaluation of a CS project with *The Birdhouse Network* (TBN) through Cornell Laboratory of Ornithology (CLO, 2020). The goal of the study was to assess the effectiveness of such an informal science project on the knowledge acquired of birds, attitudes in science and environment, as well as the scientific method. Participants in the experimental group were asked to place one or more bird boxes in their backyards/communities and then to collect data on the inhabitants' nest size, calcium intake of the birds, feathers used in the nest, and the site of the nest. Brossard et al. concluded that the participants' knowledge in bird biology did increase; however, there was no significant difference in the participants' understandings of the scientific method or attitudes toward science and environment in comparison with previously known data.

In the same year, a novel co-created CS *Monarch Larva Monitoring Project* (MLMP; MonarchNet, n.d.) took place with teams of teachers, students, and scientists working together to design, implement, analyze, and present findings. To coincide with the breeding season of monarch butterflies, teams met for 2, 1-week institutes (Summer in Minnesota and Fall in Texas). Forty-four secondary teachers and 86 students formed cooperative teams to study monarch butterflies across a 3-year time period. The primary focus of this work centered on improvements in teacher use of inquiry-based practices. Notably, the intervention increased content knowledge for both teachers and students (Jeanpierre et al., 2005).

During this time, a few studies emerged which incorporated self-efficacy and environmental factors. For example, Meinhold and Malkus (2005) examined the

relationship of pro-environmental attitudes, self-efficacy, knowledge, and behaviors. High school students on the West Coast of the United States ($N = 848$) took a series of measures related to environmentalism. The findings concluded that students with higher environmental attitudes and knowledge were more likely to exhibit pro-environmental behavior. Interestingly, self-efficacy was not a factor in pro-environmental behaviors when coupled with environmental attitudes.

Condon and Wichowsky (2018) created an intervention program that utilized CS within middle school classrooms to help promote STEM studies, as well as civic-oriented community change, through locally conducted experiments. The software, STEMhero (2020), which is a Web-based design for middle school science classrooms, collected and tracked data while participants recorded and analyzed water and/or energy usage within their own homes. This concept was promoted to give students a level of autonomy, as well as empowerment in that they were using data from their everyday lives. The pre-post design spanned 2.5 weeks, consisted of 551 middle school students from 13 schools, and studied STEM engagement by analyzing the self-reported levels of motivation. Students involved in CS activities saw an increase in STEM involvement, as well as an increase in willingness to study STEM subjects. Overall, the findings indicated that engagement in CS can ultimately levels of efficacy, both collectively and individually (Condon & Wichowsky, 2018).

Wallace and Bodzin (2017) studied the impact of CS on student achievement and motivation via *BudBurst* (Chicago Botanic Garden, 2020), a program centered on global warming and climate change, with the use of mobile learning apps. In particular, Wallace and Bodzin studied interest and identify formation as sources of STEM career motivation. Students in ninth grade ($N = 78$) were randomly assigned to either a control or treatment group. Both groups learned about global warming and climate change in the classroom; however, the treatment group participated in *BudBurst* with their Android devices. Findings from the study showed that on all measures, the treatment group outperformed the control group, revealing that this type of program can influence student motivation and identity shaping.

Hiller and Kitsantas (2014) diverged from the previous CS work in that their focus was on achievement as well as a range of self-motivational beliefs. Hiller and Kitsantas analyzed the effects of a CS program involving horseshoe crabs on STEM career motivation through a quasi-experimental study. The researchers recruited 86 students (eighth grade); divided them into a treatment group (involved in CS program with an expert where they collected data) and a comparison group (followed standard curriculum within a classroom); and analyzed how self-efficacy for scientific observation skills, sources of self-efficacy, task interest, outcome expectations, content knowledge, and career motivation was impacted by the CS program. The results of the study showed that engaging in CS can increase student's academic achievement, as well as be a motivator in pursuing STEM careers. Involvement in CS with field experts bolstered student self-motivational beliefs, refined their skill sets, increased science content knowledge, and instilled identify formation as scientists through a supportive environment. Further, students in the treatment group had strong mastery, vicarious, and social persuasion experiences with minimal anxiety following the intervention (Hiller & Kitsantas, 2014).

Most recently, Tsivitanidou and Ioannou (2020) investigated the various types of technologies utilized during CS projects within a K-12 science classroom, which offer new avenues to promote student engagement and self-efficacy. Similarly, Magnussen and Elming (2015) studied an interdisciplinary project related to urban decay for eighth grade students in Copenhagen. Using *Minecraft* (Mojang, 2019) and with mentorship from researchers, teachers, and architects, students worked at "Cities at Play" to problem-solve about systemic organizational changes within deteriorating urban environments. The integration of experts, online technologies, and authentic challenges increased student understanding of structural elements within city environments which promote community engagement and restoration. This program is one example of the potential for diverse uses of CS for student learning and self-efficacy within classrooms.

In reviewing CS literature on student outcomes over the last 20 years, there has been a growing shift in research focus for children and adolescents as shown in Fig. 3.3. Inceptive studies of CS for youth targeted content knowledge. In addition, researchers began to include self-efficacy as a motivational outcome, particularly in relation to environmental attitudes and literacy. Most recently, research studies have incorporated both motivational and achievement outcomes as an extension to understand STEM career motivation. As researchers continue to develop this research agenda, there are multiple ways to integrate measures to capture how CS activities influence student learning and motivation for career trajectories.

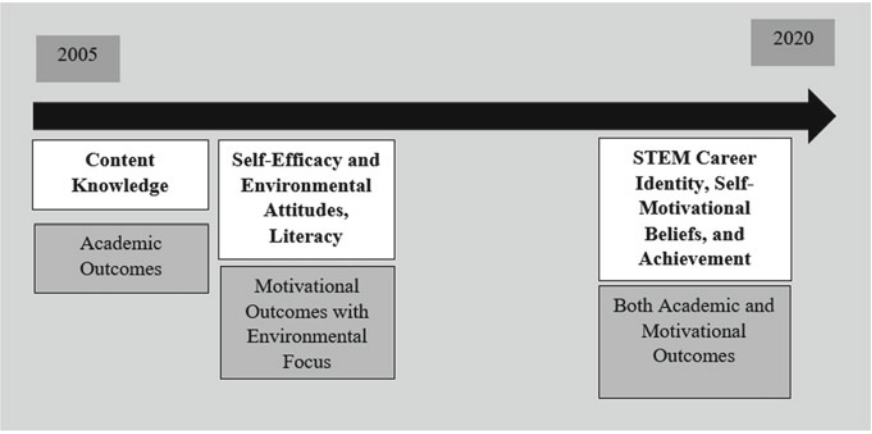

Fig. 3.3 Citizen science research focus

Current Trends in Assessing Student Self-efficacy in Citizen Science Settings

The creative uses of CS afford new avenues of research when considering student development and motivation. The progression of CS literature highlights how both achievement and motivational outcomes are applicable to student experiences. As the field continues to expand, future CS research studies should incorporate a battery of scales which relate to the impact of this type of program. Suggested constructs for future research along with achievement measures, content scores, and environmental attitudes and behaviors include self-efficacy, interest, outcome expectations, and goal orientations. For example, to capitalize on the pivotal role of scientific observation skills in CS, Hiller and Kitsantas (2016) created a measure to assess student self-efficacy beliefs for scientific observation skills known as The Citizen Science Self-Efficacy Scale (CSSES), which can be adapted to fit the needs of specific CS activities. Additional self-motivational measures to correspond with the CSSES would be beneficial.

An alternative approach to Likert-type scales is the use of a microanalytic tool. These types of assessments measure directly, in real time, an individual's motivational behaviors, cognitive, and metacognitive processes in a manner that is detail-oriented and within a natural and authentic context, like CS (Kitsantas & Zimmerman, 2002). What distinguishes this form of assessment is that the focus is on an individual's processes (strategic, motivational, and regulatory) as they perform a task (Cleary et al., 2016). Microanalytical assessments are applicable in many different practices and contexts to help gather deep, rich, data on how individuals initiate, sustain, and modify their processes as they occur in an event.

Previous research has utilized self-reported measures (i.e., questionnaires and surveys) that involve Likert-type scales to measure motivational processes. However, there is a discord on the effectiveness of such instruments in that the self-reports only depict the behavior of the student as an outcome of context perception. This characterizes self-reports as highly inefficient in accurately measuring constructs, such as self-efficacy, which are extremely contextualized. Also, questionnaires and surveys only consist of composite scores, meaning that constructs are deemed as fixed traits, versus ones that can be modified and transformed (Cleary et al., 2012). In general, most self-report studies can be administered electronically, whereas when utilizing microanalytic assessments, researchers will engage in mostly structured interviews. However, microanalysis measures a student's perceptions and processes in learning prior, during, and after a specific task, making it so that the assessment is happening throughout the designated task. That being said, microanalysis is built around specific tasks and often revolves around the three phases of self-regulated learning (forethought, performance, and self-reflection), as well as sub-processes of goal setting, strategic planning, self-observation, self-evaluation, and attributions (Cleary et al., 2012, 2016).

In previous studies, microanalytical assessments have been shown to have high reliability and validity, high interrater scores, as well as a high predictability for

performance (Cleary et al., 2012; Kitsantas & Zimmerman, 2002). Another strength is that this assessment targets specific processes used within a task in real time, and so it can be deemed as beneficial for both measurement and assessment, as well as intervention of strategies. Overall, microanalytical assessment methods are preferable for measuring an individual's processes during a task in a manner that reduces bias and error. As a CS example, to capture student self-efficacy for scientific observation skills, Hiller (2012) integrated an event measure as a form of microanalysis. In a horseshoe crab CS program, eighth grade students measured the interocular distance and determined the relative age and gender of the organisms. As the teams collected data, field experts signaled to the researcher whether measurements were correct. This method served as a real-time data source and was useful in triangulation purposes with a self-efficacy survey and semi-structured interview data.

Integrating a variety of methods in the research design provide rigorous sources for triangulation. Examples of quantitative and qualitative measures, such as a battery of scales, microanalytical measures, interviews, observational notes, videos, and student artifacts, are some dynamic ways to assess the impact of CS programs on student achievement and motivation. An array of methods allows for an in-depth understanding of specific concepts as well as resources for triangulation to improve the rigor of the study.

Sample Model of Citizen Science Intervention

The following scenario on invasive plant species outlines how measures correspond with a CS intervention which includes a mentorship component. This section serves as a model and offers guidance on how to construct CS research designs with assorted measures to capture influences on student motivation and achievement.

Intervention

Seventh grade students will be engaged in a series of experiences which will expose them to interactions with field experts as they collect data for an invasive plant species CS program. The program is a participatory design, which includes protocol training, a focus on scientific observation skills, and mentorship. Field experts will particularly emphasize classification protocol to identify local flora.

During the first week of the activity, students will be directed to observe plants in their school community and try to locate examples of invasive plant species. This experience will occur with exposure from the classroom teacher. One week later, students will receive training from field experts on invasive plant species. They will then practice distinguishing between the species within the classroom setting and take the second round of measures. Two weeks after the start of the study, students will meet naturalists at a national park reserve to receive further training and modeling

in the morning. In the afternoon, students will collect data on invasive plant species for a CS project. Following the day trip, students will complete the third round of measures.

Potential Data Collection Instruments

Sources of Science Self-Efficacy (Britner & Pajares, 2006). This scale captures the impact of the sources of self-efficacy (mastery experiences, vicarious experiences, social persuasion, and physiological states) within a science context. This scale was used in an adolescent horseshoe crab CS program (Hiller & Kitsantas, 2014) where the Cronbach's alpha reliability indexes for the present study for the subscales was 0.87 for mastery (14 items), 0.77 for vicarious (13 items), 0.86 for social persuasion (13 items), and 0.88 for physiological states (9 items), which are acceptable and similar to prior research.

Citizen Science Self-Efficacy Scale (Hiller & Kitsantas, 2016). This scale measures student self-efficacy for scientific observational skills. The Citizen Science Self-Efficacy Scale (CSSES) is a 7-item measure of student perceptions of their capabilities in scientific observation skills. In a validation study with eighth grade students, Hiller and Kitsantas (2016) found the Cronbach's alpha reliability coefficient was 0.87.

Interest Scale (Adapted from Hiller, 2012). The interest scale captures student levels of interest based on student interest for studying plant phenology. Students are asked on a scale of 1 to 5, how interested they are in studying aspects of plant phenology.

Content Knowledge Measure. A content measure evaluates student achievement based on plant phenology. The assessment corresponds with the naturalists' training materials and reviewed by two life science teachers for construct validity. The assessment will be analyzed for reliability using the Cronbach's alpha reliability coefficient.

Citizen Science Outcome Expectations Scale (Hiller & Kitsantas, 2014). This scale assesses students' value of science educational attainment to their future career plans. In a horseshoe crab CS context, a 6-item scale measured student beliefs about the outcome of participating in the CS program. The scale ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). The Cronbach's alpha reliability coefficient was 0.83. Adjustments in this scale reflect the plant phenology context.

The Revised 2-MEV Scale (Johnson & Manoli, 2011). This measure is a 16-item scale which assesses adolescent attitudes toward the environment based on the preservation and utilization of nature. The scale will be assessed for reliability for the present study with the Cronbach's alpha reliability coefficient.

Today, we will be collecting data for a citizen science project on invasive plant species. You will be writing in your field journal about your experiences before, during, and after your experience. The before, during, and after writing prompts below will guide you in your description of your experience.

Before: Prior to starting your work: (1) Describe how you will plan to collect data on invasive plant species. (2) Think about how you will tell the difference between invasive plant species and native plant species. (3) Think about how you will keep track of your observations. (4) Think about the resources you will be able to use to help you. Be sure to give specific examples.

During: While you are working, take a break to write in your field journal. (1) Think about how sure you are that you are identifying invasive plant species. (2) Think about how the observations you are making help you to identify invasive plant species. (3) Think about how well you are recording your observations. (4) Think about how sure you are that you will be able to find answers to your questions. Be sure to give specific examples.

After: Now that you have finished collecting your data: (1) Think about how well you have learned to classify invasive plant species. (2) Think about how the observations you collected helped you to identify invasive plant species. (3) Think about how well you recorded your observations. (4) Think about what steps you would take to continue learning about invasive plant species. Be sure to give specific examples.

Fig. 3.4 Storytelling prompt

CS Storytelling Prompt. This storytelling prompt incorporates self-regulatory elements with the progression of scientific observation skills outlined by Eberbach and Crowley (2009). The journal reflections will be scored with a rubric based on Eberbach and Crowley's descriptions (e.g., noticing, expectations, observational records, and productive dispositions). In a journal, students will be directed to write a story about their experiences identifying invasive plant species as compared to native plants before, during, and after the activity with prompts. The questions align with the phases of the cyclical self-regulatory feedback loop model (Zimmerman, 2013). Figure 3.4 is an example of one storytelling prompt.

Observational Notes. Three researchers/graduate research assistants will take observational notes during each phase of the intervention. The purpose of the observational notes will be used to describe the intervention.

Video Recordings. Three researchers/graduate research assistants will take video recordings during the outdoor phase of the intervention. The purpose of the videos will be used to describe the intervention.

For stakeholders interested in studying the impact of CS programs, the use of multiple instruments yields richer information about how these types of activities influence youth. The program design should include the level of participant involvement; means for integrating protocol training, scientific observation skills, and mentorship; and a variety of tools to study the CS context.

Implications for Educators

CS continues to transform in terms of topics, levels of volunteer contributions, technological applications, and outcomes. While participatory CS is more common for youth, collaborative and co-created designs offer exciting opportunities to develop student mastery and self-efficacy. Further, innovative technologies have reshaped involvement in CS ventures and are especially helpful for coarse-grained data collection to offset timing and funding considerations. The integration of technology can help scientists by providing generalized information to guide research for more strategic study (Vermeiren et al., 2016) while students strengthen their science skills. As outlined by Tsivitanidou and Ioannou (2020), new technologies offer inspiring avenues for student learning. With the current shift to online learning in K-12 settings, technologies such as the ones described below might provide new and innovative methods to boost student self-efficacy beliefs as they engage in CS activities.

Mobile applications allow for participants to engage in scientific inquiry outside of the classroom context in a manner that is personalized and directly relates to their everyday lives (Tsivitanidou & Ioannou, 2020). A CS example would be the use of *BudBurst* (Chicago Botanic Garden, 2020) with mobile apps as outlined by Wallace and Bodzin (2017, 2019).

Gaming and digital gaming assists in giving learners an opportunity to develop their scientific citizenship by having students acknowledge challenges, gather data, and engage with others in the community in discussion of the results and how it impacts their environment (Tsivitanidou & Ioannou, 2020). Project Web sites are potential motivational platforms where CS projects and games can be warehoused (Prestopnik & Crowston, 2011).

Web-based/online platforms provide a tool for educators and experts to collaborate on CS projects. Zooinverse (n.d.) would be an example of a popular online platform to promote CS for students.

Augmented reality, or in other words game-based learning, engages students in a realistic manner that is project-based and primarily run by the students with the educator acting as a facilitator. Magnussen and Elming's (2015) study of the use of *Minecraft* (developed by Mojang, 2019) for student development in varied professional areas is an example of how gaming/digital gaming is useful for CS contexts.

Virtual reality technologies allow students to interact with the environment (i.e., through tours of nature sites) completely virtual. Students collect and analyze data and easily share their findings with the community through technology. Sprenger and Schwaninger (2021) contended that creating training materials through virtual learning platforms can account for activities which require scalability while minimizing costs.

Sensors and 3D printing tools are useful in collecting environmental data which could be logged and shared with other members of the community. Various tools

are transforming access to research for citizen scientists. For example, with the use of a 3D printing tool, it is possible to print a microscope attachment for use with a Smartphone (Arc Centre of Excellence for Nanoscale BioPhotonics, 2008).

Overall, the usage of technology in CS has implications for educators as new resources might have positive benefits on student learning as well as contribute to the sharing and communication of scientific inquiry amongst students, experts, and members of the community (Tsivitanidou & Ioannou, 2020).

Additional research is needed to shed some light on how we can both cultivate student science efficacy beliefs as well as how to assess these beliefs. Learning technologies and the integration of innovations will likely reshape possibilities for CS projects and will be integral in assessing student motivation and achievement.

Suggestions for Future Research

CS programs are becoming more accessible to students with diverse technology platforms, varying research designs, and creative topics. Three issues which are relevant to future research on CS include: (1) students' proficiency in collecting data for professional studies, (2) the use of calibration to improve student accuracy, and (3) assessing student interest in CS programs.

The acceptance of support from community members to contribute to scientific projects has fluctuated across time; some scientists have been concerned that data collection by hobbyists may not be perceived as rigorous, thereby limiting the value and acceptance of research findings. This issue is particularly relevant for children who participate in CS activities (Hiller & Reybold, 2011, 2019). Within the last few decades, this dilemma has become less prominent as researchers have found that both adults and children are able to engage in scientific work with proper training at a high level of accuracy (Gardiner et al., 2012; Hiller, 2012; Pocock & Evans, 2014; Weigelhofer et al., 2019).

Secondly, while students have the capabilities to collect data accurately, there is potential to support struggling students through calibration as an inherent element of CS (Cleary et al., 2019). *Calibration* refers to when an individual makes a comparison of how well they performed on a given task in light of preset standards. Low-performing students tend to have weak calibration skills and benefit from modeling from instructors. Learners gauge how well they did on the task, and then the instructor rates their performance. If there is a disparity, the instructor shows the learner how to improve their work to meet the standards (Bol et al., 2012). Because data collection during CS is dependent on strict protocol procedures, calibration is a persistent element within the design of the program. As a case in point, when working with high school students during biogeochemical experiments, Weigelhofer et al. (2019) recommended that at least one scientist supervises students throughout the lab work for safety and protocol guideline, a practice that enables the scientist to maintain quality control as well as to provide immediate feedback to students to improve

their performance. This approach improves student work as well as reduces time-consuming and expensive checks for error detection. An untapped research agenda within CS programs is to assess how CS supports student calibration as well as self-efficacy, particularly for struggling students, students with special needs, and underrepresented students in STEM fields.

A third research issue, which is a primary focal point for researchers of CS programs, centers on students' motivation and levels of interest for engaging in activities. This factor raises competing dualities in that CS requires that participants are volunteers, whereas students who participate in CS programs in school may be steered toward the activity as part of the curriculum. This controlled participation is counter to the basic requirements of CS programs (Hiller et al., 2019).

Further, researchers interested in motivation will likely target hobbyists' levels of interest and self-efficacy in the sciences. As citizen scientists are volunteers, the level of interest may be higher than the population at large. For this reason, it can be problematic in measuring the impact of a program based on already high levels of interest (Hiller & Kitsantas, 2014; Hiller et al., 2019). Research with adolescent students in CS contexts should strategically assess the balance between student involvement and motivation within CS at the onset of the study.

Conclusion

Research within the last several decades has noted a symbiotic relationship between scientists and student hobbyists; the scientific community has benefited from large-scale public involvement whereas individuals involved in the process improve scientific literacy, content knowledge, self-efficacy, and interest (Hiller et al., 2019; Jeanpierre et al., 2005; Weigelhofer et al., 2019). For children and adolescents, the opportunity to work with scientists in authentic investigations has implications in maximizing student science achievement and STEM career motivation (Bombaugh, 2000; Hiller & Kitsantas, 2014; Wallace & Bodzin, 2017, 2019). CS-based instruction helps expose a diverse population of students to various learning methods, and hence, students who have traditionally been excluded from STEM-oriented careers may gain motivation for new career pathways through these authentic, real-world experiences (Hiller et al., 2019; Shim & Lee, 2019).

Due to a greater general acknowledgement of the benefits of CS and technological advances which are attainable for more people, a growing volume and diversity of projects is becoming prevalent. Educators and researchers invested in improving student achievement and motivation will have many perspectives on how CS programs may support students. Considering the role of self-efficacy for students working with mentors is beneficial in identifying the most effective programs and best practices.

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Chapter 4
Assessment of Academic Self-efficacy: Validity and Pragmatic Use of a Grid-Type Instrument

Pedro Sánchez-Escobedo

Abstract Grid-based measures, where item stems are rated across diverse domains or subjects, represent an economic and effective procedure to assess different psychological traits. This chapter reports the design, development, and validation of a grid-type instrument to assess self-efficacy. Inspired in a popular grid scale to measure self-concept, pilot studies leaded to major changes, such as shortening the response scale from seven to five points and reducing the number of items from eight to six. The psychometric properties, advantages, and limitations of the Mexican Self-Efficacy Grid Scale (MSEGS) are discussed by examining the results on its use to measure academic self-efficacy in 1460 high school Mexican students that voluntarily responded to the final instrument. Sex differences by subject, Cronbach alpha coefficients, and a confirmatory factor analysis (CFA) support that these changes and adaptations hold acceptable psychometric properties to assess academic self-efficacy. Furthermore, a simpler 5 × 5 grid scale can be used to confidently assess academic self-efficacy in up to four different academic subjects at the same time. It is argued that the use of this grid scale should focus on differences and strengths in specific subjects or academic fields, rather than in the general self-efficacy construct, because of the vocational and educational implications of test results.

Keywords Grid-measures in Mexico · Academic · Academic-self-efficacy

Introduction

This study presents the procedures and findings in the design and validation of an instrument to assess academic self-efficacy in Mexico. This was inspired by commonly used grid measures in Germany, specifically as the Differentiated School Self-Concept (SKSLF-8) (Rost et al., 2005). Given the conceptual convergence

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between self-concept and self-efficacy, we focused in measuring self-efficacy feelings, a dimension of the general self-concept, in four major areas of knowledge in the Mexican curriculum: Math, Sciences, Spanish language, and English as a second language.

Grid Measures

Instruments, under the grid measure logic, set several items evaluating a given construct. These items are organized in rows (stem) that are rated across diverse domains or subjects (columns), so the gird structure provides an economic measure to assess several dimensions with relation to the stem concept in a single testing situation.

Grid measures in psychological testing have proven various advantages. For example, they seem to be more time-effective, since they allow to measure a given dimension or trait (stem) across various dimensions at the same time. There is also ample evidence of their reliability, validity, and practical value in assessing a variety of psychological traits in school settings.

Given that in Mexico, grid measures have not been used in assessing Mexican students, we decide to develop the scale, using this format, and to explore its psychometric properties to judge whether this format is appropriate in this new context.

Grid measures had been used to assess self-concept. For example, the Differentiated School Self-Concept DISC; (Rost et al., 2005) and the Self-Description Questionnaires [SDQ] (Marsh & O'Neill, 1984). Regarding the first instrument, Rost kindly allowed us to review his Differentiated School Self-Concept (DISC) to design a grid-type scale to assess academic self-efficacy feelings in Mexican students.

Merenda's admonition (2005), that one of the most ineffective and dangerous practices in the measurement community is the adoption, as opposed to adaptation, of instruments from one culture to another is borne in mind. Thus, we decided to translate some items and write other items to focus on academic self-efficacy rather than in self-concept. Self-efficacy is a more familiar concept in Mexican education and was decided as a main theoretical construct to guide our instrument design.

When a test is translated from one language to another, the methods used in establishing the adequacy of the test to the new population need to be published and analyzed by the scientific community. Sometimes a perfect translation may not be sufficient to yield an equivalent assessment instrument or comparable results.

Fina et al. (2012) demonstrated that mere translation of items to other languages does not guarantee the complete understanding of the intend or innuendo of a given question. For example, the statement in Mexican Spanish "eres un estupido" does not convey the innuendo and lightness of the expression in English "you are stupid". The Spanish language connotation is more severe and rather impolite than the English language.

In this case, beyond translation accuracy, the amount of information contained in a grid type questionnaire was an additional barrier for Mexican high school students.

Initial pilot trials evidenced that our translated and modified instrument needed to be reduced from the original Likert scale of seven points to five. Likewise, it was necessary to reduce the number of items from eight to six in the stem. Apparently, the less exposure to tests in Mexican students negatively impacts their ability to effectively respond to longer and more complex grids.

The reduction on items and the points in the response scale required to establish both the reliability and validity properties of the grid-type scale.

Both, the American Educational Research Association (AERA) and the American Psychological Association, suggest that when adapting and using tests for other populations, empirical and logical evidence should be provided for score reliability and the validity of the translated test's score inferences for the uses intended in the linguistic groups to be tested. Similarly, Vijver and Hambleton (1996) argued that after adapting items, investigators should make sure that not only the intend of measurement is preserved, but that the same structure of the construct being measured is preserved as well as other basic psychometric properties. Results on the reliability and validly of the Grid type instrument to measure to self-efficacy is presented.

Academic Self-efficacy

Self-concept is a broad psychological construct that refers to one's perceived ability, and it is a factor that influences achievement and performance in various domains (Frebort and Michaela, 2011). Within this broad paradigm relies self-efficacy, a concept concerned with linking belief in one's ability to master motivational, cognitive, emotional, behavioral, and social resources to the attainment of academic outcomes (Richardson et al., 2012).

Hardy (2014) identified the academic self-efficacy as the portion of the self-concept construct related specifically to learning. Similarly, Kanfer and Ackerman (2005) defined academic self-concept as the feelings of efficacy to succeed in the school, and that that this construct is rather specific to a field, discipline, or specific domain: math, spatial or verbal domains, etc.

In sum, academic self-concept corresponds with pupils' explanations of their accomplishments (Dickhäuser & Steinsmeier-Pelster, 2002). Self-concept and self-efficacy have been used interchangeably to refer to the same object of study: the student's perception of their ability to cope and succeed in each academic field or in general in the educational process.

In this study, we focus on self-efficacy as a dimension of the self-concept since we intended to measure their feelings or accomplishment in four specific school subjects. We argue that self-efficacy seems to be a better label to refer to their sense of competency, rather that judging or evaluating themselves.

Marsh (1986) provides a theoretical perspective to explain that students simultaneously use more than one frame of reference to evaluate their abilities and achievements in different domains (mathematical versus verbal domains), since we assume that students have different perceptions of their ability from one field to another.

Hence, independence in the degree of self-efficacy between academic fields or subjects is assumed since one can have high feeling of self-efficacy in language but not in math.

Hence, testing self-efficacy by fields of study is important because students differentiate their competence by subjects (Marsh & Shavelson, 1985), and students' self-concepts are mainly based on the feedback they receive about their achievements. According to Rost et al. (2005), research has revealed that achievements scores are correlated with verbal and mathematical measures of self-concept, but they are not correlated between them. Marsh (1986) reported that math and verbal self-concepts are nearly uncorrelated with each other.

In addition, measuring self-efficacy in different academic domains may have important vocational implications in high school students, who may be prone to select those fields in which they feel more confident of success (Sanchez & Valdes, 2007).

In general, students compare their self-perceptions of their own math and verbal abilities with the perceived abilities of other students in their frame of reference and use this external, relativistic impression as one basis of their academic self-concept in each of the two areas. In this study, we address two verbal areas: English as a second language and Spanish native language and mathematics and STEAM as nonverbal fields.

Method

Participants

Participants were high school students, men, and women from 14 to 19 years old, from the state of Yucatan, Mexico. A total of 1460 students from public and private schools voluntarily responded to the grid-type instrument. Table 4.1 depicts the sample.

Table 4.1 Sample, per gender, grade, and type of school

		1	2	3	Total	Percent
Public	Men	238	149	149	536	45
	Women	285	201	175	661	55
Subtotal		523	350	324	1197	100
Private	Men	75	51	63	189	72
	Women	26	30	18	74	28
Subtotal		101	81	81	263	100
	Total	624	431	405	1460	100

Instrument

The Mexican Self-Efficacy Grid Scale (MSEGS) was designed by revising the original version of the Differentiated School Self-Concept (DISC) provided by its authors for analysis and translation of Spanish language and adjusting the intent of the question to focus on self-efficacy.

The original DISK-Grid had a stem with eight items (rows) assessing four columns with disciplines/subjects. Respondents are told to think about each subject independently and mark in a 7-point Likert scale their perception.

The original scale measured four subjects: mathematics, physics, German, and English and proved to have an adequate model of fit within each domain, and the DISC grid proved to be strictly invariant across the four subject-specific self-concepts (Baudson et al., 2015).

The Mexican grid instrument was developed by translating the original German version of the scale back and forth and creating a replica in Spanish language. A first pilot version was administered to 45 students that were not included in the final sample. After responding, they were asked to comment of the experience, particularly on the clarity of purpose and readability of the instrument. In general, these students claimed that the instrument explored their perceived competence in each of the subjects included, and that their judgments tended to be different depending upon the subject explored. However, a general complaint was the complexity of the instrument and the time needed to respond. They also mentioned that the grid table required a lot of information that affected their ability to answer the items in an effective fashion.

To address this general and consistent complaint, investigators took two major decisions, and the first was to reduce the stem from eight to six items by discarding the two with the lowest correlation with the total. And to reduce the Likert response scale from seven to five points.

Six final STEAM items were kept: I know the answers before others, I am better than my classmates, I can solve my doubts on my own, I am satisfied with my participation in class, I solve problems better than other students, and I have good grades. The columns measured four subjects: mathematics, Spanish, sciences, and English as a second language.

Data Analysis

Data was analyzed in three stages. First, descriptive statistics were used to explore for gender and subject differences. Secondly, a matrix of correlation was constructed to overview relationships among the scores. Third, to explore for reliability and construct validity, alpha coefficients were calculated, and a confirmatory factor analysis (CFA) was carried out. The Statistical Package for the Social Sciences (SPSS-25) was used.

Table 4.2 Sex per subject

Subject	Range	Men	Women	*t*	*p*
Spanish	1–30	20.16 (4.72)	21.05 * (4.47)	3.71	0.001
Sciences	1–30	20.06 * (5.35)	19.22 (5.05)	3.06	0.02
English	1–30	19.00 * (6.63)	18.19 (6.64)	2.34	0.019
Mathematics	1–30	18.88 * (5.87)	16.72 (5.72)	7.10	0.001
General	1–120	78.11 * (14.33)	75.20 (14.40)	3.85	0.001

Legend: M, (SD), * $p \geq 0.05$

Results

Sex Differences

Table 4.2 summarizes self-efficacy scores per subject and sex. Sex scores were compared with student-*t* tests.

The highest self-efficacy was in Spanish language and the lowest regarding mathematics. It can be observed that men tend to show, in general, a higher self-efficacy. Men showed higher scores in sciences and mathematics and English as a second language. Women displayed higher self-efficacy in Spanish language.

Validity and Reliability

To establish reliability, alpha Cronbach coefficient was calculated per each scale. English $\alpha = 0.92$, Math $\alpha = 0.89$, Sciences $\alpha = 0.88$, and Spanish $\alpha = 0.85$.

Content validity was explored, first by calculating the correlation coefficient between general self-efficacy scores, and the grade point average of the student was significant but low ($r = 0.302$, $p = 0.001$). This may have some practical implications in the assessment of self-efficacy as discussed later. Secondly, the notion of independence between self-efficacy feelings in different fields of knowledge was studied throughout a matrix of correlation between subjects, and the total scale was calculated. Table 4.3 shows results.

Table 4.3 Matrix of correlation between subjects

	Spanish	English	Math	Sciences
Spanish	–	0.21	0.18	0.35
English		–	**0.72**	0.14
Mathematics			–	0.38

As expected, correlations between self-efficacy scores per subject were low and non-significant, arguing for the independence of measures. Thus, a level of self-efficacy in ore area does not explain levels of efficacy in other subject or field.

To determine discriminant validity, a confirmatory factor analysis (CFA) was used to evaluate data–model fit. Comparative fit index (CFI) values between 0.90 and 0.95 as well as root mean square error of approximation (RMSEA) values and standardized root mean square residual (SRMR) values between 0.05 and 0.08 were taken to indicate adequate data–model fit. CFI values > 0.95 as well as RMSEA and SRMR values < 0.05 were taken to indicate good data–model fit.

Akaike's information criterion (AIC) and Bayesian information criterion (BIC) were used as indexes for comparison of models to measure self-efficacy in each subject (mathematics, sciences, Spanish, and English). Lowest values denoted lower adjustment of the data to the model (Blunch, 2013; Byrne, 2010). Table 4.4 illustrates derived scores.

Path analysis on the influence of items was carried out per/discipline. Path coefficients were used as estimate of the predictive strength of the item in the total measure of the self-efficacy per discipline/subject. Preliminary analysis suggested that best-fit models demanded the exclusion of item four (I am satisfied with my participation in class). Five-item adjusted model explained better the concept of self-efficacy as shown in Fig. 4.1.

Table 4.4 Data for developing the models of fit in self-efficacy scores per subject

Model	X^2	df	*p*	CFI	RMSEA	AGFI	SRMR	AIC	BIC
Mathematics	11.48	4	0.022	0.99	0.03	0.98	0.01	33.48	91.63
Spanish	16.04	4	0.003	0.96	0.05	0.98	0.01	38.04	96.19
Sciences	22.88	4	< 0.000	0.91	0.05	0.97	0.01	44.88	103.02
English	14.72	4	0.005	0.99	0.04	0.98	0.01	36.72	94.87

Legend: X^2 mean square, *df* degrees of freedom, *p* probability, *CFI* comparative fit index, *RMSEA* root mean square error of approximation, *AGFI* adjusted goodness of fit index, *SRMR* standardized root mean squares residual values, *AIC* Akaike information criterion, and *BIC* Bayesian information criterion

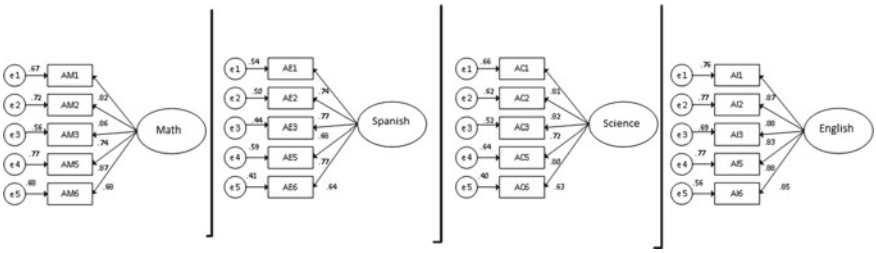

Fig. 4.1 Standardized coefficients in different fields

All path loadings were significant $p \leq 0.001$, and thus, an even more simple grid of 5×5 can be used reliable to assess self-efficacy in Mexican students.

Discussion

In Spanish language, there are several instruments available to measure self-efficacy in general and per different specific domain, such as the general self-efficacy scale by Torre (2006) or the scale of self-perceived academic self-efficacy by García-Fernandez et al. (2010). However, they have not been validated in the Mexican population, and they are general measures of academic self-efficacy that do not intend to measure specific self-efficacy feeling for specific academic subjects or knowledge domains.

Regarding the grid scale under scrutiny, results show, in general, that this is a reliable and valid instrument. A simple 5×5 grid instrument can be confidently used in Mexican schools to measure academic self-efficacy in four different academic subjects at the same time.

Results were aligned with theoretical expectations, such as observed sex differences favoring higher self-efficacy in men on nonverbal fields and low and non-significant correlations between subjects.

Findings suggest that test results must be used in a discriminatory fashion, when exploring the individual student‘s feelings of self-efficacy per subject or academic field. Vocational guidance may guide the student to the field in which he or she has the highest sense of competence or to explore the reasons for which one student may have low feelings of self-efficacy in a particular field.

The high relationship between self-efficacy feelings in math and English as a second language deserves further consideration since this finding continues to puzzle Mexican researchers with the apparently highly predictive effects in school performance of high efficacy feelings of both mathematics and English as a second language (Pat-Lopez & Sanchez-Escobedo, 2019).

Measuring academic self-efficacy may have useful vocational implications. According to Aryee (2017), students with a high sense of self-efficacy are more likely to persist and complete their college degree in their declared major of interest within the general STEM field.

Future research in the measurement of self-efficacy in Mexico may consider estimating the degree of self-efficacy in other academic fields and the relationship of test results with vocational choices and college entrance.

Measuring self-efficacy using a grid-type instrument seems to be cost-efficient and useful. Thus, grid scales must be in continuous review to guarantee their psychometric properties and their appropriate and adequate interpretation and use of results.

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Chapter 5
Psychometric Properties of the Spanish Translation of the Specific Academic Learning Self-Efficacy and Specific Academic Exam Self-Efficacy Scales in a Higher Education Context

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Abstract Academic self-efficacy is often construed as specific: task-specific, course-specific, or domain-specific. One much used course-specific scale is the self-efficacy scale of the Motivated Strategies for Leaning Questionnaire. Previous research in the Danish university context has shown that this scale, with a modified response scale, consisted of two separate course and activity-specific scales: the Specific Academic Learning Self-Efficacy scale (SAL-SE) and the Specific Academic Exam Self-Efficacy scale (SAE-SE). The SAL-SE and the SAE-SE scales were previously found to fit Rasch models and have excellent reliability, and the results have been replicated. The aim of this study was to translate the SAL-SE and SAE-SE scales to Spanish and to conduct a first validity study of these in the Spanish university context. We collected data to obtain a student sample comparable to those used in the Danish studies; psychology students in four different courses, and we used Rasch models for analyses. Results showed the Spanish scales to be separate scales, but with less optimal measurement properties than the Danish versions; both scales contained locally dependent items, one item in the SAL-SE scale functioned differentially relative to course attended, one SAE-SE item was eliminated, and another functioned differentially relative to gender. Reliabilities ranged from 0.76 to 0.84 for student subgroups.

Keywords Academic self-efficacy · Academic exam self-efficacy · Rasch model · Academic learning self-efficacy · Differential item functioning · Validity

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Introduction

Self-efficacy refers to the belief of the individual in his or her own capability to plan and perform actions necessary to attain a certain outcome (Bandura, 1997). The impact of self-efficacy on academic outcome is well documented in several studies concerned with linking the belief in one's own ability to master motivational, cognitive, emotional, behavioral, and social resources, to the attainment of academic outcomes (Richardson et al., 2012). Studies have found that self-efficacy correlates with academic performance (e.g., Ferla et al., 2009; Luszczynska et al., 2005; Richardson et al., 2012; Zimmerman et al., 1992), and meta-analyses have concluded that self-efficacy is the strongest non-ability predictor of grade point average (GPA) in tertiary education above personality traits, motivation, and various learning strategies (Bartimote-Aufflick et al., 2015; Richardson et al., 2012). Thus, students who feel efficacious when learning or performing a task (i.e., high academic self-efficacy) have been found to participate more readily, work harder, persist longer when they encounter difficulties, and to achieve a higher level of academic performance (Schunk & Pajares, 2002).

Self-efficacy is situated within Bandura's social cognitive theoretical framework (Bandura, 1997). In this framework, human achievement depends upon interactions between the person's behaviors, personal factors such as abilities, beliefs, motivation, and environmental conditions. Situational factors are thus of key importance for a person's feelings of self-efficacy, and a person can be more or less efficacious in relation to very specific tasks and particular situations or domains of academic functioning (Bandura, 1977, 1997; Richardson et al., 2012).

Bandura's self-efficacy conceptualization is task-specific, as he proposes that self-efficacy has predictive power only when it is evaluated against specific tasks in a specific context. However, if self-efficacy is evaluated against tasks in a somewhat broader domain, it may still be termed specific self-efficacy (Bandura, 1997; Scherbaum et al., 2006). Others propose that the various and numerous experiences of failure or success experienced over time in different academic domains facilitate assessment of a general sense of self-efficacy, which refers to a to a global ability to master challenges (e.g., Scholz et al., 2002; Schwarzer & Jerusalem, 1995). Specific self-efficacy beliefs have also been found to account for connections between general efficacy beliefs and particular performance (e.g., Agarwal et al., 2000; Bandura, 1997; Pond & Hay, 1989). Thus, it appears that there is agreement that the varying demands through education imply that the individual's notion of academic self-efficacy will vary depending on the specific educational context and the point in time in the course of education, whether academic self-efficacy is defined as task-specific, domain-specific, or general in nature. A student might be very efficacious at one point in time during the course of education, but less so at a later time-point, or a student might feel more efficacious in relation to specific courses but not toward other courses, or a student might feel more efficacious toward specific tasks in a specific course at a particular time-point in the course of education.

One much used measure of course-specific academic self-efficacy is the 8-item self-efficacy scale within the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991), a multi-scale instrument intended to measure students' motivational orientation and learning strategies in high school and higher education. The MSLQ has been translated into multiple languages and has been used in various ways by researchers (Credé & Philips, 2011; Duncan & McKeachie, 2005). Since Pintrich and colleagues (1991) originally conducted factor analysis on the MSLQ and reported reliabilities for the subscales: Cronbach's alpha for the self-efficacy scale was 0.93 for a mixed discipline sample of 380 American university students at various points in their education, the MSLQ self-efficacy scale has undergone various adaptations, and the psychometric properties of these adaptations have been investigated with a multitude of methods.

For example, Lee et al. (2010) changed the MSLQ self-efficacy items to refer to classes in general and not specific courses or subjects as in the original version, and they made additional changes to the wording of some items. Whether they made changes to the response scale is not entirely clear, as they do not refer to this at all. Thus, they adapted the scale to be a more general, and not course-specific, self-efficacy scale to be used in the high school context. They used multidimensional Rasch models (MRM: a collection of subscales Rasch models allowed to correlate), and with regard to the self-efficacy scale, they established fit for only 6 items to a Rasch model and reported a reliability of 0.78.

In contrast, Nielsen and colleagues (2017) only changed the response categories of the MSLQ self-efficacy scales and retained the item texts in their Danish translation. They conducted a construct as well as criterion validity study, with Danish psychology students enrolled in three psychology subject courses and replicated with a second sample in the same courses. Using Rasch measurement models, they showed that the scale was made up of two separate scales: the Specific Academic Learning Self-Efficacy scale and the Specific Academic Exam Self-Efficacy scale (SAL-SE and SAE-SE) each fitting a Rasch model, while the common single scale was rejected. Furthermore, criterion validity was established with regard to the relationship between admittance methods and the two scales, and reliabilities for the SAL-SE and SAE-SE scales were 0.87 and 0.89, which were close to those of Pintrich and colleagues (1991), even with half the number of items. Recently, Nielsen (2020) replicated the findings from 2017 with a sample of Danish psychology students in statistics classes, i.e., fit to a Rasch model for the SAL-SE scale and fit to a graphical loglinear Rasch models with local dependence between two items for the SAE-SE scale and reliabilities of 0.88 and 0.92.

Thus, we found the Danish adaptation of the MSLQ self-efficacy scale into the SAL-SE and SAE-SE scales with the replicated evidence of fit to Rasch models and very good reliabilities to be the best candidate for translation into Spanish.

The Current Study

The aim of the current study was to conduct a first investigation of the psychometric properties of a Spanish translation of the Specific Academic Learning Self-Efficacy (SAL-SE) and the Specific Academic Exam Self-Efficacy (SAE-SE) scale, to ascertain whether the measurement properties of the scales are sufficient to warrant use in the future research in the Spanish higher education context. To fulfill this aim, we investigated three research questions, using Rasch measurement models:

RQ1: Are the SAL-SE and SAE-SE scales measurement invariant (i.e., free of DIF) across student subgroups defined by gender, age, the university they are enrolled in and the specific course for which student self-efficacy was investigated?
RQ2: Are the SAL-SE and SAE-SE scales separate unidimensional scales each fitting a Rasch measurement model?
RQ3: Are the SAL-SE and the SAE-SE scales well targeted for the Spanish study population? Is reliability sufficient for individual assessment?

Methods

Participants and Data Collection

Participants were 866 psychology students from two Spanish universities, the University of Malaga (UMA) ($n = 534$) and the University of Seville (US) ($n = 332$) (Table 5.1). All the participants were enrolled in a full-time psychology undergraduate program in their first year ($n = 590$) and second year ($n = 276$). Data were collected from students attending the following subject courses: Research methods (36%), Personality psychology (15.6%), Biological psychology (25.3%), and Industrial psychology (23.2%). The Research methods and Biological psychology courses were placed in the first semester in both universities, while Industrial psychology was placed in the second semester. Personality psychology was placed in the first semester in UMA and in the second at US.

The gender distribution in both universities was similar with 18.7% of the Seville students and 21.2% of the Malaga students being male.

The data were collected in class approximately one month into the subject classes with a paper–pencil questionnaire by two of the researchers of the study, during the fall 2017/spring 2018. There was a prior arrangement of the data collections between the researchers and the teachers of the courses, and student participation was voluntary and anonymous.

All SAL-SE and SAE-SE items were administered in the same relative order as in the original MSLQ (Pintrich et al., 1991), but mixed in with items from other scales not utilized in this study.

Table 5.1 Characteristics of the two university study groups

	University US n = 332(%)	University UMA n = 534(%)	Total n = 866(%)
Course attended			
Research methods	159 (47.8)	153 (28.7)	312 (36.0)
Personality psychology	75 (22.6)	59 (11.0)	134 (15.6)
Biological psychology	54 (16.3)	165 (30.9)	219 (25.3)
Industrial psychology	44 (13.3)	157 (29.4)	201 (23.2)
Gender			
Male	62 (18.7)	113 (21.2)	175 (20.9)
Female	270 (81.3)	421 (78.8)	691 (79.1)
Age groups			
19 years and younger	207 (62.3)	334 (62.5)	541 (64.7)
20 years and older	125 (37.7)	200 (37.5)	325 (35.3)
Average age (SD)	20.2 (4.3)	20.0 (3.5)	20.0 (3.8)

Notes Percentages are within university samples and the total sample, respectively

Instruments

The Specific Academic Learning Self-Efficacy (SAL-SE) and the Specific Academic Exam Self-Efficacy (SAE-SE) scales were adapted from the self-efficacy scale in the Motivated Strategies of Learning Questionnaire (MSLQ; Pintrich et al., 1991) by Nielsen and colleagues (2017). The SAL-SE and the SAE-SE scales each consists of four items (See Table 5.7 in the Appendix) and are intended to measure course-specific learning and exam self-efficacy, respectively (Nielsen et al., 2017). Nielsen and colleagues (2017) showed the SAL-SE and SAE-SE subscales, with an adapted response scale, to have excellent measurement properties, as they each fit Rasch models for samples of Danish psychology students in three subject classes and their reliabilities were very close to what is required for the individual assessment intended with the MSLQ (i.e., 0.87 and 0.89). Nielsen (2020) replicated these findings with a sample of Danish psychology students in statistics classes, i.e., fit to a Rasch model for the SAL-SE scale and fit to a graphical loglinear Rasch models with local dependence between two items for the SAE-SE scale and reliabilities of 0.88 and 0.92. The adapted response scale in the Danish scales has five response

categories, all with meaning anchors, as opposed to the seven partially anchored categories in the original MSLQ (Nielsen et al., 2017; Pintrich et al., 1991).

The SAL-SE and SAE-SE items were translated from English to Spanish using a translate/back-translate procedure. The forward translation was done by two bilingual native Spanish speakers with the aim of maintaining the essence and meaning of the English items. The back-translation was done by a third bilingual person with no involvement in the first translation. The response categories were translated from Danish to Spanish, as Nielsen and colleagues (2017) had adapted and validated these.

Rasch Measurement Models

The Rasch model (RM; Rasch, 1960) is a measurement model, within the Item Response Theory (IRT) framework, with particularly desirable properties (Fischer & Molenaar, 1995). It is in mathematical terms parsimonious, while at the same time allowing independent investigation of the item and person parameters, as well as the relationship between these parameters (Kreiner, 2007). If a scale fits the RM, the sum score is a sufficient statistic for the person parameter estimates from the model (i.e., all necessary information is obtained with the sum score), a property unique to scales fitting the RM (Kreiner, 2013). Sufficiency is particularly attractive with scales where the sum score is used for research and assessment, as it is the case with the scales investigated in the current study. Furthermore, as with other IRT models, in contrast to Classical Test Theory, it is not assumed that the measurement precision is constant across the scale (Embretson & Reise, 2013). The requirements for fit to the Rasch model are (Kreiner, 2013):

1. *Unidimensionality*: The items of the scale assess one single underlying latent construct. In this case, the SAL-SE scale assessed one construct and the SAE-SE scale assessed another.
2. *Monotonicity*: The expected item scores increase with increasing values of the latent variable. In this case, the probability of any of the statements in the items providing a good description will increase with increasing self-efficacy scores.
3. *Local independence of items (no local dependence, no LD)*: The response to a single item should be conditionally independent from the responses given to any other item of the scale given the latent variable. In this case, responses to any one self-efficacy item should only depend on the level of self-efficacy, and not also on responses to the other items.
4. *Absence of differential item functioning (no DIF)*: Items and exogenous (i.e., background variables) should be conditionally independent given the latent variable. In this case, responses to any one self-efficacy item should only depend on the level of self-efficacy, and not also on subgroup membership as for example gender or the university students are enrolled in.

5. *Homogeneity*: The rank order of the item parameters (i.e., the item difficulties) should be the same across all persons regardless of their level on the latent variable. In this case, the item that requires the least self-efficacy to be endorsed should be the same for all students no matter if they are little or very self-efficacious, and the same for the item requiring the second-lowest self-efficacy, and so on for all items.

The first four requirements adhere to all IRT models and provide criterion-related construct validity as defined by Rosenbaum (1989), while homogeneity is only a requirement of the Rasch model.

Departures from the RM in the form of DIF or LD are often found in measurement scales. Thus, even though the Danish version of the SAL-SE and the SAE-SE scales was found to fit Rasch models, we prepared for the eventuality of this not being the case with the Spanish translations. If the only departures from the RM are in the form of uniform LD and/or DIF (i.e., the same at all level of the latent variable), we would use the graphical loglinear Rasch model (GLLRM; Kreiner & Christensen, 2002, 2004, 2007) to overcome this. In the GLLRM, the LD and DIF terms are added as interactions terms in the model. GLLRMs retain most of the desirable properties of the RM once the departures are taken into account, and the sum score will remain a sufficient statistic if the score is appropriately adjusted for any DIF included in the model (Kreiner & Christensen, 2007).

In the current study, we used the partial credit model (PCM; Masters, 1982), which is a generalization of the dichotomous Rasch model to take ordinal items, and which provides the same measurement properties (Mesbah & Kreiner, 2013). The PCM also extends to GLLRMs.

Item Analysis by Rasch and Graphical Loglinear Rasch Models

Overall tests of fit to RMs or GLLRMs (i.e., tests of global homogeneity by comparison of item parameters in low and high scoring groups and global tests of no DIF) were conducted using Andersen's conditional likelihood ratio test (CLR; Andersen, 1973). The fit of individual items was tested by comparing the observed item-restscore correlations with the expected item-restscore correlations under the specified model (Kreiner & Christensen, 2004). The local independence of items and absence of DIF were tested in two ways: by conditional tests of independence using partial Goodman–Kruskal gamma coefficients for the conditional association between item pairs (indicating presence of LD) or between items and exogenous variables (indicating presence of DIF) given the restscores (Kreiner & Christensen, 2004) and by using Kelderman's (1984) conditional likelihood ratio test of no DIF/no LD as a confirmatory tests that the LD and DIF included in GLLRMs were warranted (Kreiner & Nielsen, 2013). Evidence of overall homogeneity and no global DIF found in the global tests was rejected if this was not supported by individual item fit and absence of LD and/or DIF at the item level. Unidimensionality across the SAL-SE and SAE-SE scales was tested by comparing the observed gamma (γ) correlation of the

scales with the expected γ correlation of the scales under the unidimensional model (Horton et al., 2013). Two scales measuring different constructs will be significantly weaker correlated than what is expected under the unidimensional model.

All the test statistics effectively test whether item response data comply with the expectations of the model; thus, the results are all evaluated in the same manner; significant *p*-values signify evidence against the model. In line with the recommendations by Cox and colleagues (1977), we evaluated *p*-values as a continuous measure of evidence against the null, distinguishing between weak ($p < 0.05$), moderate ($p < 0.01$), and strong ($p < 0.001$) evidence against the model, rather than applying a deterministic critical limit of 5% for *p*-values. Furthermore, we used the Benjamini and Hochberg (1995) procedure to adjust for false discovery rate (FDR) due to multiple testing, in order to reduce false evidence against the model created by the many tests conducted (i.e., reduce Type I errors), whenever appropriate.

Reliability was calculated with Hamon and Mesbah's (2002) Monte Carlo method, which takes into account any local dependence between items in a GLLRM. Targeting was assessed numerically with two indices (Kreiner & Christensen, 2013): the test information target index (the mean test information divided by the maximum test information) and the root mean squared error target index (the minimum standard error of measurement divided by the mean standard error of measurement). Both indices should have a value close to one. We also estimated the target of the observed score and the standard error of measurement of the observed score. Lastly, to provide a graphical illustration of targeting and test information, we plotted item maps showing the distribution of the person locations against the items location, with the inclusion of the information curve. Person location was plotted as weighted maximum likelihood estimates of the person parameters (i.e., the latent scores) and person parameter estimates assuming a normal distribution (i.e., the theoretical distribution). Item locations were plotted as item thresholds.

Strategy of Analysis

We used the same overall strategy of analyses for both scales: First, the fit of the item data to the RM was tested, and if this was rejected, the departures from the RM were cataloged though various more detailed analysis (see below). If the departures were only in the form of uniform LD and/or uniform DIF, we proceeded to test the fit to a GLLRM which included the LD and DIF-interaction terms. If fit to the GLLRM was rejected, we proceeded to eliminate the most problematic item. At a more detailed level, the set of analysis for each scale included:

- Overall test of homogeneity of item parameters across low and high scoring groups.
- Overall tests of no differential item functioning (no DIF). For all sample, this was tested in relation to university (SS, MM), course (Research methods, Personality psychology, Biological psychology, Industrial psychology), gender (male, female), age group (19 years and younger, 20 years and older).

– Fit of the individual items to the model.
– Tests of local independence for all item pairs.
– Tests of no DIF for all single items relative to the background variables listed above.

Targeting and reliability of the scales were assessed for the final GLLRMs.

Software

All item analysis was conducted with Diagram software (Kreiner, 2003; Kreiner & Nielsen, 2013), and the item maps were created with R.[1]

Results

Neither the Specific Academic Learning Self-Efficacy (SAL-SE) subscale nor the Specific Academic Exam Self-Efficacy (SAE-SE) subscale fitted the Rasch model. However, for each of the subscales, fit to a graphical loglinear Rasch model of varying complexity was achieved subsequently.

For the SAL-SE subscale, there was strong evidence against the fit of Item 3 to the Rasch model (Table 5.2, RM part), and the global tests of fit showed weak evidence against overall homogeneity and strong evidence of DIF relative to course attended (Table 5.3, SAL-SE RM part).

Several iterations of item level tests for no DIF and local independence of items provided further evidence against fit to the Rasch model, in the form of evidence of DIF relative to course for Item 1, and that items 1 and 3 and items 2 and 4 were locally dependent. Subsequently, we defined a graphical loglinear Rasch model which included the LD and DIF-interaction terms reflected by the mentioned departures from the Rasch model and tested the SAL-SE data against this model. Table 5.4 shows the interaction terms of local dependence and DIF that were included in the GLLRM the SAL-SE with the evidence of their necessity in the form of conditional likelihood ratio tests under the model; all evidence was very strong. We found no evidence against fit of the SAL-SE items to this GLLRM after adjusting for multiple testing (Table 5.2, GLLRM part) and no evidence against overall homogeneity or additional DIF (i.e., related to university, gender, or age groups) at the global level (Table 5.3, SAL-SE GLLRM part).

For the SAE-SE subscale, there was initially strong evidence against the fit of Items 3 and 4 to the Rasch model (Table 5.2, RM part). In addition, the global tests revealed strong evidence against overall homogeneity and strong evidence of DIF both in relation to course attended and gender (Table 5.3, SAE-SE RM part). Subsequent iterations of item level analysis did not provide further and clear evidence of the

[1] We wish to acknowledge Pedro Henrique Ribeiro Santiago, University of Adelaide, South Australia, for the R code for the items maps.

Table 5.2 Item fit statistics for the Specific Academic Learning Self-Efficacy and the Specific Academic Exam Self-Efficacy subscales under the RMs and the GLLRMs

Subscale and items	Item-rest-score correlations					
	Obs γ	Exp γ RM	p	Obs γ	Exp γ GLLRM[a]	p
SAL-SE						
Item 1	0.65	0.68	0.25	0.65	0.68	0.15
Item 2	0.65	0.67	0.52	0.65	0.65	0.99
Item 3	0.77	0.68	$< 0.001^{+}$	0.77	0.72	0.02^{++}
Item 4	0.66	0.67	0.87	0.66	0.65	0.71
SAE-SE						
Item 1	0.68	0.65	0.28	0.76	0.75	0.60
Item 2	0.74	0.66	$< 0.01^{+}$	0.76	0.76	0.75
Item 3[b]	0.44	0.64	$< 0.001^{+}$	–	–	–
Item 4	0.78	0.66	$< 0.001^{+}$	0.78	0.76	0.38

Notes SAL-SE: Specific Academic Learning Self-Efficacy subscale; SAE-SE: Specific Academic Exam Self-Efficacy subscale; RM = Rasch model; GLLRM = graphical loglinear Rasch model; Obs γ = observed item-rest-score gamma correlations; Exp γ = expected item-rest-score gamma correlations; γ = Goodman and Kruskal's gamma correlations; p-values adjusted for false discovery rate were $^{+}$ unaltered, $^{++}$ above 5%

[a] The GLLRM for the SAL-SE subscale assumes that some item pairs are locally dependent (Items 1 and 3 and items 2 and 4), and that Item 1 functions differentially relative to course attended, while the GLLRM for the SAE-SE subscale assumes that Item 4 functions differentially relative to gender

[b] Eliminated from GLLRM

reasons for these issues. Thus, the alternative was to eliminate the poorest performing item, which was item 3 as the correlation between the item and the restscore was substantially weaker than expected under the model (γ_{observed}, γ_{expected}, $p < 0.001$). Having eliminated item 3, the only evidence against the model was in the form of DIF for item 4 relative to gender. When testing fit to the GLLRM for items 1, 2, and 4, which included only a DIF-interaction term for item 4 relative to gender, we found no evidence against fit of the three items to this model (Table 5.2, GLLRM part), nor any evidence against overall homogeneity or additional DIF (i.e., related to university, course attended, or age groups) at the global level (Table 5.3, SAE-SE GLLRM part). Finally, the evidence for this DIF term was moderate (Table 5.4).

The final graphical loglinear Rasch models for both the SAL-SE and the SAE-SE subscales are shown in Fig. 5.1.

Item Difficulties

The item difficulties (i.e., the likelihood to endorse items) reflect both the presence of LD and of DIF. Thus, while the DIF is per definition a difference in item parameters and this can be directly observed in the item difficulties, the item-interaction terms

Table 5.3 Global tests of fit and differential item functioning for the Specific Academic Learning Self-Efficacy and the Specific Academic Exam Self-Efficacy scales

Tests	SAL-SE RM			SAL-SE GLLRM[b]			SAE-SE RM			SAE-SE GLLRM[c]		
	CLR	df	*p*	CLR	df	*p*	CLR	df	*P*	CLR	df	*p*
Global homogeneity[a]	27.5	15	0.03^{+}	43.7	49	0.69	76.8	14	< 0.001^{++}	7.2	15	0.95
Global DIF relative to:												
University	13.0	15	0.60	30.1	27	0.31	15.0	14	0.38	11.6	15	0.71
Course	90.3	45	< 0.001^{+}	42.7	33	0.12	76.3	42	0.001^{++}	48.6	45	0.33
Gender	17.4	15	0.30	31.3	27	0.26	39.3	14	< 0.001^{++}	1.4	7	0.99
Age groups	17.2	15	0.31	29.2	27	0.35	13.0	14	0.52	11.4	15	0.34

Notes SAL-SE: Specific Academic Learning Self-Efficacy; SAE-SE: Specific Academic Exam Self-Efficacy; RM: Rasch model; GLLRM: graphical loglinear Rasch model; CLR: conditional likelihood ratio; DIF: differential item function. [a] Global homogeneity test compares items parameters in approximately equal-sized groups of high and low scoring students. $^{+}$ The critical limits for the *p*-values after adjusting for false discovery rate in the GLLRMs were: 5% limit unaltered and 1% limit $p \leq 0.002$ for the SAL-SE subscale; both 5% and 1% limits unaltered for the SAE-SE subscale

[b] The GLLRM for the SAL-SE subscale assumes that Items 1 and 3 as well as items 2 and 4 are locally dependent, and that Item 1 functions differentially relative to course attended

[c] The GLLRM for the SAE-SE subscale with Item 3 eliminated assumes that Item 4 functions differentially relative to gender

Table 5.4 Conditional likelihood ratio tests of local independence and no DIF in the GLLRMs for the Specific Academic Learning Self-Efficacy and the Specific Academic Exam Self-Efficacy scales

Scale and model terms	CLR[a]	Df	*p*
SAL-SE			
LD items 1 and 3	93.92	16	< 0.0001
LD items 2 and 4	73.65	16	< 0.0001
DIF item 1 and course	50.15	12	< 0.0001
SAE-SE			
DIF item 4 and gender	17.13	4	< 0.01

Notes GLLRM: graphical loglinear Rasch model; SAL-SE: Specific Academic Learning Self-Efficacy; SAE-SE: Specific Scademic Exam Self-Efficacy; CLR: conditional likelihood ratio; LD: local dependence; DIF: differential item function

[a] All tests were conducted under the graphical loglinear Rasch models defined by the local dependence and the DIF included in the respective models (see Fig. 5.1)

resulting from LD means that item difficulties are provided for so-called composite items from the LD items in GLLRMs (Fig. 5.2). The item difficulties for the SAL-SE and the SAE-SE subscales are both within a range of just about two 2 logits on the respective latent scales, from approximately −1.0 to 1.0. Thus, neither of the two scales contained items, which were very easy to endorse (i.e., demanded a very low

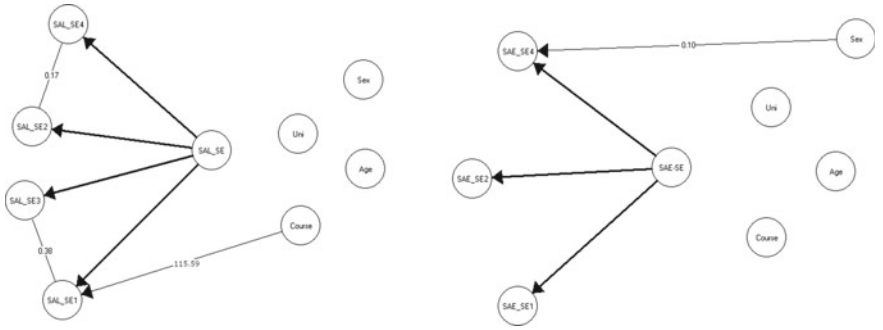

Fig. 5.1 Final graphical loglinear Rasch models for the Specific Academic Learning Self-Efficacy (left side) and the Specific Academic Exam Self-Efficacy (right side) subscales. *Notes* Correlations are partial Goodman and Kruskal's gamma coefficients (γ). Disconnected nodes indicate that variables are conditionally independent. In the GLLRM for the SAL-SE scale, no gamma coefficient is available to describe the DIF of item 1 relative to course attended, as this is a nominal variable—the chi-square value (115.59) is shown instead

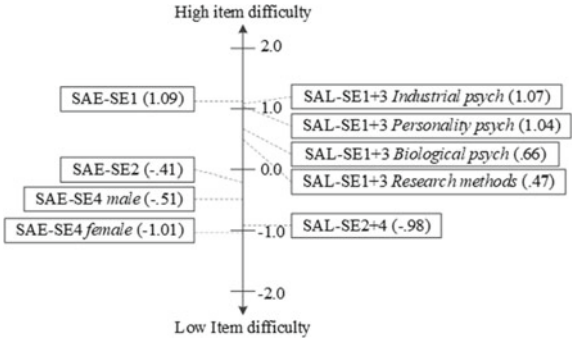

Fig. 5.2 Item difficulties in logits for the SAL-SE and the SAE-SE subscales

level of self-efficacy) or very difficult to endorse (i.e., demanded a very high level of self-efficacy).

In the SAE-SE subscale, item 1 (*I believe I will receive an excellent grade in this class*) was the hardest to endorse in terms of level of Specific Academic Exam Self-Efficacy, while item 4 (*considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class*) was the easiest in terms of Specific Academic Exam Self-Efficacy, and even more so for the female students.

For the SAL-SE scale, the pattern of item difficulties was somewhat more complex, due to the two locally dependent item pairs (items 1 and 3 and items 2 and 4, respectively), as well as the DIF by course attended for item 1. Thus, the hardest to endorse was the locally dependent items 2 (*I am confident I can understand the basic concepts taught in this course*) and 4 (*I am certain I can master the skills being taught in this class*) in terms of Specific Academic Learning Self-Efficacy. The easiest to endorse was the locally dependent items 1 (*I am certain I can understand the most difficult material presented in the readings for this course*) and 3 (*I am confident I can*

understand the most complex material presented by the instructor in this course) for the students attending courses in Industrial Psychology and Personality Psychology.

Effect of DIF on Person and Mean Scores

DIF was present in both the SAL-SE and the SAE-SE scales. In the SAL-SE scale, it was item 1, which functioned differentially relative to course attended. Thus, there was systematic differences in the likelihood to endorse the item "*I am certain I can understand the most difficult material presented in the readings for this course*" for students attending courses in Research methods, Personality psychology, Biological psychology, and Industrial psychology, given the same level of *learning* self-efficacy (Fig. 5.1). Across the entire score range of the SAL-SE scale, the maximum effect of this DIF amounted to a score difference of almost one scale point (0.92 to be precise) if DIF was taken into account (Table 5.8 in the Appendix). This is a substantive difference in scores for individual students for a scale with a score range of only 16. Another way to assess the effect of the course DIF is to estimate the bias introduced in the mean scores of the students attending the different courses if DIF equating is not performed. Table 5.5 shows that this bias in the mean scores was the highest, when comparing students attending courses in Personality

Table 5.5 Comparison of observed and DIF-adjusted mean Specific Academic Learning Self-Efficacy scores and mean Specific Academic Exam Self-Efficacy scores in groups affected by differential item functioning

Subscales and DIF groups (*n*)	Observed scores		Adjusted scores		Bias
	Mean	SE	Mean	SE	
SAL-SE subscale					
Course targeted[a]					
Research methods (381)	13.15	0.15	13.15	0.15	0.00
Personality psychology (134)	14.10	0.21	14.51	0.19	−0.41
Biological psychology (219)	14.08	0.18	14.18	0.17	−0.09
Industrial psychology (201)	14.93	0.17	15.20	0.06	−0.28
SAE-SE subscale					
Gender[b]					
Male students (192)	10.69	0.16	10.69	0.16	0.00
Female students (743)	10.12	0.08	9.98	0.08	0.13

Notes SAL-SE: Specific Academic Learning Self-Efficacy subscale; SAE-SE: Specific Academic Exam Self-Efficacy subscale; SE: standard error

[a] Differences in observed mean scores (χ^2 (3) = 62.6, $p <$ 0.001). Differences in adjusted mean scores (χ^2 (3) = 91.9, $p < 0.001$)

[b] Differences in observed mean scores (χ^2 (1) = 10.6, $p <$ 0.01). Differences in adjusted mean scores (χ^2 (1) = 15.6, $p < 0.001$)

psychology (−0.41) to students attending courses in Research methods, and lowest, when comparing students attending Biological psychology (−0.09) to the students in Research methods. Thus, even though the overall conclusion of the comparison of the mean SAL-SE scores across the four courses would be the same whether the DIF was adjusted for or not, we recommend that DIF analysis and appropriate DIF adjustment are done when the purpose of a study includes statistical analysis of students attending different courses.

In the SAE-SE scale, item 4 functioned differentially relative to student gender, so that female students were systematically more inclined to endorse "*considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class*" than were male student, while at the same level of *exam* self-efficacy (Fig. 5.1). Across the full score range of the SAE-SE scale, the maximum difference in any score resulting from the DIF was 0.29 scale points (Table 5.9 in the Appendix). The bias in the gender-based mean scores was 0.13 if scores were not adjusted for DIF. While this is a rather low bias, it was high enough to weaken the evidence of a gender difference in exam self-efficacy, compared to the comparison using DIF-adjusted scores (Table 5.5).

Unidimensionality

We formally tested whether the SAL-SE and SAE-SE scales made up a single unidimensional self-efficacy scale. We did this after having achieved fit to the respective GLLRMs, as unrecognized strong local dependence between items within the different scales will inherently provide evidence of more dimensions than there is. The observed correlation between the SAL-SE and the SAE-SE scales was weaker than the expected correlation under a unidimensional model ($\gamma_{\text{observed}} = 0.588$, $\gamma_{\text{expected}} = 0.674, \text{SE} = 0.018, p < 0.0001$); thus, unidimensionality across the SAL-SE and the SAE-SE scale was clearly rejected.

Targeting and Reliability

The targeting of both the SAL-SE and the SAE-SE scale varied across the subgroups for which DIF was discovered. For the SAL-SE scale, between 63 and 71% of the maximum information was obtained for the subgroups of students defined by course attended, with the best and good targeting for students attending Personality psychology courses, while targeting was considered moderate for the remaining course subgroups (TI target index, Table 5.6). The targeting of the SAE-SE scale was very good for the female students with 80% of the maximum information obtained, while it was poor for the male students (Table 5.6). The item maps (Fig. 5.3) illustrate the reason for the less than optimal targeting in most of the subgroups that there is a mis-alignment between the item thresholds, which for most subgroups is located

Table 5.6 Targeting and reliability of the Specific Academic Learning Self-Efficacy and the Specific Academic Exam Self-Efficacy subscales

Subscales and DIF subgroups[a] (*n*)	Theta								Score			
	Target	Mean	TI mean	TI max	TI target index	RMSE Mean	RMSE Min	RMSE target index	Target	Mean	Mean SEM	r[b]
SAL-SE												
Research methods (381)	−2.17	0.52	1.731	2.703	0.640	0.769	0.608	0.791	7.56	13.15	1.31	0.80
Personality psychology (134)	−1.39	1.32	1.727	2.423	0.713	0.760	0.642	0.845	8.73	14.10	1.31	0.76
Biological psychology (219)	−2.21	1.08	1.655	2.622	0.631	0.779	0.618	0.793	7.34	14.08	1.28	0.77
Industrial psychology (201)	−2.41	1.77	1.620	2.456	0.660	0.775	0.638	0.823	7.04	14.93	1.27	0.77
SAE-SE												
Male students (192)	−2.01	2.19	0.810	1.460	0.555	1.111	0.828	0.745	6.65	10.69	0.89	0.84
Female students (743)	−1.95	1.33	0.791	0.992	0.798	1.112	1.004	0.903	7.32	10.12	0.89	0.82

Notes TI: test information; RMSE: the root mean squared error of the estimated theta score; SEM: the standard error of measurement of the observed score; *r*: reliability

[a] Targeting and reliability are provided for groups defined by DIF variables

[b] Weighted mean reliability across DIF subgroups was 0.76 for the SAL-SE subscale and 0.82 for the SAE-SE subscale

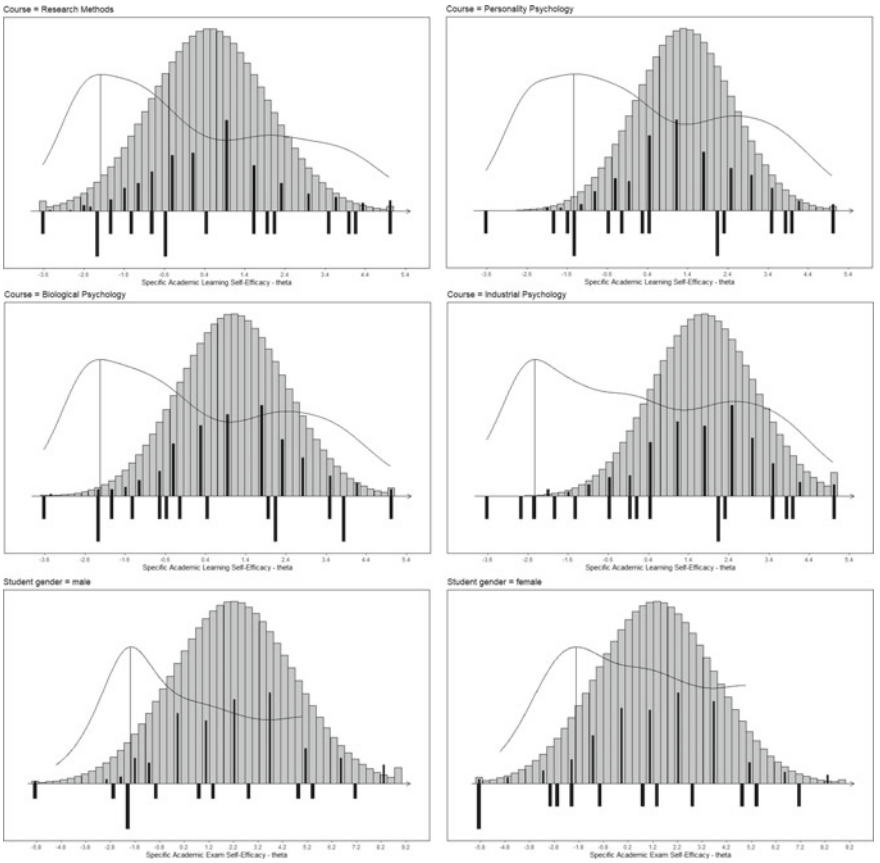

Fig. 5.3 Item maps with distributions of person parameter locations and information curve above item threshold locations for the SAL-SE and SAE-SE subscales. *Notes* Person parameters are weighted maximum likelihood estimates and illustrate the distribution of these for the study sample (black bars above the line) and for the population under the assumption of normality (gray bars above the line), as well as the information curve, relative to the distribution of the item thresholds (black bars below the line). For the SAL-SE subscale, item maps are shown for students from each of the four courses attended, as the scale functioned differentially relative to degree program (top four item maps). For the SAE-SE subscale, there are shown item maps for separate age groups, as this scale showed DIF for gender groups (two bottom item maps)

toward the lower end of the scale, and the person parameter estimates which are located more toward the higher end of the scale. It is also illustrated by the point of maximum information being located toward the lower end of the scales, and for most subgroups, the information curve drops substantially in the range of the scales where most students are located. However, markedly with the exception of the SAE-SE scale and the subgroup of female students.

Discussion, Implications, and Future Research

The aim of the study was to conduct a first investigation of the psychometric properties of the Spanish translation of the Specific Academic Learning Self-Efficacy (SAL-SE) and the Specific Academic Exam Self-Efficacy (SAE-SE) scale, using Rasch measurement models to evaluate whether these are of sufficient psychometric quality to warrant use of the scales in the future research in the Spanish higher education context. When comparing our results to the results of Nielsen and colleagues (2017), who proposed the scales using a similar though Danish student sample, and the follow-up validity study by Nielsen (2020), we found that the psychometric properties of the Spanish translation of the scales were not as good. Whereas the Danish scales both fitted the RM in the first validity study by Nielsen and colleagues (2017) and the only departure from the RM in Nielsen (2020) was two locally dependent items in the SAE-SE scale, we found that the Spanish SAL-SE scale fitted a GLLRM with local dependence between some items and DIF relative to course, and that the Spanish reduced 3-item SAE-SE scale fitted a GLLRM with DIF relative to gender. The targeting of the two scales to the Spanish study populations was comparable to the targeting to the Danish study populations found previously, while the reliabilities were somewhat lower in the Spanish sample.

Two other validity studies, which are partially comparable to the present study, exist. The first study examines a Danish adaptation of the SAL-SE and the SAE-SE scales to scales that are not course-specific, but instead measure learning and exam self-efficacy in relation to whichever courses students are currently enrolled in: Current Academic Learning Self-Efficacy (CAL-SE) and Current Academic Exam Self-Efficacy (CAE-SE) (Nielsen, 2021). The second study examines another Danish adaptation of the SAL-SE and the SAE-SE scales into scales that measure learning and exam self-efficacy in relation to whichever courses students will be participating in as the first in their degree program, prior to actually starting the degree program, thus, scales measuring Pre-Academic Learning Self-Efficacy (PAL-SE) and Pre-Academic Exam Self-Efficacy (PAE-SE) (Nielsen et al., 2019). The student samples used in these two studies were also from two different universities, but included a number of academic disciplines: nine in Nielsen et al. (2019) and four in Nielsen (2021), rather than students enrolled in different courses, as in the present study. Consequently, both these studies included investigations for DIF relative to university as well as DIF relative to degree program. Nielsen (2021) found the CAL-SE scale to be free of DIF, but the CAE-SE scale to suffer from DIF relative to degree program (four programs). Nielsen et al. (2019), on the other hand, found the PAL-SE scale to suffer from DIF relative to degree program (nine programs), while the PAE-SE scale was free of DIF. Thus, we find it likely that the both the Spanish and the Danish SAL-SE and/or the SAE-SE scales would also suffer from DIF relative to degree program, and this should be investigated in future studies.

The gender DIF discovered in the SAE-SE scale in the present study is a new finding, as the Danish versions of the scales both fitted Rasch models free of DIF (Nielsen et al., 2017) and no gender DIF were found in the CAE-SE scale (Nielsen,

2021) nor in the PAE-SE scale (Nielsen et al., 2019). However, using the general academic self-efficacy scale (GASE), Nielsen and colleagues (2018) found gender DIF resulting in inflated general academic self-efficacy scores for female psychology and technical university students as compared to the male students if DIF is not adjusted for. This result is in line with the current study, where the gender DIF also would inflate the scores Specific Academic Exam Self-Efficacy scores of the female students if not resolved. Thus, the current gender DIF result may or may not be a cultural phenomenon, and we suggest that cross-cultural DIF studies (Danish-Spanish) are undertaken to discover which is indeed the case. Previous studies have reported gender differences in academic self-efficacy using various instruments; e.g., D'Lima et al. (2014) found that the self-efficacy of first-year male college students was higher than that of female students at both the start and the end of the semester; Flores et al. (2014) male university students had higher self-efficacy in relation to problem solving than the female students, while Vantieghem and Van Houtte (2015) found, from the start to the end of the seventh-grade school year, boys' academic self-efficacy decreased when they experienced more pressure for gender conformity, while the girls' academic self-efficacy did not decrease when experiencing such pressure. Thus, we further suggest that cross-cultural studies also include data related to vicarious experiences and social persuasion as sources of self-efficacy (Bandura, 1997), as these might be, at least partially, underlying causes for both gender differences and gender DIF.

Reliability and Targeting

Reliability of both the SAL-SE and the SAE-SE subscale was, for the study sample of psychology students, sufficient for use in large surveys studies, but not for assessment of the self-efficacy of individual students (0.76 for the SAL-SE scale and 0.82 for the SAE-SE scale). Individual assessment was feasible in the two Danish validity studies (Nielsen, 2020; Nielsen et al., 2017), and this was also the purpose with the 8-item self-efficacy scale in the MSLQ (Pintrich et al., 1991). Thus, the current results are poorer than the results reported for the Danish version of the scales for a comparable study sample of psychology students (Nielsen et al., 2017). In the Danish study, the reliabilities are very close to 0.90 and, thus, more suitable for individual assessment, and they came close to matching the reliability of 0.93 reported for the full 8-item self-efficacy scale for the development sample of students from five different academic disciplines (Pintrich et al., 1991). The lower reliabilities in the current study, compared to the Danish study, are probably at least partially due to the local dependence in the Spanish SAL-SE scale, as local dependence reduces reliability (Kreiner & Christensen, 2004, 2007). With regard to the SAE-SE scale, the most likely cause for the lower reliability is the elimination on an item in this scale. It is also noteworthy that the reliabilities for the Danish CAL-SE and CAE-SE scales (Nielsen, 2021) and the Danish PAL-SE and PAE-SE scales (Nielsen et al., 2019) for multi-degree samples (between 0.76 and 0.86 for subgroups) are also

somewhat lower than the reliabilities for the Danish SAL-SE and SAE-SE scales (Nielsen et al., 2017). Again, this is most probably due to the local dependence versus no local dependence between items in the various version of the scales.

Targeting (i.e., the degree to which items provide information in the area of the scale where the sample population is located) varied across different subgroups of students in both scales, due to the differential item functioning. Thus, targeting of the SAL-SE scale was only good for students attending Personality psychology courses, and targeting of the SAE-SE scale was only good for the female students. For the Danish versions of the scales, Nielsen and colleagues (2017) found that targeting of the SAL-SE scale was good for psychology students across courses attended, while the targeting of the SAE-scale was moderate. Turning to the Danish PAL-SE and PAE-SE scales, Nielsen and colleagues (2019) found the targeting of the PAL-SE scale to be good for students admitted to nine degree programs, while targeting of the PAE-SE was moderate. The targeting of the Danish CAL-SE and CAE-SE scales was found to be good by Nielsen (2021). However, in the present study as well as the aforementioned (Nielsen, 2020, 2021; Nielsen et al., 2017, 2019), it is evident that most information is obtained at the lower end of the scales, while students are located somewhat more toward the higher end of the scales. Thus, even if targeting was good in most cases, it appears that the scales would benefit from extension with items that require higher levels of self-efficacy to be endorsed. The present results are not comparable to the MSLQ development study (Pintrich et al., 1991), as they did not divide the scale into subscales or investigated targeting.

Item Difficulties

A remarkable finding in the present study concerns the rank order of the item difficulties (i.e., the likelihood to endorse an item in terms of level on the latent scale) of the SAL-SE and the SAE-SE items. We found that the rank order of the SAE-SE item difficulties from easiest to most difficult to endorse was item 4, item 2, item 1. This is the same order of item difficulties reported by Nielsen and colleagues (2017) and Nielsen (2020) for the Danish translation of the items; they both reported item 4, item 3 (this was eliminated in the present study), item 2, item 1 as the order. Furthermore, the agreement in results extended to negative and positive logit values for the item difficulties, as the difficulty of item 1 was positive and the difficulties of the remainder of items were negative in both studies. For the SAL-SE items, we found the rank order of the item difficulties to be the locally dependent items 2 and 4 (easiest to endorse) and the locally dependent items 1 and 3 (most difficult to endorse). Again, this is directly comparable to the findings of Nielsen and colleagues (2017) and Nielsen (2020) for the Danish translation, as they reported the order of the item difficulties to be item 2, item 4, item 3, item 1 (from easiest to most difficult). The same was the case for the SAE-SE scale, and the agreement in results extended to negative and positive logit values for the item difficulties, as the difficulty of items

1 and 3 was positive in both studies, while the difficulties of items 2 and 4 were negative in both studies.

Even though the Danish translation of the scales both fitted the Rasch model and the Spanish translation of the scales fitted more complex models with DIF and locally dependent items, it seems plausible that the relative level of course-specific learning or exam self-efficacy required to endorse individual items within the two scales is the same across the two language versions. Thus, possibly also that the sense of which parts of learning and exam-related activities psychology students feel most efficacious toward is not culturally determined, but more "universal". This is certainly a matter for future studies to explore further, with more cultures and language versions of the two scales, but also across student populations from other academic disciplines. It should, however, be noted that this does not pertain to the absolute levels of self-efficacy, as no items would be endorsed at such low levels of self-efficacy by the Spanish psychology students in the present study as was the case for the Danish psychology students in Personality, Biological, and Industrial psychology courses (see Figure 1 in Nielsen et al., 2017) or for the Danish psychology students in statistics courses (see Figure 1 in Nielsen, 2020).

Strengths and Limitations

The study has three major strengths. The first consists of the strong psychometric methods used, as they both lend credibility to the psychometric results and facilitate comparison to the original studies of the two scales. The second strength is the design of the study, as it includes a large sample of students enrolled in the same subject courses in two major Spanish universities, thus allowing to conclude that the lack of measurement invariance was relative to subject courses and not differences between universities. The third strength is that the study adds nuances to the body of knowledge of self-efficacy primarily in the Spanish higher education context, as it is the first validity study of the SAL-SE and SAE-SE in the Spanish context. Furthermore, the study adds to the body of knowledge on self-efficacy across cultural contexts as it is directly comparable to previous studies in the Danish higher education context. Thus, the study demonstrates the relevance of studying the psychometric properties of a Spanish translation of the scales, both in order to develop future Spanish and cross-cultural studies to develop a better understanding of the variables related to the two constructs.

Likewise, the study has three weaknesses. Firstly, it could be considered a limitation that the sample comprises only psychology students and not students from other academic disciplines; however, as mentioned above, it is at the same time a strength as it made comparison with the original study possible. The second and more serious weakness is that neither the SAL-SE nor the SAE-SE scale contained items that were very difficult to endorse (i.e., demanded a very high level of self-efficacy) in the present study, and the same was the case in the original Danish study (Nielsen et al., 2017), while some items were a bit more difficult to endorse in the Danish

study with only psychology students attending statistics classes. Lastly, it could be considered a weakness that we did not include additional exogenous variables for more elaborate DIF analyses as well as other construct variables to investigate their relationship in a larger nomological network. This we suggest is remedied in future research, as there is now a sound basis to work from with the current results.

Closing Suggestions

In closing, we suggest that future studies, in any cultural context, are conducted with the aim of expanding the two scales with additional items that require higher levels of learning and exam self-efficacy, respectively, to be endorsed. Such studies might successfully be undertaken as mixed-methods studies starting with a qualitative identification of item content from focus group interviews with students, followed by a survey to determine how general they are in larger populations, ending with item analysis using Rasch models or other IRT models. Such an expansion of the two scales, with more "difficult" items, would also inherently improve the targeting of the two scales, as more information would become available in the parts of the scales, where most of the students are located. Thus, in this way, more precise measurement would be obtained, and reliabilities for Spanish samples might reach the level required for individual assessment and feedback, which are the original purpose of the Motivated Strategies for Learning Questionnaire (Pintrich et al., 1991), from which the items originally stem. Such expanded version of the scales might then be used for studies of learning and exam self-efficacy with larger and more diverse student samples. Meanwhile, the present Spanish version of the scales can serve pedagogical purposes such as the improvement of teaching practices or didactic methodologies at the general level, in order to enhance student self-efficacy, as reliability is sufficient for statistical comparison at the group level.

Appendix

The instrument

See Tables 5.7, 5.8 and 5.9.

DIF-equation tables

Table 5.7 Items of the Specific Academic Learning Self-Efficacy and the Specific Academic Exam Self-Efficacy scales in English and in the Spanish translation

English version	Spanish translation
SAL-SE-1: I'm certain I can understand the most difficult material presented in the readings for this course	Estoy convencido de que puedo entender las lecturas más díficiles presentadas en esta asignatura
SAL-SE-2: I'm confident I can understand the basic concepts taught in this course	Estoy seguro de que puedo entender los conceptos básicos enseñados en esta asignatura
SAL-SE-3: I'm confident I can understand the most complex material presented by the instructor in this course	Estoy seguro de que puedo entender el material más complejo presentado por el profesor de esta asignatura
SAL-SE-4: I'm certain I can master the skills being taught in this class	Estoy seguro de que puedo dominar las habilidades que son enseñadas en esta asignatura
SAE-SE-1: I believe I will receive an excellent grade in this class	Creo que sacaré una nota excelente en esta asignatura
SAE-SE-2: I'm confident I can do an excellent job on the assignments and tests in this course	Estoy convencido de que puedo hacer un excelente trabajo en los trabajos y exámenes de esta asignatura
SAE-SE-3: I expect to do well in this class	Espero hacerlo bien en esta asignatura
SAE-SE-4: Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class	Teniendo en cuenta la dificultad de la materia, el profesor y mis habilidades, creo que lo haré bien en esta asignatura
Response scale: 1 = not at all, 2 = to a poor degree, 3 = to some degree, 4 = to a large degree, 5 = perfectly	Escala de respuesta: 1 = no en absoluto, 2 = en un grado menor, 3 = hasta cierto punto, 4 = en un grado mayor, 5 = totalmente

Notes The overall prompt called for students to rate how well each item described them as a student. SAL-SE items make up the Specific Academic Learning Self-Efficacy scale. SAE-SE items make up the Specific Academic Exam Self-Efficacy scale. The English item texts correspond to the self-efficacy scale in the motivated strategies for learning questionnaire Pintrich et al. (1991), while the response categories are the categories adapted and validated by Nielsen et al. (2017). Item were administered in the order they appear in the MSLQ, mixed in with items from other scales

Table 5.8 Equated scores showing the impact of DIF relative to course attended across the score range of the Specific Academic Learning Self-Efficacy scale

Course attended			
Research methods	Personality psychology	Biological psychology	Industrial psychology
4.00	4.00	4.00	4.00
5.00	5.33	5.03	4.83
6.00	6.53	6.05	5.80
7.00	7.71	7.08	6.85
8.00	8.84	8.11	7.97
9.00	9.91	9.15	8.16
10.00	10.92	10.20	10.41
11.00	11.86	11.22	11.61
12.00	12.70	12.20	12.63
13.00	13.51	13.15	13.51
14.00	14.37	14.12	14.39
15.00	15.31	15.10	15.32
16.00	16.23	16.05	16.22
17.00	17.09	16.95	17.07
18.00	17.95	17.85	17.93
19.00	18.90	18.85	18.89
20.00	20.00	20.00	20.00

Notes Extreme scores cannot be equated for DIF

Table 5.9 Equated scores showing the impact of DIF relative to gender across the score range of the Specific Academic Exam Self-Efficacy scale

Student gender	
Male	Female
3.00	3.00
4.00	4.03
5.00	3.98
6.00	4.95
7.00	6.28
8.00	7.71
9.00	8.93
10.00	9.98
11.00	10.99
12.00	11.98
13.00	12.97
14.00	13.99
15.00	15.00

Notes Extreme scores cannot be equated for DIF

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Part III
Empirical Studies on What Shapes Academic Self-efficacy

Chapter 6
What Shapes Academic Self-efficacy?

Viviana Macakova and Clare Wood

Abstract Self-efficacy has long been considered a predictor of academic achievement as well as other learned skills. But, we know little about what factors influence self-efficacy itself, and whether these other factors can impact self-efficacy's relationship with academic achievement. In this chapter, we review the evidence relating to three factors that have the potential to influence the strength of the relationship that exists between academic self-efficacy and academic achievement: mindset, basic psychological needs satisfaction, and other possible factors. We will consider the evidence in relation to both child and adult learners and argue that academic self-efficacy is a belief influenced by factors associated with not just prior experiences of learning but also home-based relationships and psychological security.

Keywords Self-efficacy · Academic achievement · Implicit theories · Psychological needs

Introduction

Self-efficacy is a term applied to the beliefs that a person holds about their own abilities (Bandura, 1997). We acquire a sense of academic self-efficacy through our experience with our learning environments, which becomes the basis for a set of beliefs about our own capabilities. As Bandura explains in his Social Cognitive Framework, every behavior we witness can influence our own behavior and how we think about that observed behavior. Self-efficacy is one of the key concepts of Social Cognitive Theory. It is argued that self-efficacy can be influenced in several ways. Firstly, by the experience of success and failure—when we experience success, this contributes to positive self-efficacy, and failure undermines this. Secondly, we can watch others who are 'like us' and incorporate their experiences of success and failure as if they were our own. Another influence is that of persuasion—we can influence the self-efficacy of others by persuading them that they will be successful

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in a particular situation, but these appeals should be realistic and are unlikely to be successful if the person we are persuading has already experienced failure. Finally, our emotional reactions to a situation are important. Specifically, if we can control or change negative emotional responses to situations that we experience, this can support the development of self-efficacy.

It is argued that the better our sense of self-efficacy, the better we are able to cope with situations that we may encounter, and this has been supported by empirical work examining perseverance in university students (e.g., Wright et al., 2013). Also, it is noted that the higher self-efficacy we possess, the better we are at adopting or adapting an observed behavior. As such, observation is seen as crucial for the learning of new skills and how to deal with unfamiliar situations—both of which are experienced in the context of higher education. It is therefore not surprising that there is a considerable amount of research supporting the existence of a relationship between self-efficacy (both in general and academic self-efficacy specifically) and academic achievement, be it at school or later at university (e.g., Alivernini & Lucidi, 2011; Feldman & Kubota, 2015; Richardson et al., 2012; Vuong et al., 2010). Specifically, students who score higher on scales of academic self-efficacy show better academic performance than students who score lower on academic self-efficacy. Moreover, Richardson et al. (2012) found in their systematic literature review that university students' beliefs regarding their performance (sense of self-efficacy) accounted for up to 9% of the change in their grade point average.

Although the links between academic achievement and academic self-efficacy are well documented, less is known about the factors that contribute to that relationship. Specifically, the factors that underpin academic self-efficacy itself remain under researched. We argue that for adult learners in particular, there is likely to be a range of factors that contribute to their academic self-efficacy. By mapping the full range of influences on academic self-efficacy in adults, this not only improves our understanding of what contributes to and maintains academic self-efficacy, but also creates a framework for more effective intervention where the underpinning factors we have identified are open to change. In this way, we can develop intervention strategies for non-compulsory education that ultimately have the potential to impact student engagement, achievement, and university drop out.

In this chapter, we will explore three factors which have been found to impact academic self-efficacy in learners, namely their implicit theories, basic psychological need satisfaction, and social support along with attachment, and we will consider how satisfactory they are at accounting for self-efficacy in adult learners in particular. These three factors have been identified because they are supported by empirical evidence in school age samples, but also because of their alignment with the mechanisms proposed by Bandura to contribute to the development of self-efficacy, which highlight the importance of how success and failure are experienced (and, how we may be persuaded to adopt more positive interpretations) and the importance of others in both modeling behaviors and in supporting and nurturing our own experiences of success. We begin by discussing one that has received much research and popular attention: implicit theories of intelligence, otherwise known as 'growth mindset' (Dweck, 2000).

Implicit Theories and Self-efficacy

Dweck (2000) proposed the idea that individuals hold implicit theories about intelligence or ability, which have the potential to influence their academic engagement. Specifically, she suggested that people tend to possess one of two broad mindsets: incremental (or 'growth') mindset or entity (or 'fixed') mindset. Individuals with a fixed mindset hold the belief that intelligence and general ability are stable traits, consistent with the general view that people either are, or are not, intelligent or capable. Consequently, such individuals tend to focus on evidencing their abilities rather than engaging in activities to develop further, because they hold a belief that success is the result of talent 'without effort'. This contrasts with the beliefs of those who hold a growth mindset. This mindset holds that success is the outcome of dedicated effort, that ability can be developed through practice, and although some people may be talented, effort is required to fulfill potential.

Dweck argues that such beliefs can impact the way children engage with school, with some students believing that they cannot do an activity or subject and withdrawing effort accordingly because they do not believe that they are capable of learning it. For example, in their study, Blackwell et al. (2007) observed that the possession of growth mindset attributes and beliefs among seventh-grade students was strongly associated with better academic performance. Not only that, but they also found that this relationship was causal, with students who were exposed to teaching that promoted a growth mindset achieving better academic outcomes relative to a control group. Interestingly, Claro et al. (2016) also found an association between academic achievement and growth mindset in general for a sample of Chilean high school students. They found that a growth mindset was less likely to be observed in children from lower income families, although where such children did hold a growth mindset, it acted as a significant buffer against the effects of poverty on their academic achievement.

More recently, Yeager et al. (2019) conducted a large-scale, pre-registered intervention study of secondary school students in the US to better understand when a short (one hour) growth mindset intervention was successful at significantly impacting academic outcomes in school children. They found that the intervention was successful for lower ability pupils, but there was a context effect: the intervention was found to be particularly effective when peer group norms were in alignment with the messages of the intervention session. Although Miller (2019) notes that the results of this study have been criticized for demonstrating only small effect sizes, he also points out the importance of understanding context and heterogeneity of effects (which Yeager et al. set out to do) and the need for educators to temper their expectations regarding the impact that growth mindset approaches will have at a practical level. He also flags the need for research to map 'the cognitive, social, and behavioral mechanisms explaining the improved grades' (p. 911). For example, Burnette et al. (2013) discovered in their meta-analysis, where more than half of the participants were above the age of 18, that mindset did not influence academic performance directly but rather indirectly via self-regulation.

It makes sense to suggest that growth mindset should align with better academic self-efficacy, and it may be that self-efficacy is what is driving individual differences in academic outcomes, rather than growth mindset per se. We argue that some explanations of growth mindset conflate students' mindset (i.e., theories about the stability of ability or intelligence as a fixed trait in general) with self-efficacy. That is, it will be recalled that self-efficacy is a set of beliefs held by a person about their own abilities, rather than about ability in general. Where Dweck argues that mindset beliefs impact the way students engage with their learning, because children with fixed mindset are more likely to withdraw effort because they do not believe they can learn something, she is describing an effect of mindset on a child's sense of self-efficacy. In other words, growth mindset is important because it is one of the factors that underpins learners' sense of academic self-efficacy.

Although there appears to be a large, if debated, body of experimental work that has demonstrated the potential for growth mindset training to benefit children's academic outcomes and other studies that have demonstrated associations between academic outcomes and mindset in school age children, less work has been conducted with adult learners. Moreover, where it has been conducted, the results are not as convincing as the data from child studies. For example, Bahnik and Vranka (2017) were unable to detect a significant relationship between mindset and academic ability in their sample of over 5000 university students, and Macnamara and Rupani (2017) similarly failed to observe a relationship between growth mindset and academic outcomes in their sample of university students. It should be noted, however, that in both these studies, the measures of academic achievement were collated from a time-point prior to the assessment of participants' mindset, and so it is difficult to draw conclusions from these data.

We explored this idea that growth mindset might underpin academic self-efficacy in our own study (Macakova & Wood, 2020). We asked university students from multiple universities to complete measures of their implicit theories, self-efficacy, and basic psychological needs satisfaction and to report recent grades from the current year of their courses. We then used structural equation modeling to analyze the relationships between these factors. We found that self-efficacy was predicted by both implicit theories (mindset) and basic psychological needs satisfaction and that, in line with prior research, self-efficacy was able to predict academic achievement. There was no evidence that mindset could explain individual differences in academic achievement directly.

Locating these results in the broader literature on mindset, we can see that although there appears to be evidence of a direct effect of mindset on achievement for children, this seems to be dependent on contextual effects, rather than being a strong direct influence for all learners. For adult students, mindset becomes more of an indirect influence on attainment, mediated by self-efficacy. These differences between the two age groups could be because schoolchildren's beliefs about ability in general are more easily changed than those of older students, whose beliefs are likely to be better established. Also, self-efficacy is a belief about one's own ability to perform, which is likely to be more stable in adult learners whose sense of self-efficacy is consolidated by more extensive life and academic experience. Another important

consideration for adult learners relative to school children is the fact that they are engaged in post-compulsory education. Where children are at school, this is subject to legal and cultural expectations about attendance and engagement, which apply less to students at university. Consequently, there are important differences in adult students' motivation and the context of their learning that need to be acknowledged. For us, one area that is important, but is often overlooked, is the contribution of basic psychological needs satisfaction to students' sense of academic self-efficacy.

Basic Psychological Needs Satisfaction

Basic Psychological Needs Theory (BPNT) is derived from Self-determination Theory outlined by Deci and Ryan (2000). It is one of the six sub theories of Self-determination theory, and it centers on the importance of competence, relatedness, and autonomy as fundamental psychological needs that must be satisfied (or 'nutrients' that must be accessible) if we are to develop, adjust, and function successfully (Deci & Ryan, 2000; Ryan & Deci, 2017). *Competence* refers to the experience of mastery and a sense of being effective. *Relatedness* refers to the ability to experience connections with others and establish a sense of belonging and nurture. *Autonomy* refers to volition and will and the need to engage in self-endorsed and authentic actions, thoughts, and feelings. Together, these three needs are seen as essential for psychological wellbeing (Vansteenkiste et al., 2020). Arguably, these needs are particularly salient in the case of adult students, who may be more vulnerable to frustration of these needs as a consequence of living away from established support networks, needing to adjust to new ways of living and working, and new methods of learning and assessment, all of which may represent threats to established senses of competence, relatedness, and autonomy. Moreover, when we think about these ideas in relation to those of Bandura regarding how self-efficacy develops, we can see that competence and autonomy both relate to the idea of experiencing success and the authentic emotional reactions that result from this, and that relatedness connects to the idea that salient others influence our views about ourselves.

It has been argued that if components of basic psychological needs are satisfied, self-efficacy will be enhanced (e.g., Diseth et al., 2012; Macakova & Wood, 2020). Importantly, Vansteenkiste et al. (2020) summarize a range of costs associated with the frustration of basic psychological needs, which include loss of motivation, disengagement, and distress. In particular, frustration of basic psychological needs has been linked to cheating (Kanat-Maymon et al., 2015), stress (Campbell et al., 2017), anxiety (Ng et al., 2012), and suicidal ideation and behaviors (Britton et al., 2014; Rowe et al., 2013).

Consistent with this theoretical account, several studies have found that basic psychological need satisfaction can affect adult students' academic achievement. For example, Trenshaw et al. (2016) found that university students' academic achievement was affected by basic psychological need satisfaction and by the relatedness

component in particular. Trenshaw et al. found that relatedness was the most prominent need among the three, and that if it was fulfilled, it served as a supporting component for fundamental motivation toward university studies.

Interestingly, we see a different pattern for younger students. Among school age children, the most salient predictor of the three psychological needs is found to be autonomy (Reeve, 2009; Sierens et al., 2009). Young learners have their relatedness fulfilled by the fact that they have the same classmates and the same teachers for longer period of time, and they also live at home and so can access family support. Autonomy, however, represents a bigger challenge for school age children, where the ability to make decisions or act authentically may be more open to challenge by adults (parents or teachers).

Students may be more susceptible to psychological distress and reduced wellbeing when their basic needs are not fulfilled, which then leads to lower academic performance (Cordeiro et al., 2015; Trenshaw et al., 2016). However, most research that has investigated the relationship between academic performance and basic psychological needs satisfaction has not considered the idea that basic psychological needs may underpin self-efficacy, and it is self-efficacy influences, that is, driving individual differences in academic achievement. We would suggest that this connection between basic psychological needs and self-efficacy is most strongly rooted in the idea of competence. If competence is frustrated, then this will contribute to a reduction in academic self-efficacy because the individual will not be able to form beliefs based on positive experiences of successful engagement. If relatedness is frustrated, this may negatively impact personal beliefs about social competence. Where autonomy is frustrated, self-efficacy may also be impacted because the authenticity of actions and feelings may be compromised, leading to the formation of anxiety or doubt in relation to personal effectiveness.

Our study found that basic psychological needs are an important influence on self-efficacy for university students: Where they were satisfied, academic self-efficacy was enhanced (Macakova & Wood, 2020), which was also suggested by previous research (Diseth et al., 2012). However, and importantly, we also found that there was no direct concurrent relationship between academic performance and basic psychological needs satisfaction for our university students. This relationship was found to be indirect. It makes sense to suggest that because basic psychological need satisfaction is a higher concept that is related to healthy functioning it is likely to influence our sense of self-efficacy, which in turn will influence academic performance.

The related notion that self-efficacy functions better when one's emotional and physical state is improved is also suggested by Social Cognitive Theory (Bandura, 1977, 1997). Specifically, there are studies which suggest that when mental state is heightened (e.g., you no longer have stress or depression), self-efficacy heightens. For example, Medrano et al. (2016) suggested in their study of college students that when students' mood was heightened, their self-efficacy was positively impacted too, and if the students' mood was lowered, their self-efficacy was also depressed. From this, one can see why emotional state as well as basic psychological need satisfaction is an important predictor of academic self-efficacy.

Emotional states matter, but as Bandura notes so does how we perceive them. For example, there might be a situation where you fear something. Fear is the emotion. After a friend or parent talks to you and points out that the fear you are experiencing could be perceived as something good, new, and exciting, you stop viewing fear as fear and start to view it as a feeling of opportunity. It is the same feeling, but it has been relabeled, and self-efficacy is affected positively as a result. Also, how you perceive your emotional state can also depend on social support and attachment relationships from parents or close friends.

Attachment, Parental, and Social Support

So, our mindset and the extent to which we feel our basic psychological needs are satisfied appear to underpin students' sense of self-efficacy. A third factor of interest is that of attachment quality. Attachment, broadly speaking, is a term used to refer to the bond that exists between people. It originates from the work of John Bowlby and others who were interested in the impact of early parent–child relationships on subsequent development. The idea that early attachment may impact self-esteem and the way adult relationships are formed and develop (and, the importance of these adult relationships for successful adjustment) has also been a topic of wider interest.

It has some relevance to the present discussion because of studies that have found that the more securely the person is attached at a young age, the better self-esteem and self-reliance they possess. For example, Wright and Perrone (2010) found that attachment has a significant impact on self-efficacy. They also found that secure attachment early in life can support self-efficacy and subsequent academic achievement. Moreover, secure attachment has also been linked to enhanced beliefs regarding studies competence to perform academically. Specifically, if students have a secure attachment, they are more confident and believe more in their academic decisions and that they have made the right decisions (Wright et al., 2014).

In addition to secure attachment supporting better self-efficacy, Davila and Kashy (2009) found that secure attachment can also contribute to experience of enhanced social support. Specifically, they found in their 14-day trial among couples that secure attachment was associated with higher malleable support experience. This is especially useful when one needs to trust other people's suggestions or opinions as is often the case in academic tutoring situations or when interpreting academic feedback. Moreover, Wright et al. (2014) found out that participants who had more secure attachment had better social support experiences and reported fewer core obstacles than those who had an insecure attachment.

It would seem then that secure attachments formed at the beginning of life as well as a strong attachments among friends are important factors affecting academic self-efficacy and are related to the basic psychological need of relatedness. In terms of application, it may seem that it has less potential application in the context of informing educational interventions. However, previous research also found that the relationship between attachment and achievement is mediated by social support. In

other words, if one has good social support, be it from parents or fellow students, the relationship between attachment and academic achievement is even stronger. And so, there is scope for later intervention that can influence self-efficacy by focusing on availability of key relationships for learners.

For younger students, the social support of parents has been found to significantly impact the academic self-efficacy of learners (Adler & Dozier, 2020). It has also been found that parents' educational ambitions for their teenage children can positively influence their children's academic self-efficacy. Not just that, but school-initiated contact among parents also increased students' academic self-efficacy (Fan & Williams, 2010). From the research conducted in this area, it is clear that attachment and social support, especially the perception of social support from peers or parents, are important factors in academic achievements. In fact, research has shown that almost half of the variance in academic self-efficacy is due to the two factors of attachment and social support (Wright, et al., 2014).

Social support is also considered as one of the key variables that can increase self-efficacy, and it is a part of Social Cognitive Theory (Bandura, 1997) through verbal persuasion and social modeling, where encouragement is given to perform a specific behavior (Glanz et al., 2008). In social modeling, it is good practice when one can observe how a task is tackled by others before trying it yourself. This is especially true when this task is performed by someone we know and can relate to because we have shared characteristics. We can tell ourselves 'if they can do it, I can do it too'. Also, if we have a positive influence around us, we are more likely to copy those positive behaviors. Another form of a social support from Social Cognitive Theory is verbal persuasion. For example, Luzzo and Taylor (1993) found that verbal encouragement or persuasion in college students can substantially increase self-efficacy. Lundberg et al. (2008) found that mature students only receive limited social support and would benefit from more support during their studies. They also explain that when there is a sincere interest from your spouse/partner's side, this is viewed by mature students as a good social support, resulting in enhanced self-efficacy.

Implications for Intervention

In the first section, we considered the literature that has shown that growth mindset interventions can be effective for school children, although it would seem that mindset interventions may only be effective for particular types of learner and if subject to context-based effects: Yeager et al. (2019) found that for high school students at least, the intervention was effective for students from lower income backgrounds. But importantly, they also pointed to the need for the learners to be located in peer groups where the ideas embedded in the mindset intervention were consistent with peer group values. And so, we can see that social relationships are an important indirect influence on mindset and self-efficacy. However, the evidence for adult learners is complicated by the failure to attend to some of the important contextual

factors that impact their experiences of higher education, such as the satisfaction of basic psychological needs.

Basic psychological need satisfaction should, in principle, offer a more successful route into improving self-efficacy because of its fundamental nature—where a fixed mindset may become entrenched or self-serving (and so harder to change), the drive to satisfy our needs for competence, relatedness, and autonomy does not abate or diminish, although their frustration can result in some maladaptive behaviors. And so, it would seem that there is real potential for university settings to consider interventions which focus on addressing threats to competence, relatedness, and autonomy in academic setting through thoughtful application of formative assessment and feedback, models of academic tutoring and peer support, and the creation of learning activities and assignments that offer students independence and self-expression.

The research into attachment has reiterated the potential impact that the formation of key relationships will have on young people's sense of academic self-efficacy. What is encouraging is that there is evidence that both early attachment and later social support contribute to self-efficacy in important ways, and so this underscores the need for educational settings to create space for the development of these relationships and to recognize the importance of these relationships as influences on learners' developing sense of self-efficacy. Taken together with the observation about the importance of peer voices in the effectiveness of mindset interventions and the impact of relatedness satisfaction in adult learners when understanding the relationship between psychological needs and self-efficacy, we argue that self-efficacy interventions should benefit from incorporating a peer support component.

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Chapter 7
Academic Self-efficacy in a Globalized Era: Impacts of Culture and Cross-Culture

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Abstract Research has shown that academic self-efficacy can have significant influence on individuals' learning motivation and performance. Of the many research directions of academic self-efficacy, the multidimensional socio-contextual sources influencing students' academic self-efficacy is one of the most complex and yet the most salient for discussion in the globalized academic environments that higher education institutes face. This chapter reviews recent literature on how culture or cross-culture experience can influence or be influenced by students' academic self-efficacy. We first discuss students' academic self-efficacy from a culturally sensitive perspective by providing a cultural dimension model adapted from Hofstede (Culture's consequences: international differences in work-related values. Sage, 1980; Culture's consequences: comparing values, behaviors, institutions, and organizations across nations, 2nd edn. Sage, 2001; Online Readings Psychol Culture 2(1):2307-0919.1014, 2011) and Oyserman et al. (Psychol Bull 128(1):110–117, 2002) and illustrating the different dimensions with examples of how they may influence students' academic self-efficacy. With the cultural dimensions defined, the complex issue of how international students who possess a different internalized cultural value may clash with the culture and academic system of the host country, and how the clash may impact students' academic self-efficacy is explored. We conclude the chapter with some suggestions for future research on academic self-efficacy from a culturally sensitive perspective and some implications on how higher education institutes may support international students from varying backgrounds in enhancing their academic self-efficacy.

Keywords Academic self-efficacy · Globalization · Culture · Multidimensional · International students

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Introduction

Self-efficacy is an individual's judgment of whether one is capable of successfully accomplishing certain tasks and achieving the desired outcomes (Bandura, 1978, 1997). Self-efficacy has been studied extensively in multiple facets since Bandura's (1978) initial concept. Research have shown that students' self-efficacy in educational settings can have significant influence on individuals' learning motivation (e.g., Alivernini & Lucidi, 2011), uses of learning strategy (e.g., Roick & Ringeisen, 2018), learning outcome (e.g., Bartimote-Aufflick et al., 2016), and performance (e.g., Talsma et al., 2018).

With the increasingly globalized world where students are receiving more opportunities of international exchange and multicultural stimulations, how the informative basis and influences of individuals' self-efficacy may be affected by their cultural background, and their situated socio-cultural situation has become an important direction of research (Oettingen & Bandura, 1995; Oettingen & Zosuls, 2006). Bandura (1978, 1997) proposes four main sources of information from which individuals form their self-efficacy, namely mastery experience, vicarious experience, social persuasion, and emotional and physiological states; Klassen (2004a) has suggested that Bandura's four main sources of self-efficacy can be divided into two categories: those that are more self-focused (i.e., mastery experience and emotional and physiological states) and those that are more socially conferred (i.e., vicarious experience, and social persuasion). Additionally, Klassen (2004b) highlights that cultural dimensions may impact any or all of these sources. The formation of self-efficacy beliefs is complex and encompasses many processes in which individuals perceive culturally influenced sources and prioritize them according to their own cultural values (Oettingen & Zosuls, 2006).

In this chapter, we will investigate the role that culture plays in students' academic self-efficacy. We first attempt to address academic self-efficacy from a culturally sensitive perspective, defining a multidimensional framework to sum recent literatures on cross-national investigations of academic self-efficacy. We then shift our focus to explore the influence of culture on international students' academic self-efficacy. We conclude with some implications to prepare higher education in enhancing international students' academic self-efficacy. This chapter views students' self-efficacy in academic settings toward their academic performance as their academic self-efficacy (ASE).

Methodology

Numerous studies have compared students' academic self-efficacy from a cross-national perspective, many of which include comparison of the east and the west. The comparison of cultures tends to follow the dichotomy of collectivism and individualism, with the commonly accepted norm of collectivism emphasizing

harmony, conformity, collective identity, and mutual obligation and individualism highlighting freedom, independence, personal initiative, and self-realization. The general tendency of student ASE performance is lower in the east, or in collectivistic countries, and higher in the western individualistic countries (e.g., Ahn et al., 2016; Han et al., 2015; Klassen, 2004b; Wang et al., 2018b).

Recent research emphasizing the importance of culture in educational psychology has claimed that culture has multiple layers and cannot be only be identified as individualistic and collectivistic (King et al., 2018). Though individualism and collectivism offer useful directions in distinguishing different cultures, the terms are too broadly defined to address the subtle differences within various countries and regions (Kitayama, 2002; Oyserman et al., 2002). Bonneville-Roussy et al. (2019) also find that by investigating cultural values beyond the individualism/collectivism dichotomy may allow new perspectives in the differences in development of self-efficacy.

In an attempt to address ASE from a culturally sensitive perspective, we will need to know how to define culture more comprehensively. Thus, in this chapter, we first attempt to define the culture dimensions pertaining to ASE. A semi-systematic literature review on recent literature of ASE and international students is then conducted with culture dimensions as the basis of the analysis framework.

Defining Culture Dimensions

Hofstede's (1980) cultural differences model is the most prominent framework to examine culture, widely applied to explore aspects of culture in various settings, including marketing, management, international communication, and education. Hofstede (1980, 2001, 2011) proposes six dimensions on which cultures differ: power difference, uncertainty avoidance, individualism and collectivism, masculinity and femininity, long-term and short-term orientation, and indulgence and constraint. However, Hofstede's scope of cultural dimension is so broad that it sees culture as pertaining to only the national level and may be unable to account for the complexity of culture (Mc Sweeney, 2002) and the cultural changes in the rapidly globalized era, especially in higher education with an international flow of students (Signorini et al., 2009).

Kitayama (2002) suggests that culture is not "in one's head" but "out there," implying that culture is a fluid and dynamic property exhibited by the practices and beliefs of the surrounding environment rather than an entity that is naturally possessed by individuals situated in the environment. In addition, instead of being a result of a certain culture, many psychological behaviors and performances are influenced by the cultural context and practices embedded in such cultures (Kitayama, 2002). Therefore, to examine the influence of culture on cognitive responses such as perception of ASE, a more micro-framework examining the various social contexts within the nation is needed.

Oyserman et al. (2002) elaborate on the cultural dimensions and elucidate a framework comprising the approaches to five social contextual level of culture (Fig. 7.1), starting from the most distal level of historic and philosophical influence to the most proximal level of subject construal. Oyserman et al.'s model is informative in that it does not generalize culture to be static for all individuals in the country or separate from situations or contexts of interaction. The model provides a lens to approach cultural influences as interactive with "the social world, within which individuals live their lives and as a result of which they internalize values, attitudes, and norms" (Oyserman et al., 2002, p. 113).

Hofstede (1980, 2001, 2011) and Oyserman et al. (2002) provide two distinct frameworks regarding the differences in culture, one is macro- by entailing the different dimensions that the cultures encompass, and the other is the various social levels that the culture may influence and engage in interaction. To provide a more comprehensively culturally sensitive perspective to explore the role of culture in

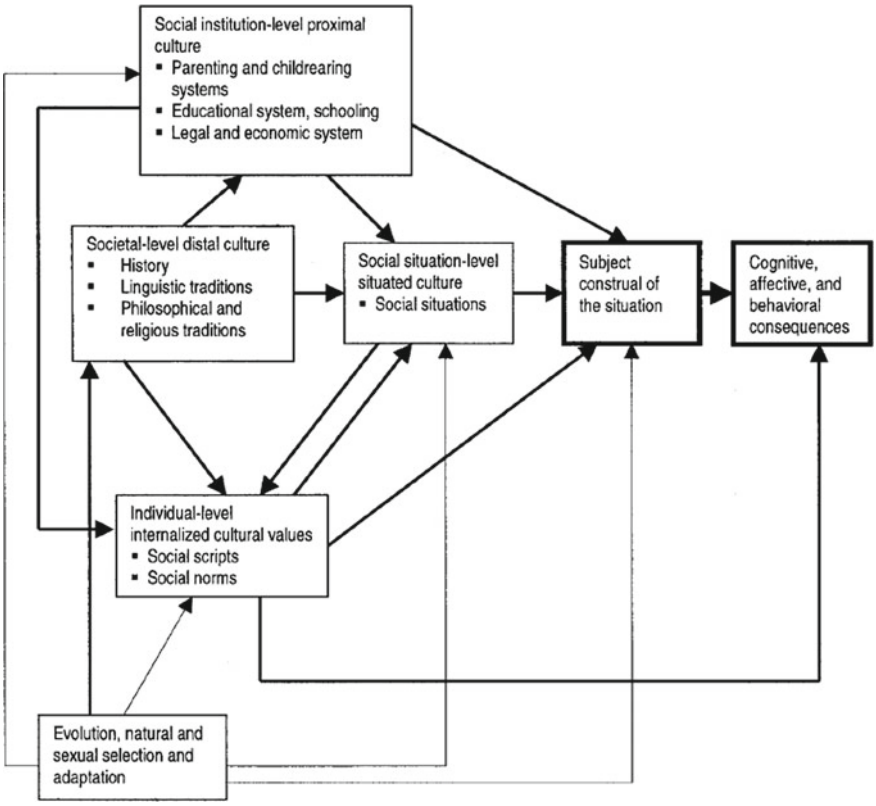

Fig. 7.1 Oyserman et al.'s socially contextualized model of cultural influences. *Source* Oyserman et al. (2002, p. 113) (Reproduced with permission)

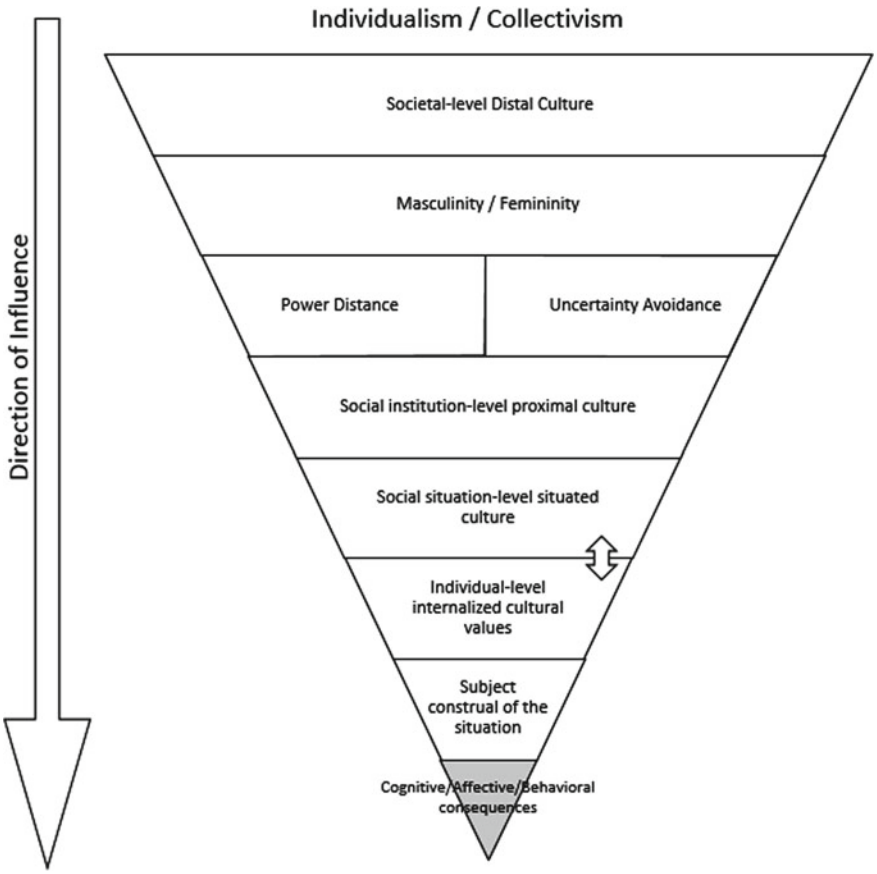

Fig. 7.2 Cultural dimension interaction model resulting in cognitive/affective/behavior consequences. *Source* Summed and developed by the authors, with dimensions adapted from Hofstede (2011), Oyserman et al. (2002)

ASE, we adopt the dimensions and definitions in these two frameworks that are more closely related to ASE and adapt them into a model with the elements complementing each other (Fig. 7.2).

Search Procedure

To conduct the semi-systematic review, we have set a few keywords, including "academic self-efficacy or self-efficacy," and "cross-culture, culture, or international students" in Google Scholars and examined the full papers that we can access. We have limited our search to published journal articles, books, or book chapters; no

dissertation or unpublished research is included in the literature review. To examine the recent trend of research on academic self-efficacy and culture, the publish time of the articles is set to 2010–2021. Some studies examining elementary school students' self-efficacy or teacher self-efficacy are not of the focus of the present chapter and are excluded from the analysis. Upon examination, there are limited studies investigating the cultural aspects that may influence students' ASE or impact international students' ASE when they enter a host community. A total of 21 articles on the academic self-efficacy in relation to culture dimensions or with cross-cultural comparisons are included in our analysis with the cultural dimension interaction model.

Analysis

As most studies on ASE and culture focus on the individualism–collectivism model, our framework of analysis is also situated within the model. We acknowledge that individualism and collectivism are the very macro-scopes of culture, to understand how various aspects of culture may interact with ASE, and the social contextual dimensions and different facets of cultures will need to be defined. Thus, we adapted dimensions that are more closely related with ASE and constructed the seven-tier model (see Fig. 7.2). Under the individualism–collectivism model, the most distal level is the societal-level distal culture including philosophy and history. The next level being masculinity/femininity, as gender roles and goal orientation are grounded in the philosophy and history of the culture. Hofstede (2001) claims that masculinity/femininity and individualism/collectivism are independent dimensions, signifying that individualistic cultures are not necessarily masculine, and vice versa. Power distance and uncertainty avoidance are seen as independent dimensions, but we perceive them as being influenced by the distal culture and the masculinity/femininity of the culture. The rest of the levels are adopted from Oyserman et al.'s (2002) model. Each of the levels is under the influence of all levels above it, with the only exception of the individualized level which can influence the social situation level. The interaction of the levels ultimately results in individuals' cognitive/affective/behavior change or consequences. Adopting the semi-systematic literature review (Snyder, 2019) to overview the theme of ASE in relationship to the cultural dimension model specified in this chapter, we draw examples from recent studies on ASE. Although the studies may not have utilized the cultural frameworks of Hofstede (1980, 2001, 2011) or Oyserman et al., (2002), the aspects of culture investigated in the studies may echo their definitions of cultural context or dimension, and thus, we include them to exemplify how the cultural constructs impact ASE.

Addressing ASE from a Culturally Sensitive Perspective

This section illustrates how different cultural contextual levels and dimensions may influence students' ASE. The sequence of the social context or the cultural dimensions along with ASE study examples will follow the framework proposed in Fig. 7.2.

The societal-level distal culture is represented by the more-or-less static traits and traditions from history, philosophy, language, and religion. For instance, Tweed and Lehman (2002) suggest that in Asian-influenced cultures, learning takes root upon Confucian philosophies which believe in effort leading to success, value of outcomes rather than processes, and acquirement of essential knowledge, whereas in Western-influenced cultures, Socratic learning concept emphasizes questioning and proposing personal hypothesis assert independence, attributes success to ability, and appreciates freedom for individualized tasks. The Confucian–Socratic philosophical framework is echoed by Ahn et al. (2016) in their literature review, who summed three possible reasons to why students from collectivistic cultures report lower self-efficacy: (1) Collectivistic cultures encourage harmony and emphasize fitting-in, and thus, individuals may lack the motivation for self-enhancement; (2) individuals from collectivistic cultures are more vulnerable to failure experience; and (3) the lower scores of self-efficacy may reflect the cultural demands for modesty. The first and third possible reasons can be seen to have a Confucian philosophical basis in the emphasis for harmony and modesty.

Masculinity and femininity as the dimension of culture refer to the gender roles and goals. In cultures with higher masculinity that emphasize gender roles with great distinction, women may receive fewer opportunities to observe models for vicarious experience in fields which they are not encouraged to participate (Oettingen, 1995). Further, the glass ceiling phenomenon can be observed across the labor market (Moreau et al., 2007) and noticed in the external recruitment and hiring processes (Fernandez & Campero, 2016). Although schools have been identified as a more feminized work environment, females are still underrepresented in the administration (Moreau et al., 2007). Researchers also mentioned about how imposter phenomenon influences the position search, the lag of the publications, and promotion of female in academic field (e.g., Armstrong & Shulman, 2019; Tuli, 2019). Numerous studies have examined the relationship between ASE and gender (Fallan & Opstad, 2016; Huang, 2013); yet surprisingly, there seems to be a lack of exploration on the impact of gender roles and gender expectation in various cultures on students' ASE. According to the OECD report (Givord, 2020), women in most countries succeed in higher levels of education than men; however, they still have fewer career opportunities and receive lower pay. The report also notes that although girls in high school may perform better than boys academically, they are less likely to pursue higher education in disciplines such as science, mathematics, or computing, which offer careers with higher pay. On average, only 14% girls who are top achievers in science or mathematics claim that they will continue to work as professionals in similar fields, while 26% top-performing boys reported so (Givord, 2020). Givord suggests that education decision

and career choice are related to students' self-esteem and self-efficacy; although the report does not comment on students' ASE in relation to their gender and their country of origin, the phenomenon shows that students' career decision is still impacted by gender roles, which may be a result of culture.

Power distance examines the culture's reaction to social hierarchies and in equalities (Hofstede, 2001); cultures with larger power distance are thought to be more authoritarian, marked with relatively fixed social classes as a norm. Power distance also influences individuals' behaviors in social interactions and their subject construal of interpreting situations involving others' social status. In educational contexts, power distance can be observed in teacher–student relationships and social/peer pressure. An example illustrating how power distance of a certain culture influences students' ASE and stress of learning can be found in Ahn et al. (2016). Ahn et al. find that Filipino students reported lower mathematics self-efficacy than US students and higher anxiety than students from both the US and from Korea and suggest that the result of high anxiety might be due to the Philippines' large power distance which resulted in strong social pressure to preserve the order of the hierarchy.

Uncertainty avoidance is the culture's preference for structured or scheduled decisions or the tolerance for uncertainty. Cultures that have higher uncertainty avoidance tend to be more intolerant to ambiguities and change (Hofstede, 2001) and may be more anxious when dealing with the unknown. The high uncertainty avoidance is also reflected in the cultural needs for being in familiar or predicable situations, seeking for only the correct answers and rejecting intellectual disagreements (Oettingen, 1995), which also impact students' ASE. Bonneville-Roussy et al. (2019) find that inquiry-based tasks are less likely to predict students' ASE if the students are from countries that score high in uncertainty avoidance. In other words, students in countries that are high in uncertainty avoidance perceive inquiry-based teaching methods are more stressful and may have lower self-efficacy in their ability to accomplish tasks without definite answers.

The social institution-level proximal culture refers to the established systems of certain cultures, including parenting system, childrearing system, and educational systems. One of the most salient areas of study on the culture systems relating to ASE is the parental belief or parenting systems, which account for a major source of individuals' social persuasion perception that forms their ASE. Yuan et al. (2016) find that Asian–American students with higher quality parent–child relationship had higher levels of self-efficacy and better performance, while the process is not observed in European–American students. Similarly, for Korean students, social persuasion by family members can predict mathematics self-efficacy (Ahn et al., 2016). Though not directly aiming to explore individuals' ASE, cross-national studies have shown that American mothers were more positive in rating their children's ability and had higher satisfaction in their children's performance than Japanese and Taiwanese mothers (Stevenson et al., 1986, 1993). American mothers are more willing to attribute their children's success to their abilities, while mothers from Japan and Taiwan are more likely to attribute children's success to effort (Stevenson et al., 1986). The attribution of success to effort in Japan and Taiwan can also be found in students' beliefs in Stevenson et al. (1993) study. The attribution for success makes up a part of the

culturally influenced parenting systems and may influence students' ASE through parents' social persuasion.

The individual level refers to the internalized values and priorities that each individual carries with them. Although every person in the same country may be exposed to similar culture and social situations (i.e., social situation-level situated culture), the extent of culture internalized by the individual is fluid and dynamic. The internalized value has a strong influence on the individuals' subject construal of the social situation around them. A similar process of how internalized values can influence ASE is illustrated within the complexity of the formation of ASE: The various sources of ASE information are selected, weighed, prioritized, and finally integrated into the personal ASE belief, while culture can affect not only the type of sources offered, but also the personal process of selecting and prioritizing the information (Oettingen, 1995; Oettingen & Zosuls, 2006).

With the different culture levels and dimensions defined, we provide some examples of recent research on how these levels and dimensions may impact students' ASE. To further address the complexity of ASE in the modern globalized higher education, we will discuss the complicated culture perspectives and perceptions of international students and the role of culture in their ASE formation.

International Students

The internationalization of higher education, which allows the exchange and interaction of various ideas and knowledge, has been of heightened importance among countries (UNESCO, 2019). International students bring new ideas and cultural values, which serve as positive stimuli and inspirations to the host country (Khan et al., 2015). To higher education institutes, international students are one of the main resources in the global knowledge economy, and the number of international students recruited by the university seems to have become one of the indicators of school quality (Börjesson, 2017; Machin & Murphy, 2017). Moreover, having more diverse experiences allows people to think more openly, imaginatively, and creatively (Wang et al., 2014) and helps to see the world with a different perspective. Employers often prefer to hire graduates who have studied abroad because it usually means that the graduates are more experimental, adaptable, culturally aware, and collaborative in that they can understand how others work and think. Hence, more and more countries focus on encouraging their best students to study abroad while attracting students from other countries to come and pursue higher education (e.g., Foundation for International Cooperation in Higher Education of Taiwan (FICHET), 2021; Government of Canada, 2020; Universities UK, 2014).

With the increasing number of the international students in the different countries, maintaining high teaching and learning quality is an important issue. International students are unique in that they bring their own individual-level internalized cultural values, which influence their subject construal of the situation, from their mother

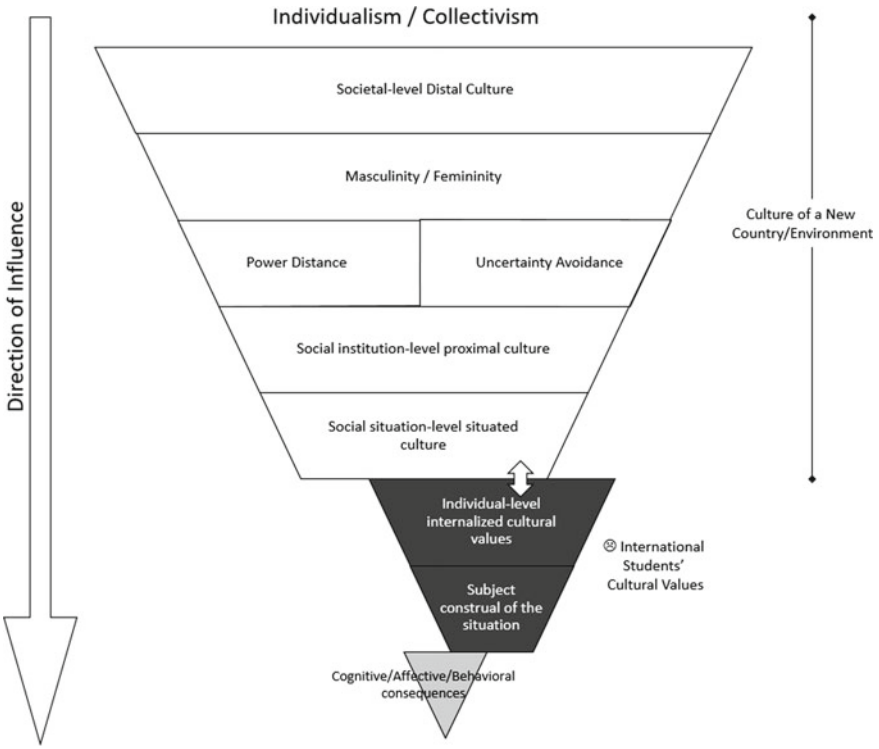

Fig. 7.3 International students' cultural value systems. *Note* The individualized-level internalized values are carried by the international students from their country of origin into the new cultural system and may have high influence on their subject construal and behavioral consequences

countries, into a new cultural system (of the host country) with different social situations from those that they are familiar with (Fig. 7.3). The impact of the interaction between the new cultural system and the international students' internalized cultural values on their ASE and behavior consequences is, thus, worthy of exploration in the modern globalized education.

Clash of Value System, Challenges, and Impact on ASE

In the globalized context of higher education, culture is not static and confined in one country, but fluid and dynamic due to the increasing mobility of international students. However, as illustrated by Fig. 7.3, international students may bring internalized cultural values of their home cultures into the new system and feel out of place. The clash of values results in challenges that may interfere with their learning performance and adaptation, such as the need for social support, lack of language proficiency, and

low academic self-efficacy (Filippou, 2019; Leong, 2015). In order to adjust to a new culture, for instance, Chinese students need to learn new language skills and communication styles, think in the Western frame of mind, understand what the classroom environment and socio-cultural background of the host country expects, and learn to balance their life and schoolwork (Heng, 2018).

With the rapid growth in the number of international students, there has been numerous studies on international students' transitional challenges and the importance of shifting into an internationalized curriculum (e.g., Ecochard & Fotheringham, 2017; Jin & Cortazzi, 2016; Ramachandran, 2011). However, though the studies highlight the challenges for international students, the studies have limited discussions on the international students' native or host culture systems and how students' ASE may be impacted by the challenges. This section describes some challenges international students face in reflection to the cultural value systems model as illustrated in Fig. 7.3 and discuss how these challenges may impact students' ASE.

Language is closely linked to culture (Signorini et al., 2009) and can be seen as one of the main elements that are fundamental to build up the culture systems (i.e., distal level in Fig. 7.3). Studying abroad in a foreign country with a different language appears to be a major challenge to international students. International students' language proficiency can often negatively affect their academic success, even when they are confident in using the target language in class (Wang et al., 2018a). Moreover, students from China had lower self-efficacy compared to other groups in writing papers, succeeding in exams, and understanding course literature, which might be due to their language anxiety in academic writing and in using English (Filippou, 2019). In other words, international students' language (English) self-efficacy can predict their self-efficacy in using English to learn, which ultimately impacts their ASE (Wang et al., 2018a). In addition, language and communication challenges imply that students have problems in establishing relationships in the host society (Guo & Guo, 2017); students may become self-segregated (Leong, 2015) or experience emotional stress or loneliness due to the lack of social network (Jin & Schneider, 2019). The language barrier further impacts the international students' adaptation into social institution level of established cultural systems as they are hindered from gaining social support and seeking help, which may also influence students' ASE as they have fewer opportunities to receive social persuasion and vicarious experience.

In addition to language barriers, several studies (Jin & Schneider, 2019; Leong, 2015) have noted different aspects of culture gap that may impede international students' adaptation to the host college. Leong (2015) suggests that it is especially difficult for East Asian international students to adjust to the academic life of American colleges because of language and cultural barriers. Through interviews, Leong (2015) finds that the permissiveness of American culture is a source of freedom and also a challenge for East Asian students; participants commented that in the American college, students are expected to work independently and be responsible for their education, while in Asian colleges, students are often reminded of deadlines, assignments, and potential penalties for missing the deadlines.

The international students may also experience disorientation when they experience new teaching styles, pedagogical differences, and faculty–student relationship that may contrast the culture system of their country of origin. The freedom in course selection and time management and the culturally different teaching styles may also lead to students' adaptive stress (Li et al., 2018). Jin and Schneider (2019) also report that college faculties perceive international students' challenges, aside from language barriers, to be their lack of understanding of U.S. academic culture and of the society, including gender norms. Though the studies do not reflect the socio-cultural systems that may result in the barriers, the participant response echoes to the difference in uncertainty avoidance and masculinity or femininity of the students' native and host countries that result in a contrasting social institution-level proximal culture in the host country.

With the challenges of adaptation and cultural disorientation, international students' transition into the new environment influences and is influenced by their ASE. The cultural challenges and disorientation may negatively impact international students' initial life and academic experience in the host country, leading to the impairment of their academic performance and of their mastery experience and ultimately diminish their ASE (Wirawan & Bandu, 2016). The decline of the international students' ASE then further impacts their future performance, which influences their retention rate, forming a vicious cycle. The next section sums how international students' ASE may affect their cultural adaptation and highlights the importance for higher education institutes to build international students' ASE.

Importance of Building International Students' ASE

Academic self-efficacy seems to play an important role in international students' learning process. Tilfarlioglu and Doğan (2011) illustrate that self-efficacy affects academic success positively, and positive relationships could been observed between self-efficacy and learner autonomy, self-efficacy and academic success, and learner autonomy and academic success. For ESL/EFL students, academic achievement is foregrounded by crucial learner attributes, including motivation, self-efficacy, self-regulation, and language proficiency (Phakiti et al., 2013). Similarly, Shi (2016) highlights that higher self-efficacy in ESL/EFL students can predict better academic performance and reduce their anxiety on language proficiency.

In addition, a stronger sense of ASE helps international students adapt and adjust to the new environment more easily. Students with high self-efficacy tend to adjust more successfully to new and stressful situations (Rujiprak, 2016). The sense of self-efficacy can serve as supports in assisting students face and overcome challenges (Petersdotter et al., 2017), and thus, international students who have higher self-efficacy tend to adapt more easily to a new environment (Bulgan & Çiftçi, 2017; Freeman et al., 2019; Rujiprak, 2016) and report fewer adjustment problems (Poyrazli et al., 2002).

As international students face more unique challenges than domestic students (Ecochard & Fotheringham, 2017; Perry, 2016), their experience and ASE are tightly connected and reciprocal of each other. Thus, increasing international students' academic self-efficacy, helping them to adapt to the academic environment is an important issue to the higher education institutes.

Implications

With the growing number of studies on ASE, scholarly efforts have been devoted to a more comprehensive understanding of the sources from which students derive their ASE and the impacts of ASE on students' academic performance or attitude. In this section, we suggest some pedagogical strategies that higher education institutes may adopt to enhance their international students' ASE while tending to the needs of domestic faculties in intercultural development. We also provide some directions for future research on investigating ASE from a culture-sensitive perspective. We hope that by looking at ASE from different culture dimensions may shed new light in the comprehensiveness of ASE research and help prepare both the students and higher education institutes in the internationalization of academic exchanges.

Preparing Higher Education Institutes for the Globalized Era

The internationalization of higher education is an unavoidable trend. International students are important resources for higher education institutes in terms of economic contributions, cultural diversity and awareness, innovative ideas, and global relationship (Leong, 2015; Ren & Hagedorn, 2013). However, international students face more problems and unique challenges than the domestic students of the host countries (Perry, 2016). These challenges may impact international students' academic performance, lower their ASE (Khan et al., 2015; Wirawan & Bandu, 2016), and interfere with their mental health and retention rate (Ecochard & Fotheringham, 2017). Therefore, it is crucial for higher education institutes to support and enhance international students' experience and raise their ASE. This chapter sums four main methods from previous literature on international students' ASE and adaptation experience: bridging language proficiency, offering academic and culture transitional courses and workshops, cultivating culturally sensitive faculty and staff, and helping international students form social support.

Firstly, language proficiency seems to be the most common challenge that international students face and also the greatest obstacles in international students' adaptation to the classroom and life in the host country. When international student studies abroad, if the main language of the destination is different from their first language, offering an ideal situation to learn the new language may be a possible way to support them (Börjesson, 2017). Thus, offering language and academic bridging training

programs or consulting centers may help improve international students' language proficiency and academic transition (Heng, 2018).

Also, to increase international students' self-efficacy and to adapt to study overseas, Nikula and Sibley (2020) suggest that participating in an academic preparation course help lessen the declination of international students' sense of ASE when they initiate their study in the host country. Many international students may feel cultural disorientation in the differences in teaching styles and academic expectations between their country of origin and the host country (Leong, 2015; Li et al., 2018). The training workshops or preparation programs may familiarize the international students with how the educational systems work in different countries and what may be expected from the courses, help them build more confidence in their academic life, and, thus, increase their ASE (Poyrazli et al., 2002). Similarly, Poyrazli et al. (2002) mention that international students who are more active or assertive can initiate more academic interactions or seek for academic help, such as using writing centers and inquiring assignments with professors and, therefore, having a higher ASE. Transitional training workshop hosted by the higher education institutes may teach students to be assertive while being sensitive to their original and host cultures and help them experience fewer adjustment problems.

In addition, higher education institutes should not only focus on the international students' adaptation, but also pay attention to how the faculty and staff adapt to the growing number of international students. When facing international students, faculties may sometimes demonstrate hesitant and contradictory attitude on student transition assistance and support (Haan et al., 2017; Jin & Schneider, 2019). It is also important for higher education institutes to highlight that international student support should come from both the engagement of the faculty and from administration and other support centers (Haan et al., 2017). Hamre and Pianta (2006) mention that students would feel safer, adapt better, form friendly relationship with fellow students, and perform better academically in the school environment when they build steady and supportive relationships with teachers. While the faculty who possesses similar backgrounds to the international students may best comprehend and empathize with them (Jin & Schneider, 2019), professional development workshops on culturally responsive pedagogies, experiences of working with international students, and international students' challenges and difficulties can better prepare the faculty to face students with diversified backgrounds and can enhance the academic experience for both the students and the faculty (Heng, 2018).

Furthermore, higher education institute should pay attention to international students' support, both in terms of academic supports and of social supports. International students without sufficient social supports are more likely to accumulate stress and be unable to adapt to the new culture (Rujiprak, 2016). International buddy systems, orientation culture workshops, and culture clubs consisting of other international students may be good methods of providing social supports to the new international students.

International students are mostly top students from their countries of origin and are used to have high academic performance. If the adaptation difficulties and disorientation of academic systems diminish the international students' ASE, they may

not be motivated to study, leading to the heightened dropout rate of international students in the higher education institutes of the host country. The international exchange of knowledge and talent may be hindered by the disorientation of culture; thus, we suggest some strategies for higher education institutes to enhance international students' adaptation experience and ASE. We also stress that these four strategies, including language proficiency bridging, academic or culture transitional courses and workshops, culturally sensitive faculty and staff, and establishment of social support, must be designed and implemented through a culturally sensitive perspective. For instance, different language bridging programs may be designed for international students with similar language or cultural backgrounds to familiarize them with the new host culture and language; as students with similar culture backgrounds may share similar culture dimensions in terms of teaching styles and power distance, the program may also allow for a transition into the new academic culture. The workshops or programs should be tailored to fit students from various cultures and should not see all international students as a coherent cultural group.

Toward a Culturally Sensitive Academic Self-efficacy

In this section, we conclude the chapter with some suggestions for future research directions on ASE. The formation of self-efficacy beliefs draws from cultural forces and influences (Klassen, 2004b; Klassen & Usher, 2010; Oettingen & Zosuls, 2006). Yet, studies examining ASE from the cultural perspective mostly focus on the culture dimension of individualism/collectivism. Therefore, in addition to including culturally imaginative pedagogies in higher education institutes, more culturally imaginative research is needed to address the differences in students' ASE belief and academic performance.

One of the most salient dimensions of culture is the masculinity/femininity of the culture, including the gender roles, attitudes, and approaches in the society (Hofstede, 2001). We expect that the gender roles and masculinity/femininity pertaining to the culture may impact students' vicarious experience and social persuasion in forming their ASE. Fewer girl top achievers in math and science will pursue a career in similar fields than boys (Givord, 2020). However, there are relatively few studies related to the relationship among gender, culture, and ASE, and how these variables may influence students' career choice; future studies are needed to examine how the ASE of students is influenced by the gender roles of their culture and further influences their life choices.

Other cultural dimensions that may impact students' ASE are the power distance and the social institutional level, including the education systems and the parental systems of the culture. The power distance between teacher and the students may influence students' perceived social persuasion and vicarious experience. The effect of teaching styles and teacher–student relationship on the ASE of students in different cultures and of international students is worthy of examination. In addition, the effect

of parental styles on students' ASE and on their academic achievement in various cultures may inspire more research.

The cultural dimensions' impact on ASE is even more self-evident and complex in the case of international students. For instance, the clash of uncertainty avoidance may be seen in teaching styles and pedagogic strategies of the host country and the international students' culture of origin, which may negatively impact international students' ASE and academic performance. Furthermore, international students are mostly top student in their own country, with high academic achievement and, theoretically, high ASE aspiring them to study abroad; thus, the investigation on the progression of international students' ASE before and after they study abroad may help higher education institutes understand international students' expectations and disorientation in the reality and be able to provide more support to help international students adapt and retain in the new academic environment. In this chapter, we have suggested some strategies for higher education institutes to support international students; more research on the effects of higher education institutes' strategies on enhancing of international students' ASE is needed to further verify the strategies and confirm the support for international students can effectively assist them improving their academic experience in the host culture.

We also highlight the importance for future studies to acknowledge the complexity of international students; instead of seeing the international students as a homogeneous group, more studies examining the diversity of international students' cultural backgrounds and values are needed. Likewise, more studies diversifying the host countries welcoming the international students should also be advised.

Conclusions

This chapter attempts to address the cultural aspect of ASE by first defining cultural dimensions, drawing examples on how the cultural aspects may influence or be related to ASE. We have summarized a model of cultural dimensions based on Hofstede (1980, 2001, 2011) and Oyserman et al. (2002) and examine the complexities that international students face in their cultural adaptation and how the international students' adaptation difficulties may influence and be influenced by their ASE. We conclude the chapter with some pedagogical implications on how to prepare higher education institutes for the globalized era in boosting international students' ASE and some suggestions for the future research agenda of a culturally sensitive ASE. We hope that in the near future, studies on ASE may be more diversified, with more investigations on how different cultural dimensions influences students' ASE. Also, we hope to see more investigation on international students' academic experience in the host country, their cultural adaptation, and their ASE.

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Chapter 8
Children's Academic Self-efficacy in Reading and Reading Development—From Theory to Practice

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Abstract Self-efficacy has been found to be an important predictor of various learning-related outcomes. In this chapter, we focus on the role of academic self-efficacy in the context of reading among school-aged children. We first discuss measurement of reading self-efficacy both theoretically and in the light of recent empirical findings. We then turn on reviewing how reading self-efficacy contributes to reading achievement and development and focus on the variations in this relationship. Recent findings on how reading self-efficacy changes and develops over time as well as the varying role of the four theorized sources of self-efficacy in this development are being discussed. Finally, we look more closely on how reading self-efficacy can be intervened as a part of reading support by explicitly targeting the four sources of self-efficacy. The chapter concludes with suggestions for future research on children's academic self-efficacy in reading. Increased understanding of the individual processes in reading self-efficacy development seems to be needed to better address the needs of different groups of students with differentiated instruction.

Keywords Self-efficacy · Sources of self-efficacy · Reading fluency · Primary school · Longitudinal · Person-centered approach

Introduction

To become a fluent reader is a hallmark of primary school education and thus a pivotal academic skill. Later on, reading to learn is needed every day and everywhere in the modern world. Fluent reading skills can thus be seen as the *sine qua non* of all academic learning. Some children have more difficulty in gaining reading skills, and overall, children's interest in reading and their reading skills have been found to decrease in recent years. We know much about the cognitive factors that hamper or support reading development (Lyytinen et al., 2004). Recently, more attention has also been given to the non-cognitive factors, such as motivation, in this development

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(see Toste et al., 2020). In this chapter, we will focus specifically on the role of academic self-efficacy (ASE) in the context of reading. More specifically, ASE in reading refers to children's beliefs about their capabilities in reading. In this chapter, this specific part of ASE will be referred as reading self-efficacy.

The chapter begins with discussions on what kind of efficacy beliefs children actually have concerning reading and how these beliefs have been measured in primary school-aged children. Children's self-efficacy evaluations and their specificity are discussed both theoretically and in light of empirical findings in reading. We then focus on reviewing how reading self-efficacy is known to contribute to reading achievement and development. The role of self-efficacy for learning in different reading sub-skills is discussed, as efficacy beliefs may be differently related to different reading sub-skills. The next section describes what we know about how efficacy beliefs change over time, and the role of the four theorized sources of self-efficacy in this development is discussed. Finally, the possibilities to support children's reading self-efficacy as a part of reading instruction are considered, and implications for the practice are suggested. The chapter concludes with future considerations for ASE research in reading.

Self-efficacy Evaluations in Reading

Specificity

According to Bandura (1997), beliefs about our capabilities are context specific: that is, we hold multiple beliefs of our academic capabilities, which can vary across different skill areas (such as math or reading; Bong, 1997) but also within a skill or domain between different sub-skills (Shell et al., 1995). Hence, a child can believe in his/her skills in arithmetic but may lack that self-efficacy in geometry, for example. In addition, efficacy beliefs are assumed to also vary in *level* (i.e., level of task demand), *strength* (weak or strong) and *specificity* (generality; Bandura, 1997, p. 42). *Specificity,* which we will focus upon in more detail in this chapter, refers to the generality of self-efficacy beliefs—that is, a student can hold high efficacy beliefs in his/her capabilities in academic skills in general or hold high self-efficacy only in certain contexts or tasks. Bandura (1997) theorized that efficacy beliefs differ at three levels of specificity: general, intermediate and specific. The *general level* refers to beliefs about one's capabilities in general and can refer either to general academic efficacy beliefs, such as "I'm sure I can perform well at school," or to general beliefs in a certain skill area, such as "I'm sure I can perform well in reading." The *intermediate level* refers to beliefs regarding certain competencies or sub-skills, such as "I'm sure I can write a novel." The most *specific level* refers to beliefs in one's capability to perform a particular task, such as "I'm sure I can read this text." Correspondingly, people have varying beliefs about their capabilities, for example, in reference to math in general, certain math competencies or specific math tasks (e.g., Bong & Hocevar,

2002). Moreover, each of these beliefs is important to explore, as they may affect our functioning and skill development differently (Pajares & Miller, 1995). Although the conceptualization and methods of measurement of self-efficacy may affect its relationship to achievement, this has received less attention in reading research, as we discuss in the following section.

Measurement of Reading Self-efficacy

Self-efficacy research is more plentiful in other skill areas, such as in math and science than in reading (Klassen & Usher, 2010). In reading studies, self-efficacy has been conceptualized in various ways, both in relation to different specificity levels and to operationalizations that come close to related constructs, such as self-concept. This somewhat complicates the integration of prior research findings. In the following, we will look more closely at the ways in which self-efficacy has been measured in prior studies in reading.

In most studies, children's reading self-efficacy is assessed by operationalizing self-efficacy as general-level beliefs in reading (e.g., Lee & Zentall, 2017; Smith et al., 2012). Similarly, many reading motivation scales include subscales of self-efficacy in which self-efficacy is conceptualized as general level self-efficacy (e.g., self-efficacy subscales of MRQ, Baker & Wigfield, 1999; YRMQ, Coddington & Guthrie, 2009). In some reading studies, self-efficacy has been assessed more broadly, in terms of ASE (Galla et al., 2014; Mercer et al., 2011), which refers to assessing whether students believe they are able to meet general academic demands. In few studies, the focus has been on more specific level beliefs in reading. In these studies, students are asked to rate their confidence in tasks such as "Read one of your textbooks" (Shell et al., 1995) or "Read out loud in front of class" (Carroll & Fox, 2017), which can be understood to assess *intermediate level* beliefs. Even fewer attempts have been made to assess self-efficacy in relation to concrete reading tasks, that is, at the most *specific level*. Schunk and Rice (e.g., 1991, 1993) conducted small-scale studies in which they asked students to rate their self-efficacy in correctly answering each reading comprehension question shown to them.

As a result of the focus of the previous studies, our understanding of children's self-efficacy in reading seems to be based mostly on children's general level beliefs. This may affect the interpretations that are made of reading self-efficacy and therefore our understanding of the role of self-efficacy in relation to reading development. First, the way how general self-efficacy is operationalized has often strayed from the original theorization of self-efficacy articulated by Bandura (1997). Self-efficacy has been operationalized as students' perceived competence (e.g., "I am good reader"), or the focus has been on social comparison (e.g., "I learn more from reading than most students in the class"), rather than targeted future capabilities and self-referent evaluations (e.g., "I can learn to read") in line with the original conceptualization of self-efficacy (Bong, 2006). These operationalizations partly overlap with those of self-concept (Bong & Skaalvik, 2003). Self-efficacy researchers have repeatedly

criticized the use of incongruent operationalizations that do not follow the theoretical groundings of self-efficacy (Klassen & Usher, 2010; Schunk & DiBenedetto, 2020). Although self-efficacy and self-concept are closely related constructs and share many similarities, they are found to differ even from the beginning of the first school year (McTigue et al., 2019) and have some differences in the ways they affect learning (Bong & Skaalvik, 2003).

Second, it may be that not all children have well-formed beliefs of their general capabilities in reading. Rather, when children were interviewed about their beliefs regarding their capabilities as readers, they described their self-efficacy in relation to specific reading situations (Guthrie et al., 2007). It is suggested that the more specific evaluations develop first, and then, with increasing experience with texts and reading situations, these beliefs are later integrated into more general views of one's reading capabilities (Guthrie et al., 2007). In addition, when students are asked about their reading capabilities in general, they may have very different sub-skills of reading in mind, and these may differ from those assumed or intended by the researchers. Children are found to recall their capabilities to read fluently (Butz & Usher, 2015; Henk & Melnick, 1998) or their word-reading skills (Guthrie et al., 2007; Klauda et al., 2020) rather than their reading comprehension skills when they have evaluated their reading self-efficacy, whereas the outcome skill has often been reading comprehension skills. Therefore, it may be that children's self-efficacy evaluation and the outcome skill assessed by researchers have not fully corresponded. This is something that might be considered when interpreting the associations found between self-efficacy and reading skills. It is also possible that the variation with regard to the skills children have in mind when responding is the reason for the finding that general efficacy beliefs seem to be more miscalibrated or biased than more task-specific beliefs (Talsma et al., 2020).

We still have little understanding of whether children's beliefs differ at the various specificity levels, and whether and how the varying operationalizations affect our findings and conclusions of the functional role of reading self-efficacy. Recent findings indicate that children may have these varying beliefs about their capabilities from the age of 8 years onward (Peura et al., 2019b). That is, children may feel self-efficacious about their general reading capabilities (i.e., "I'm certain I can learn to read faster") but their intermediate-level beliefs (i.e., "I'm certain I can read a book") or their beliefs in specific reading tasks (i.e., "I'm certain I can read this text") may be different. In the following, we discuss the possibilities for how the specificity of self-efficacy may affect our interpretations of children's reading self-efficacy.

Gender- and Age-Related Differences in Reading Self-efficacy

Differences in the strength of children's self-efficacy have been studied especially in relation to students' gender and age. Gender differences have received more attention, and in reading or, more broadly, in literacy activities, common assumption is that girls believe in their capabilities in these activities more than boys (see Huang,

2013). However, the empirical findings on gender differences show a more varied picture. Taking the studied specificity level of self-efficacy into consideration may offer some explanations for these inconsistent findings. Girls are found to have higher reading self-efficacy when general efficacy beliefs are assessed (Smith et al., 2012; Wigfield & Guthrie, 1997), whereas when children's specific efficacy beliefs related to reading tasks are evaluated, differences between girls and boys are not documented (Carroll & Fox, 2017; Piercey, 2013).One plausible explanation may be that gender role stereotypes or expectations, such as that "reading is for girls" (Nowicki & Lopata, 2017), are more evident when students make general level evaluations of their capabilities in reading. In these kinds of evaluations, children may focus more on relative ability comparisons, rather than when they make more specific evaluations of their capabilities in specific reading tasks. It may also be that general level evaluations are more influenced by whether one likes reading overall. When all three specificity levels were studied together, differences between boys and girls were not found either on the general or specific levels, but quite unexpectedly, boys had slightly higher intermediate level self-efficacy in reading than girls (Peura et al., 2019b). This finding favoring boys may relate to the fact that the intermediate level targeted self-efficacy in recreational reading activities and in digital reading (e.g., reading on the Internet), which may be contexts boys spent more time with and may thus feel more self-efficacious in.

Overall, differences between girls and boys are still found to be small. Therefore, looking at the individual variation across genders which might extend our understanding of reading self-efficacy might be a more fruitful approach for comprehending mechanisms behind the differences in reading self-efficacy. When the focus is on simple group differences, our attention may be drawn away from more relevant individual differences. Researchers should also be careful to interpret and translate findings to the public so as not to sustain and reinforce unnecessary gender expectations related to reading, but rather to help to reduce them. Continuous efforts on trying to identify risk factors that may expose children to low beliefs in their capabilities, and especially those factors on which we can and should place special emphasis in educational practices, are needed (Peura, 2021).

Children may evaluate their reading self-efficacy differently at varying ages. The few findings considering age-related differences have been inconsistent, possibly due to the varying operationalization of reading self-efficacy. When children's beliefs in specific reading tasks are evaluated, older children are found to have higher self-efficacy than younger children (Carroll & Fox, 2017; Peura et al., 2019b). Conversely, when general level efficacy beliefs in reading are assessed, an opposite pattern is found (Smith et al., 2012)—that is, younger children have higher reading self-efficacy. These findings seem reasonable, as the task-specific beliefs likely develop in tandem with the growing skills of children. General beliefs, on the other hand, come close to more general views of oneself and seem to follow observations of decline that are made in related constructs, such as in self-concept (Scherrer & Preckel, 2019). Whether the relation between self-efficacy and reading skills varies at different age phases needs still to be researched. Recent findings underline the

importance of reading-related beliefs to reading performances from the first years of schoolings (McTigue et al., 2019; Peura et al., 2019a).

Relationships Between Reading Self-efficacy and Reading Development

The well-known positive effects of high self-efficacy have also been documented in reading. Students with high self-efficacy seem to put forth more effort and persistence in reading, spend more time on reading activities and read more for enjoyment than students with low beliefs about their skills (Galla et al., 2014; Schüller et al., 2017; Wigfield & Guthrie, 1997; Lee & Zentall, 2017). Furthermore, efficacy beliefs are found to directly relate to students' reading achievement among primary school children (Hornstra et al., 2016; Smith et al., 2012). The strength of this positive association between self-efficacy and reading skills has, however, varied. Possible reasons for the varying findings may relate to the variation in the studied sub-skill of reading as well as to the ways how self-efficacy has been operationalized. Looking at these issues more closely may help to understand whether and how efficacy beliefs contribute to reading development overtime.

In the area of reading, self-efficacy has been mainly studied in relation to reading comprehension rather than in relation with other sub-skills of reading. Efficacy beliefs may, however, have a somewhat different role in different sub-skills of reading. Among middle school and older students, self-efficacy is found to positively associate with both reading fluency and reading comprehension (Ho & Guthrie, 2013; Mercer et al., 2011). Among primary school students, we know less about this, but Carroll and Fox (2017) found that efficacy beliefs linked positively to reading fluency, yet not to reading comprehension. It also seems that the strength of the association somewhat varies between the sub-skills of reading: The associations between self-efficacy and reading fluency are found to be rather strong (Carroll & Fox, 2017; Peura et al., 2019a), whereas rather small associations between self-efficacy and overall reading achievement have been documented (Liew et al., 2008; Smith et al., 2012). It may be that younger students consider reading as the ability to read quickly and fluently and may thus evaluate their reading self-efficacy in reference to their capabilities in reading fluency, whereas older children consider reading more as the ability to comprehend what is read. Further research is needed to elucidate age-related differences and whether efficacy beliefs differently affect children's reading performances in diverse reading areas.

Another consideration in the relationship between self-efficacy and skills relates to the ways self-efficacy is measured and operationalized. In general, more specific efficacy beliefs are found to show stronger relations to performance than more general efficacy beliefs (see Talsma et al., 2018). Still, this issue has been little considered in reading. Piercey (2013) showed that the relationship between reading self-efficacy

and reading achievement is stronger when they are assessed at corresponding specificity. Similarly, general reading self-efficacy showed the weakest association with reading skills (Peura et al., 2019a). In longitudinal studies, prior self-efficacy, rather surprisingly, has not been found to predict reading development over time (Galla et al., 2014; Guthrie et al., 2007; Mercer et al., 2011), nor later reading achievement (Lee & Zentall, 2017; Liew et al., 2008). In the aforementioned studies, children's general ASE or general reading self-efficacy was assessed. On the contrary, when Lee and Jonson-Reid (2016) assessed children's self-efficacy for specific reading tasks, they found it to predict children's later reading achievement. In a study, in which different specificity levels of reading self-efficacy were assessed, the associations between self-efficacy and reading development were found to vary according to the studied specificity level (Peura et al., 2019a). That is, children's intermediate level beliefs, which referred to beliefs of their capabilities for everyday reading activities, such as reading a book, positively predicted reading fluency development, whereas general or specific beliefs did not. These findings suggest that the differing empirical observations might be explained by the varying predictive power of the diverse beliefs, in line with Bandura's notions (1997).

These observations seem important for both theory and practice. They imply that more emphasis should be placed on what kinds of efficacy beliefs in reading are being measured. This relates to the congruent operationalization of self-efficacy, as well as its correspondence for the reading context under study. Studying reading self-efficacy in various ways may reveal an enriched understanding of how self-efficacy interacts with reading behaviors and performances. Teachers and practitioners should be aware and observant of this variation in beliefs; children's general beliefs of their reading capabilities might not tell the whole story of their reading self-efficacy.

Development of Reading Self-efficacy

As efficacy beliefs are known to be important in reading skill development, knowledge of how these beliefs evolve, and change seems essential. Efficacy beliefs are considered to be rather malleable perceptions of one's capabilities which change more easily than other related self-beliefs, such as self-concept (Bandura, 1997; Bong & Skaalvik, 2003). It is likely that changes in these beliefs happen in childhood (Bandura, 1997), when skills develop rapidly. In general, children are found to become more self-efficacious of their capabilities over time (e.g., Hornstra et al., 2016). As efficacy beliefs are closely related to the skills of a learner, it seems reasonable that when skills develop, confidence in one's skills also increases. However, contradictory findings exist, as a recent meta-analysis concluded that self-efficacy is stable over time (Scherrer & Preckel, 2019), although the direction of change observed in self-efficacy varied notably across the reviewed studies. Prior findings differ also in considering the stability of children's self-efficacy (cf. Phan & Ngu, 2016; Phan et al., 2018) as well as in considering the shape patterns in which self-efficacy is found to change (e.g., linear, nonlinear) (cf. Hornstra et al., 2016; Phan,

2012). This variability in the findings suggests that children may differ in how their self-efficacy changes and develops.

Thus far, little research has considered how efficacy beliefs related to reading change. Schöber et al. (2018) studied change in secondary school students' reading self-efficacy over a year and found that students became more self-efficacious of their reading capabilities over the study period. Likewise, Peura et al. (2021) found that primary school children's reading self-efficacy, in general, increased over a year. Interestingly, when also variability in changes in reading self-efficacy was considered with a person-centered approach, four different trajectories of change emerged over a follow-up period of one year (Peura et al., 2021). The findings showed that all children do not follow the same patterns of changes in their reading self-efficacy; rather, some children become more self-efficacious over time; whereas, others lower their self-efficacy. Most of the children were on a positive learning cycle where they hold high self-efficacy which further increased over time. Some children had lower initial levels of self-efficacy, but their beliefs in their capabilities increased over time. Another group of children held rather high and relatively stable self-efficacy over the year. On the other hand, some children had low initial self-efficacy, and they were found to end up having even lower beliefs in their capabilities over time. These observations of the variability in self-efficacy development follow the findings in related research of self-concept in literacy, in which children's self-concept development is found to follow different trajectories of change through the school years (Archambault et al., 2010).

Focusing more on the heterogeneity in self-efficacy development could enrich the understanding of how self-efficacy changes. In this way, understanding of the individual processes in development and the individual reciprocal interactions in which self-efficacy is theorized to develop in social cognitive theory (Bandura, 1997) could be gained. Some students seem to be more vulnerable to losing their reading self-efficacy, and increasing understanding of this variability could help to identify those children who are most in need of support and to design individualized support for their self-efficacy. Applying person-centered approaches (Howard & Hoffman, 2018) could help to capture this variability in the ways how reading self-efficacy fluctuates.

Experiences that Build Reading Self-efficacy

Efficacy beliefs are considered to form and change in a process of triadic reciprocity between environmental, personal and behavioral influences (Bandura, 1997). Four information sources are especially essential in self-efficacy development: mastery experiences, verbal persuasions, vicarious experiences and physiological and emotional states (Bandura, 1997). These experiences are considered context dependent; that is, mastery experiences in science are likely to raise confidence particularly in science. It has also been found that the experiences students use as their source of self-efficacy somewhat vary between skill areas (Butz & Usher, 2015;

Usher et al., 2019). Thus far, sources of self-efficacy have been studied rather little in reading contexts. In the following, the four sources, and the current understanding of their role in building students' reading self-efficacy, are introduced.

Mastery experiences—that is, interpretations of past experiences as successes—have consistently shown to have the most powerful effect on one's self-efficacy (see Byars-Winston et al., 2017; Usher & Pajares, 2008). This seems to also be true in reading, where the most frequently reported efficacy-building experiences are found to be students' successful experiences in reading (Butz & Usher, 2015). Children have described that their own performances—that is, being able to read difficult words and/or challenging parts of a story—inform them whether they are efficacious in reading (Guthrie et al., 2007). Experiences of mastery in reading are found to be essential also in shaping children's self-efficacy development. Children who experienced high levels of mastery in reading are found to become more self-efficacious in their capabilities in reading over time (Peura et al., 2021). On the contrary, those children who lost their confidence in their own capabilities in reading experienced less mastery in reading (Peura et al., 2021).

Verbal persuasions, such as positive feedback and encouragements from parents, teachers and peers, also build students' confidence in their own skills in reading (Butz & Usher, 2015; Guthrie et al., 2007). Verbal persuasions are suggested to be especially important in the early phases of skill development (Bandura, 1997). When children are acquiring new skills and at the same time forming beliefs about their capabilities, they may be especially sensitive to the feedback and social support they receive with regard to their skills. At this stage, children experiencing that they receive less of this kind of support seem to be harmful. In reading, experienced lack of feedback and support from significant others (teacher, parents, peers) and, more importantly, the loss of this support over time are found to relate to children's decreasing self-efficacy over time (Peura et al., 2021). These findings underline the importance of continuous and explicit social support for learning from teachers and parents.

Vicarious experiences—that is, observing others performing well, such as peers and teachers—inform students of their own capabilities as well. The influence of social models is assumed to be especially important when students have low confidence or little experience in the task in question (Bandura, 1997). However, in meta-analyses, this source has been found to be related only weakly or not at all to students' self-efficacy (see Byars-Winston et al., 2017). Still, rather little is known of the role of this source in reading. Butz and Usher (2015) found that students with high self-efficacy reported vicarious experiences in reading more often than students with low self-efficacy. In younger children, children who reported fewer vicarious experiences over time decreased in confidence in their own capabilities in reading over the year (Peura et al., 2021). To ensure that all children could experience positive reading models, more knowledge of whom children perceive as vicarious models in reading would be needed. For low-performing children, coping models may be especially beneficial (Pajares, 2006).

Interpretations of *physiological and emotional states*, such as anxiety, tension, stress reactions or joy, also affect students' self-efficacy. Strong negative emotional reactions (such as anxiety) are likely interpreted as a sign of incapability, but we still have rather little understanding of the role of this source in reading. Butz and Usher (2015) found that students reported few physiological and emotional experiences in reading, and these experiences did not differ between low and high self-efficacy students. When students were explicitly asked to rate their level of reading-related negative arousals (Peura et al., 2021) or were asked about their feelings while reading a challenging book (Klauda et al., 2020), some expressed high negative arousal toward reading or stated that they were nervous while reading. Negative arousal in reading situations was found to relate also to lower beliefs of one's reading capabilities (Peura et al., 2021). Conversely, those students who reported little and, over time, diminishing negative arousal in reading became more confident of their own reading capabilities over a year. The role of negative emotions, such as anxiety, for learning and self-efficacy has been acknowledged, especially in mathematics (Sorvo et al., 2017; see also Barroso et al., 2020). Recent findings indicate that anxiety can also be specific to reading (Ramirez et al., 2019). If a child feels anxious during reading, it may hamper learning in various ways—for example, by loading working memory and hindering concentration and engagement, which may make the child feel that she/he is less capable of learning. Reducing negative arousals in reading situations calls for sensitive practices and the creation of a safe atmosphere for all kind of emotions to be expressed.

Intervening Children's Reading Self-efficacy Through the Four Sources

Given the importance and positive effects of children's ASE for their learning and reading activities, it is essential to ask how reading self-efficacy can be supported, and whether self-efficacy can be promoted by providing experiences and support through the four sources of self-efficacy as proposed in social cognitive theory (Bandura, 1997). In general, interventions targeting self-efficacy are found to be effective and gain change in reading self-efficacy (Unrau et al., 2018). In their meta-analysis Unrau et al. (2018) found that interventions that targeted two or three of the theorized sources of self-efficacy were more effective to change self-efficacy than those that targeted only one source or other issues (such as learning goals). However, none of the reviewed studies targeted all four sources of self-efficacy. In addition, the way how self-efficacy was measured was found to affect the changes revealed in self-efficacy: ASE assessed with regard to specific reading contexts and tasks were more sensitive to change than general beliefs (Unrau et al., 2018). Most of the included studies assessed ASE or related constructs (such as self-concept), and reading self-efficacy was explicitly assessed in a few studies. In the following, we will present findings of an intervention study that targeted reading self-efficacy by explicitly supporting the

four sources of self-efficacy (see Aro et al., 2018) in more detail as, to our knowledge, this is the first intervention study to target the four sources of reading self-efficacy.

The reading self-efficacy intervention focused on primary school children from grade levels 2–5, who participated in a 12-week self-efficacy intervention targeting both self-efficacy and reading fluency. This "self-efficacy group" was contrasted with the "skill group", which received intervention focused solely on reading fluency support. Children with difficulties in reading were selected for the intervention, as children who constantly struggle with their learning seem to be more vulnerable to decreased motivation and low beliefs in their skills (Klassen, 2007). They may also have less positive efficacy-building experiences (Paananen et al., 2019; Usher & Pajares, 2008). In addition, the beliefs of low-performing children are likely challenging to intervene in, as difficulties in reading tend to be permanent (Torppa et al., 2015) and views of oneself tend to maintain.

Children in the self-efficacy intervention were explicitly provided positive experiences of the four theorized sources of self-efficacy (for a more detailed description of the intervention, see Aro et al., 2018). To provide *mastery experiences*, individually challenging but reachable tasks adapted to each child's skill level were used. Mastery experiences were further supported by directing children's attention to their own improvement and recognizing the improvement by providing concrete visual feedback of the progress and improvement during training. The aim was to help the child to interpret the learning experiences as experiences of mastery in reading, which was further supported by the feedback that was given by the teacher and peers. Accordingly, to provide *verbal persuasion*, positive, explicit, systematic and concrete feedback was given on each child's practice, effort, and particularly on improvement. Feedback was given for improvement connected to the ability to learn and for the effort and persistence during learning. *Vicarious experiences* were assured with working groups of peers with an equal level of reading, and children's attention was focused on the improvements of others and peer feedback (mastery and coping models). Moreover, children were encouraged to compare their performance to their own previous performance, not to the performance or improvements of other children. *Emotional and psychological states* were considered by making these emotions visible by naming them, discussing learning-related emotions through stories and encouraging children's own observations and comments on their reading performance, emotions and practice. In addition, opportunities to express feelings toward practice were provided. Reading self-efficacy interventions have rarely explicitly targeted emotional experiences. Emotional arousals may, however, remain unnoticed in normal teaching procedures—likely unintentionally. Teachers are found to acknowledge students' negative emotions and failure expressions, by giving them inexplicit positive feedback ("Yes, you can") rather than explicitly discussing the reasons behind these expressions (Vehkakoski, 2020). Therefore, specific attempts to focus and give time to the learning-related affective arousals and the interpretation children give to these experiences may be needed. Especially if the child subsequently struggles with learning and performs poorly in comparison with classmates, it may be hard to see one's own progress, which may evoke negative emotions.

Most importantly, children receiving explicit self-efficacy support improved more in their self-efficacy than the group receiving only skill support (for more details, see Aro et al., 2018). In addition, the change in self-efficacy accounted for significant variation in reading fluency gains during the intervention only in the self-efficacy group, although children in both groups improved in their reading fluency. The findings thus implied that supporting motivation and reading skills together can have benefits in comparison with targeting merely the skills of a learner. This may be especially true for the struggling readers. Accordingly, improvement only in achievement may not be enough to yield positive changes in self-efficacy, at least during the limited observation period. The skill improvement may not transfer to the experiences of mastery automatically if the child has not experienced that he/she has improved. Rather, children seem to benefit from specific attempts to provide concrete evidence and feedback of children's progress that enables them to see their progress and improvement, as well as helps them to link the amount of effort to that improvement. These kinds of supports can help children to see both their skills and their beliefs in their skills as malleable and challenge their views of themselves. Teachers' sensitivity to the interpretation children give of learning experiences as well as to their affective arousals in learning situations is essential in providing this support. Children with high self-efficacy are found to benefit also from reading skill support more (Ronimus et al., 2020). High efficacy beliefs may help children to see and recall their progress and also to interpret their achievements as successes, which may boost them to achieve further.

Future Considerations in Reading Self-efficacy Research

Although the understanding of the role of reading self-efficacy in children's reading development is continuously increasing, some caveats have remained. One such issue is the individual processes of how self-efficacy functions in learning and the individual experiences children gather in their learning environments. As discussed earlier, a person-centered approach may be one way to enhance understanding of the individual processes and the ways self-efficacy affects reading behaviors and skill development. Children may also be differently responsive to self-efficacy support. Some children may have low reading skills but high self-efficacy to use the skills, whereas others may not struggle with the reading skills but more with their confidence in using their reading skills. These two groups of children would likely need different kinds of support and benefit from different kinds of interventions.

Individual differences also relate to the miscalibration of self-efficacy (Hattie, 2013; Klassen, 2007): That is, children may be excessively under- or overconfident of their skills. Some students may have low reading skills but still hold high beliefs about their skills, or vice versa. For such students, the association between beliefs and skills might be negative. Thus, although in general the relation between self-efficacy and reading skill is positive, the average association may mask important individual variation in this relationship. The effects of miscalibration on children's performance

and learning in reading are largely unknown. Miscalibration may also offer one explanation for the finding that, despite the overall positive effects of reading self-efficacy interventions, all children are not found to improve their reading self-efficacy during interventions (Aro et al., 2018; Unrau et al., 2018). For overconfident students, which low-performing students are particularly likely to be, the mere improvement in beliefs may not even be a desirable outcome. Some children might actually benefit more from better calibrated—that is, more realistic—beliefs and observations of their reading performances, rather than higher efficacy beliefs. Overly optimistic beliefs can be harmful if they lead to maladaptive learning behaviors, such as lack of effort and persistence. Whether aims to support self-efficacy can help students to better calibrate their self-efficacy has been rarely explored. While the benefits of high self-efficacy have received the most attention in the self-efficacy literature, researchers' understanding of what is the most adaptive level of self-efficacy that enables children to use their potential in reading and cultivates their learning, motivation and overall well-being still needs fine-tuning.

Efficacy beliefs seem to influence reading development from early on. Still, understanding of how early these beliefs actually develop and how they form is limited. Increasing comprehension of the early reading-related experiences and on how children gather these experiences from their environments—that is, how they select, weight and integrate the experiences—could help us to better design targeted support to provide positive experiences related to reading. Advancing understanding of for whom the experiences are particularly beneficial and needed could help us in this effort. For example, children with learning difficulties might especially need individualized support to have access to positive source experiences (Paananen et al., 2019). Enriched understanding of how apt children are overall in changing their beliefs, and how quickly changes—for example, in pedagogical practices (differentiated tasks, supportive feedback)—change children's experiences and self-appraisals could be gained with more intensive data collection (e.g., time series, experience sampling).

At the moment, changes in learning environments, such as new technology-enhanced learning environments and distance learning, challenge the ways educators monitor learning, give feedback to students and support their learning. For example, students' failure expressions and emotional reactions may remain unnoticed in these environments. On the other hand, these environments can open up new opportunities for support, as the adaptive environments, for example, often enable monitoring of the individual learning process better, which creates opportunities for increased individual feedback. The ideas of social cognitive theory could be used in implementing support for learning and motivation in these environments. Among adult learners, self-efficacy support in online learning environments is found to be beneficial for their learning (Huang et al., 2020). Learning and reading in these environments are continuously increasing. As young readers navigate online environments, they also need support for their motivation and confidence.

Conclusions

In the first years of school, positive beliefs about one's capabilities as a reader seem to boost for better reading performance. This implies that educators should be attentive to children's beliefs and aim to identify those children who already have low confidence in their skills at the beginning of schooling. In this chapter, we emphasized the idea that a closer look at how reading self-efficacy is measured can help us understand the variation in children's efficacy beliefs as well as their functional role in reading. To get better insights into the fluctuations in children's beliefs in the moment as well as over their development, we should try to capture the very beliefs that come into play in reading situations. Social cognitive theory works well as a standpoint to design support for struggling readers. Providing positive learning experiences through the four sources of self-efficacy is a beneficial way to support children's beliefs. An increased understanding of the variation in children's experiences could help us to understand how children respond to pedagogical practices and what kind of support is most beneficial, both for reading development and for children's self-efficacy. Researchers and practitioners need to continue studying how to best support young readers, as children's beliefs can either engage or disengage them toward reading activities.

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Chapter 9
Self-efficacy in the Classroom: The Roles of Motivation, Positivity and Resilience

Clare Wood, Carlo Tramontano, and Suzannah Hemsley

Abstract Self-efficacy has been found to be consistently related to academic achievement. In a recent analysis of a nationally representative sample of over 3000 UK school children aged 7–12 years old, we found that self-efficacy is one of the four dimensions of children's classroom-related well-being and motivation to learn. In this chapter, we will examine the extent to which children's self-efficacy (academic, emotional and social) can be explained by individual differences in motivation, positivity and resilience and whether these patterns are influenced by the age and gender of pupils. We found that positivity and resilience contributed to the children's self-efficacy beliefs in all three domains, but there was a separation of contribution when we considered extrinsic and intrinsic motivation in relation to self-efficacy: specifically, intrinsic motivation contributed to the children's emotional and academic self-efficacy only, whereas extrinsic motivation contributed to social self-efficacy.

Keywords Self-efficacy · Motivation · Positivity · Resilience · Well-being · Attitudes

Introduction

Self-efficacy refers to the beliefs that individuals hold about their own ability to produce a particular outcome or result, such that they are able to affect events or actions that are likely to impact their own lives (Bandura, 1994, 1997, 2001). Bandura suggests that there are four sources of influence on the self-efficacy of individuals. The first is direct experience of success—where an individual experiences a positive outcome, this helps to build a positive sense of self-efficacy. Where failure is experienced, this can erode or damage self-efficacy. A second source of self-efficacy comes from observing others who are similar to us and learning from their experiences of

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success and failure. These vicarious experiences are internalised and influence our own sense of self-efficacy in those situations. A third source is that of social persuasion—it is possible to impact self-efficacy if we can persuade an individual that they will be successful. However, verbal appeals can be easily undermined if they are unrealistic or if the individual has negative experiences. As a result, persuasion is most likely to be effective if it is in the context of a controlled situation where experience of failure can be minimised and success is experienced. Finally, a fourth influence on self-efficacy is a person's emotional reaction to a situation—minimising stress and changing their negative interpretation of any emotional or physiological reactions to a situation can support the development of a sense of self-efficacy. For children, school is an important context that informs children's developing sense of self-efficacy, because it is a context where success and failure are experienced and to some extent controlled by the learning environment created, and children are grouped with others similar in age and ability who will also inform self-efficacy beliefs.

By explaining the different sources of influence, Bandura further stressed that self-efficacy should not be understood as a stable personality trait that changes little—if at all—over time. Nor should it be seen as having a generalised impact on any domain of life. Instead, self-efficacy is malleable and is likely varied across different aspects of an individual's life. For instance, an individual might be highly self-efficacious in sport, but have very low self-efficacy when it comes to public speaking. And even within the same realm of life, such as education and school, focussing only a single domain of self-efficacy might result in a partial understanding of individuals' experiences (Bandura, 1997).

Self-efficacy can be examined in the context of specific domains of competence, and we have specifically been interested in three domains that seem to be of particular relevance to school-age children: academic self-efficacy, emotional self-efficacy and interpersonal self-efficacy. Academic self-efficacy relates more specifically to our beliefs about our competence in the arena of academic performance. Hence, this is a domain more strictly related to the cognitive component of educational experiences. However, emotional and social domains are equally relevant to school life. Emotional self-efficacy relates to our beliefs about our ability to recognise, understand and regulate our emotions. And social self-efficacy relates to our beliefs about how well we can relate to others and be successful in social interactions and situations.

Self-efficacy in Children and the Role of Motivation

There is a literature that has demonstrated that a relationship exists between academic achievement and children's sense of self-efficacy both concurrently and over time, which is both direct and indirect through other related factors (e.g. Carroll et al., 2009; Ferla et al., 2009; Hwang et al., 2016; Komarraju & Nadler, 2013; Motlagh et al., 2011). However, the bulk of child-based research into this topic has focussed on high-school students (children aged 11–18) and less is known about the nature

of self-efficacy in academic settings for children who are at an earlier stage of their schooling.

Although there are some methodological challenges associated with the use of self-report measures in younger children, some work in the area of young children's self-efficacy has been undertaken. However, like the work conducted with older students, this literature still shows that there is a link between young children's sense of self-efficacy and their academic behaviours, although the focus has tended to be on basic skills and reading/literacy outcomes in particular. For example, Wigfield and Guthrie's (1997) study of fourth and fifth-grade children in the USA found that the children's sense of self-efficacy in relation to reading ability was positively related to the amount of reading and breadth of reading that the children undertook. It should be noted that Wigfield and Guthrie conceptualised reading self-efficacy as a component of the children's motivation to read, but we suggest that it is perhaps better thought of as an outcome of motivated reading (in line with Bandura's conceptualisation of self-efficacy), rather than part of motivation itself. For example, there is evidence from a five-year longitudinal study of Korean children that there is a stronger relationship between self-efficacy and previous academic attainment than there is between self-efficacy and future academic achievement in high-school students (Hwang et al., 2016). In other words, self-efficacy is the product of previous educational experiences. Perhaps worryingly, the Hwang et al. study also points to diminishing returns over time—suggesting that the contribution of self-efficacy to academic attainment will progressively lessen, although this may be because other variables become more significant influences as children develop.

Another study that examined self-efficacy in younger children was that of Wilson and Trainin (2007); they found that first-grade children differentiated between their self-efficacy for reading, writing and spelling and found that there was evidence of an indirect relationship between self-efficacy and reading achievement, which was mediated by the children's attributions in relation to their achievements, with children making internal attributions (i.e. recognising their own effort in their success) having better achievement than children who attributed their success to external factors. Moreover, Liew et al. (2008) found a relationship between academic self-efficacy in second grade and reading and maths outcomes in third grade. Similarly, Lee and Johnson-Reid (2016) found that children's task-related self-efficacy explained individual differences in their reading achievement in their sample of urban elementary school children, and this was mediated by the children's motivation (but not their classroom behaviour).

In summary, there is a limited but promising literature examining self-efficacy in primary school-aged children, and that literature suggests that self-efficacy has a role to play in children's academic attainment (in reading in particular). There also appear to be associations between motivation and self-efficacy, such that motivation measures appear to mediate the relationship between self-efficacy and attainment in some analyses. However, we suggest that there is a need to separate out measures of intrinsic and extrinsic motivation in order to understand the way in which self-efficacy and motivational processes interact. This is because at school much of children's behaviour is managed through the use of extrinsic reward systems, whereas the

goal of education is to establish self-motivated learning practices, which can be undermined by systems of reward and punishment. Understanding the contribution of these two forms of motivation to self-efficacy has potential implications for how educators organise school settings for young children.

Self-efficacy and Well-Being: Positivity and Resilience

Our interest in this area stems from increasing concerns in the UK around student well-being and the increased responsibility being placed on schools for the children in their care. To support them to do this, we contributed to the development of the Wellbeing and Attitudes to Learning Survey (RS Assessment, 2019). The development of the items for this tool resulted in the identification of four broad dimensions: self-efficacy, motivation, positivity and resilience. So far we have discussed self-efficacy and motivation, but there is also a need to better understand how positivity and resilience might contribute to individual differences in self-efficacy amongst younger learners.

Self-esteem, optimism and satisfaction have been suggested to represent the facets of a higher-order individual disposition referred to as *positivity*, representing 'an individual propensity to positively evaluate or to be positively oriented towards various life domains including oneself, and one's future and past experiences' (Caprara et al., 2009, p. 277). The academic literature into positivity has increasingly provided evidence of the role positivity plays in promoting well-being and adjustment (e.g. Alessandri et al., 2012; Caprara et al., 2019; Luengo Kanacri et al., 2017; Zhou et al., 2021). However, a recent contribution has provided initial evidence that the impact of positivity on performance (i.e. in-role and extra-role behaviour at work; grades and academic citizenship behaviour) is most likely mediated—at least partially—by individuals' self-efficacy beliefs (Barbaranelli et al., 2019). In particular, while positivity might predispose individuals to a positive evaluation of events across different domains, self-efficacy beliefs 'allow individuals to translate this general positive proneness into operative beliefs that take into account both the specificity of external requests (…) and the self-regulative abilities needed to deal with those requests' (Barbaranelli et al., 2019, pp. 722–3). Based on these premises, we argue that self-esteem, optimism and satisfaction should be significantly positively associated with self-efficacy beliefs in all three domains of interest (i.e. emotional, interpersonal and academic).

Resilience is operationalised as positive adaptation in the face of adversity (Riley & Masten, 2005), with the emphasis placed on sustained adaptation or recovery to an adequate level of functioning. There has been more interest in the interrelationships between self-efficacy and resilience in younger children. For example, Cowen et al. (1991) found that fourth to sixth-grade children who had experienced adversity and who had been classified as 'stress resilient' showed higher self-efficacy scores than children who were classed as 'stress affected'. Hamill (2003) similarly categorised high-school students and found evidence that self-efficacy was a factor that

differentiated 'resilient' children from 'maladaptive' ones, and Martin and Marsh (2006) also found self-efficacy to be one of the key characteristics of academically resilient Australian high-school children. As with the literature on self-efficacy, we find that much of the developmental literature on resilience has also focussed on the performance of high school rather than primary/elementary school children.

Rationale

We argue that there is a need to understand what contributes to young children's sense of self-efficacy beyond prior achievement. Specifically, we were interested in how different aspects of positivity, resilience and motivation mapped onto three forms of self-efficacy: emotional, interpersonal and academic in a sample of UK school children aged between 7 and 11 years. To do this, we have re-examined the data we used to develop the *Wellbeing and Attitudes to Learning Survey* to find out what these data can tell us about the relationship between self-efficacy and the other dimensions of well-being and learning, because there has been only limited research looking at self-efficacy in primary school-aged children. We were particularly interested in disentangling some of the subcomponents of 'motivation' and 'positivity' in order to achieve a better theoretical understanding of how self-efficacy interrelates with them at this developmental time point. In line with existing studies, we expected motivation, positivity and resilience to predict variance in self-efficacy, and we expected the age and gender of the children to also exert an influence on self-efficacy scores, in line with previous literature that has shown gender differences with respect to self-efficacy (see Schunk & Pajares, 2002) and age-based effects showing declines in self-efficacy over time (e.g. Caprara et al., 2008).

Methodology

Participants

The focus of the Wellbeing and Attitudes to Learning Survey was on children who are in 'Key Stage 2' classrooms—this means that the children were aged between 7 and 11 years of age at the time of taking the survey, as Key Stage 2 covers four age groups of children: Year 3 (7–8 years old); Year 4 (8–9 years old); Year 5 (9–10 years old) and Year 6 (10–11 years old).

A nationally representative sample of schools was recruited to participate in the development of the tool and subsequent data uses by RS Assessment, and ethical permission was granted by Nottingham Trent University's Ethics Committee for secondary data analysis of the data obtained.

The analyses were conducted on a sample of Key Stage 2 children of 3799 students, of which 1875 (49.4%) were female and 1924 (50.6%) were male. In terms of age group distribution, there were 875 (23.0%) from Year 3; 881 (23.2%) from Year 4; 1056 (27.8%) from Year 5; 948 (25.0%) from Year 6 and 39 (1%) not reporting the information.

Data Collection Procedure

The children completed the Wellbeing and Attitudes to Learning Survey items online, via a Qualtrics link, as part of the development and finalisation of the survey that is now commercially available. The children completed the survey at school, under the direction of school staff, who were given the following instructions to follow:

> *Explain to the children that: "You are helping to develop a special questionnaire which will be used to see how much children enjoy school. You are going to be asked to answer each question VERY HONESTLY". Ensure that the children understand what 'honest answering' means via a short discussion before continuing. Please don't be tempted to hover over the children or otherwise try to see what their responses are as they complete the questionnaire. Ask the children to put their hand up when they have finished it so that you know who can be returned to class. Please do not allow the children to discuss their answers or look at each other's responses.*

At this stage, the Wellbeing and Attitudes to Learning Survey comprised 47 items and would later be refined to a final set of 41 items. However, for this chapter, we have chosen to focus on a subset of 29 items that enabled us to examine our main research question of interest.

Plan of Analyses

Descriptive statistics were initially investigated to examine the normal distribution of the measures. In particular, skewness and kurtosis were tested, with values $< |1|$ indicating a good approximation to normality. Reliability of the measures was assessed using factor score determinacy (FSD), with value greater than 0.70 considered satisfactory and excellent approaching one. Since there were no specific expectations on the pattern of relationships based on the literature, a saturated model was initially posited and explored (see Fig. 9.1), using path analysis implemented in MPlus.

Results were explored, and the model was then re-specified fixing to zero the non-significant paths. The fit of the re-specified model was evaluated examining multiple fit indices (Hu & Bentler, 1998, 1999; Tanaka, 1993). In particular, we considered the following with their corresponding cut-off value: (1) chi-square, expected to be not significant in model adequately fitting the data, although potentially sensitive to the sample size; (2) comparative fit index (CFI), with values greater than 0.95 considered excellent (Bentler, 1990; Hu & Bentler, 1999); (3) root mean square

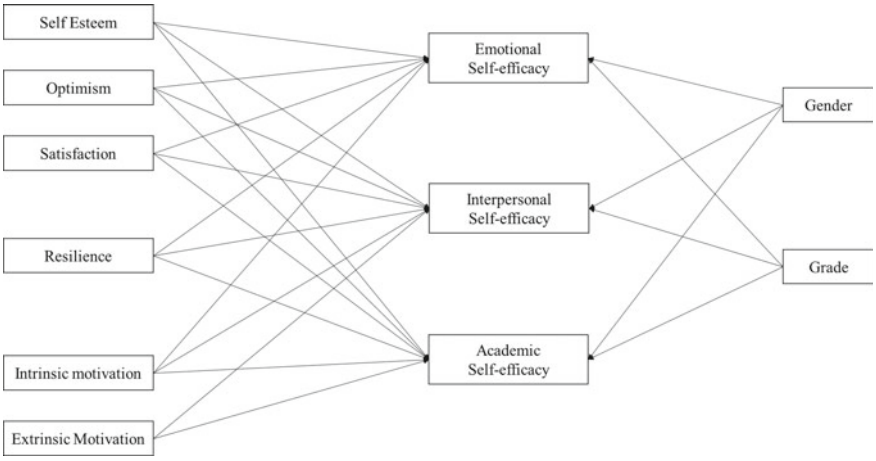

Fig. 9.1 Posited model

error of approximation (RMSEA), with values lower than 0.05, associated with a not-significant test of close fit, considered excellent (Browne & Cudek, 1993; Steiger, 1990); (4) standardised root mean square residual (SRMR), with values lower than 0.08 considered excellent (Hu & Bentler, 1998, 1999; Joreskog & Sorbom, 1993).

Self-efficacy comprised 11 indicators covering three key domains: *emotional, interpersonal and academic*. *Emotional self-efficacy* was assessed with four items (FSD = 0.90). The items were averaged to obtain a composite score, which was normally distributed (skewness = − 0.41; kurtosis = − 0.27). *Interpersonal self-efficacy* was assessed with three items (FSD = 0.92). The items were averaged to obtain a composite score, which was normally distributed (skewness = − 0.55; kurtosis = − 0.13). *Academic self-efficacy* was assessed with four items (FSD = 0.911). The items were averaged to obtain a composite score, which was normally distributed (skewness = − 0.39; kurtosis = − 0.29).

Motivation was assessed by six items, focussing on intrinsic motivation and extrinsic motivation. Specifically, *intrinsic motivation* was assessed with three items (FSD = 0.92). The items were averaged to obtain a composite score, which slightly deviated from normal distribution (skewness = − 1.68; kurtosis = 2.84). *Extrinsic motivation* was assessed with three items (FSD = 0.87). The items were averaged to obtain a composite score, which was normally distributed (skewness = − 0.34; kurtosis = − 0.87).

Positivity comprised indicators *of self-esteem, optimism and satisfaction. Self-esteem* was assessed with three items (FSD = 0.89). The items were averaged to obtain a composite score, which was normally distributed (skewness = − 0.98; kurtosis = 0.75). *Optimism* was assessed with three items (FSD = 0.95). The items were averaged to obtain a composite score, which marginally deviated from normal distribution (skewness = − 1.17; kurtosis = 1.14). *Satisfaction* was assessed with three items

(FSD = 0.94). The items were averaged to obtain a composite score, which was normally distributed (skewness = 1.03; kurtosis = 0.38).

Resilience was assessed with three items (FSD = 0.94). The items were averaged to obtain a composite score, which was only marginally skewed (skewness = − 1.10; kurtosis = 0.88).

Results

Since few of the measures presented some minimal deviation from normality, the path analysis models were implemented using maximum likelihood with robust standard errors (MLR). The final model presented in Fig. 9.2 showed an excellent fit: $X^2(5) = 8.71$, $p = 0.12$; CFI = 0.999; RMSEA = 0.014 (0.000–0.029), $p = 1$; SRMR = 0.006.

The results, in particular, highlighted that:

- Emotional self-efficacy is significantly and positively associated with self-esteem ($\beta = 0.25$), optimism ($\beta = 0.19$) and resilience ($\beta = 0.31$), while negatively with intrinsic motivation ($\beta = -0.10$) and gender ($\beta = -0.06$). Overall, the model explains 33.6% of the variability.
- Interpersonal self-efficacy is significantly and positively associated with self-esteem ($\beta = 0.16$), optimism ($\beta = 0.21$), satisfaction ($\beta = 0.08$), extrinsic motivation ($\beta = 0.08$) and resilience ($\beta = 0.22$), while negatively by gender ($\beta = -0.04$). Overall, the model explains 35.4% of the variability.

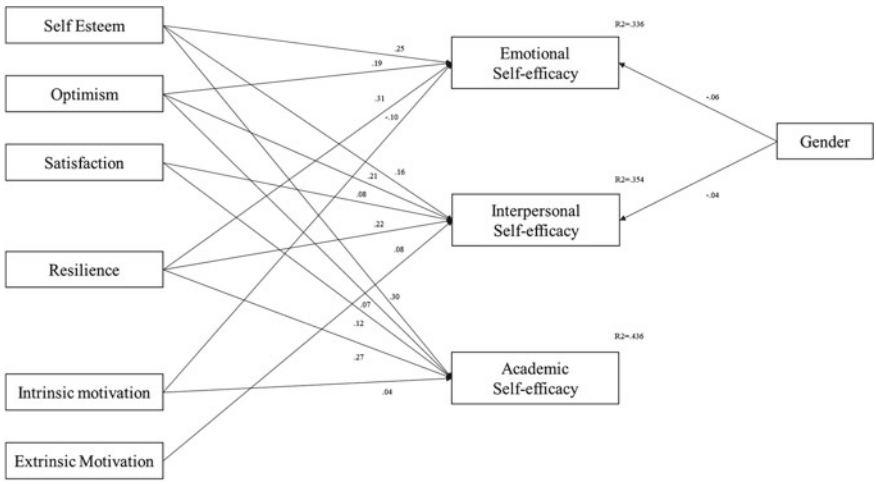

Fig. 9.2 Final model

- Academic self-efficacy is significantly and positively associated with self-esteem ($\beta = 0.30$), optimism ($\beta = 0.07$), satisfaction ($\beta = 0.12$), intrinsic motivation ($\beta = 0.04$) and resilience ($\beta = 0.27$). Overall, the model explains 43.6% of the variability.

Gender was found to have a significant but small influence on emotional ($\beta = -0.06$) and interpersonal self-efficacy ($\beta = -0.04$), but no significant effects of year group were observed.

Discussion

This chapter presents novel analyses which consider how positivity, resilience and motivation contribute to individual differences in three sub-domains of self-efficacy, which we argue are of significance to school experiences in English children aged between 7 and 11 years. A finding of note was that intrinsic motivation was related to the children's self-efficacy beliefs in ways that were distinct from that observed for extrinsic motivation. Specifically, indicators of intrinsic motivation were predictive of the children's emotional self-efficacy (emotional self-regulation beliefs) and their academic self-efficacy, whereas extrinsic motivation was only related to interpersonal self-efficacy. In other words, children who are self-motivated learners hold more positive beliefs about their ability to emotionally self-regulate at school and believe that they will be more successful academically. In contrast, children who report higher levels of extrinsic motivation were more likely to hold beliefs that they were effective in controlling and maintaining social relationships in the school context. What this indicates is that extrinsic motivation in this age group is tied to pupils' beliefs about their ability to manage the teacher–student relationship successfully and is not related to pupils' beliefs about their academic competence or emotional self-management. This has implications for classroom settings where extrinsic reward systems are used with the intention to motivate children to engage with learning; the data suggest that children who respond to such incentives are those who have a stronger sense of social competence. So, while they may be effective in managing pupil behaviour, they are not necessarily effective in impacting pupils' beliefs about managing academic tasks well or regulating their emotions.

The results largely confirm our hypotheses about the relationship between positivity subcomponents (i.e. self-esteem, optimism and satisfaction with life at school) with self-efficacy beliefs. In particular, the path analysis consistently highlighted significant and positive associations, with the only exception of being the path between satisfaction and emotional self-efficacy. This specific finding is, nevertheless, in line with previous studies mostly linking satisfaction with academic self-efficacy and interpersonal behaviour (e.g. Diseth et al., 2012; Huebner et al., 2014). These results further support the association between positivity and multi-domain self-efficacy consistent with literature, suggesting a mediational role of self-regulatory capabilities in relation to performance and adjustment (Barbaranelli et al.,

2019). Hence, while it is important to create an educational environment supportive of a positive mindset, it is equally important to promote the development of self-efficacy, not only in the cognitive domain (e.g. academic, or subject specific such as reading, or math self-efficacy) but also in the emotional and social domain.

Resilience was also found to be related to all three forms of self-efficacy beliefs assessed within our survey, which is consistent with findings from studies of resilience in older children (e.g. Cowan et al., 2010; Hamill, 2003; Martin & Marsh, 2006). Consistent with the view that self-efficacy is the product of past experience, it makes sense that children who reported a stronger sense of resilience also held strong beliefs about their own sense of self-efficacy in multiple domains. It would be interesting to study this longitudinally within Key Stage 2 children to see whether these relations are reciprocal and to better understand where there is scope for intervention within this age group.

In this age group, we found that gender differences appear to be significant but very small, which seems in line with literature on emotion expression (Chaplin & Aldao, 2013). We did not find a significant year group difference. It would be relevant to follow the development of self-regulation beliefs and capabilities over time in particular at the transition to secondary education, when gender and age differences are more likely to become apparent (see Schunk & Pajares, 2002).

There is scope for more intervention-based work with this age group to support the development of self-efficacy through the management of motivational environments and by supporting schools to develop 'positive classrooms', which will foster increased levels of hope, optimism and satisfaction with school. With the self-efficacy and resilience relationship, we suggest that growth in these beliefs and responses to adversity are likely to be reciprocal, and consideration could be given to using self-efficacy training as a route into fostering resilient mindsets in children at this age.

To summarise, we have found in a nationally representative sample of English children aged 7–11 years that three domains of self-efficacy (emotional, interpersonal and academic) are explained by individual differences in children's positivity (self-esteem, optimism, satisfaction) and resilience. Intrinsic motivation can account for the children's academic and emotional self-efficacy beliefs, but extrinsic motivation is related to the children's beliefs about interpersonal self-efficacy.

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Chapter 10
Promoting Online Student Persistence: Strategies to Promote Online Learning Self-efficacy

Jacqueline S. Stephen and Amanda Rockinson-Szapkiw

Abstract Persistence in an online course is associated with several factors (Chu and Chu in Comput Educ 55:145–154, 2010; Prior et al. in Internet High Educ 29:91–97, 2016; Zimmerman and Kulikowich in Am J Distance Educ 30:180–191, 2016), including online learning self-efficacy (Bandura in Self-efficacy: the exercise of control. Freeman, 1997; Stephen et al. in Am J Distance Educ, 2020; Tinto in Leaving college: rethinking the causes and cures of student attrition, 2nd edn. University of Chicago Press, 1993; Tinto in J College Student Retention Res Theory Pract 19:254–269, 2017; Zimmerman and Kulikowich in Am J Distance Educ 30:180–191, 2016). Students with strong online learning self-efficacy are confident in their ability to use technology, manage their time to ensure course work is complete, and to navigate the online learning space successfully (e.g., submit assignments, watch online videos, and participate in an online discussion forum); therefore, they are more likely to persist. Drawing from an extensive review of the literature, the authors of this chapter define online learning self-efficacy and then discuss high-impact interventions related to this construct. While high-impact practices (HIPs) to improve student success, including persistence, in residential university and college settings are well established, little research on high-impact practice experiences for online settings exists (Kuep in High impact practices in online education: research and best practices. Stylus, 2018). This chapter, thus, provides discussion in this much-needed area and presents a model for a HIPs First-Year Seminar that focuses on promoting online learning self-efficacy and other human agency-related elements.

Keywords Online learning environment · Self-efficacy · Persistence · Non-cognitive

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Introduction

Persistence in an online course is associated with several factors (Chu & Chu, 2010; Prior et al., 2016; Zimmerman & Kulikowich, 2016), and online learning self-efficacy (Bandura, 1997; Tinto, 1993, 2017; Zimmerman & Kulikowich, 2016) continues to emerge in the literature as one factor necessary for online student persistence (Stephen et al., c). Self-efficacy involves a student's belief in "… their capabilities to organize and execute a course of action required to attain designated types of performances" (Bandura, 1986, p. 391). Online learning self-efficacy is a student's confidence in his or her capabilities to complete a course online. Online learning self-efficacy includes several areas, such as technology use, time management, and learning (Zimmerman & Kulikowich, 2016). Students with strong online learning self-efficacy are confident in their ability to use technology, manage their time to complete course work, and navigate the online learning space efficiently (e.g., submit assignments, watch online videos, and participate in an online discussion forum).

A review of the literature reveals specific strategies that online instructors and designers can use to promote students' online learning self-efficacy (Bartimote-Aufflick et al., 2016). These strategies include but are not limited to creating opportunities for peer interactions, encouraging reflection about online learning, optimizing the use of technology, providing information about online learning, providing low stakes activities to familiarize students with the online space, and providing timely encouragement and feedback. Therefore, this chapter provides a discussion about online learning self-efficacy and strategies to promote it. The chapter ends with a proposal for an online high-impact practice to support online self-efficacy (Gargallo et al., 2016; Wernersbach et al., 2014).

A Description of Online Self-efficacy

Research over the past several decades has demonstrated that attrition among students in online environments is higher than in residential environments (Ali & Leeds, 2009), and attrition is consistently associated, in part, with lack of self-efficacy (Lee & Choi, 2011). Alternatively, persistence in online learning environments has been associated with high online learning self-efficacy (Stephen et al., 2020). Therefore, understanding online learning self-efficacy and how to promote it is critical to improving online education and students' persistence in it.

For this chapter, online learning self-efficacyis defined as a student's belief in his or her capacity to execute behaviors and exert control over the social factors necessary to learn within the online environment (Bandura, 1977, 1997). This cognitive self-evaluation influences students' online learning experiences, including the learning goals they strive for, the amount of energy they expend toward their learning goals, and the likelihood of success and persistence in an online course (Zimmerman, 2002).

The concept of online learning self-efficacy has evolved as online learning has developed and progressed. Technology self-efficacy, computer self-efficacy, Internet self-efficacy, and learning management systems (LMS) self-efficacy (Kuo et al., 2014; Martin et al., 2010; Miltiadou & Yu, 2000; Pellas, 2014; Tang & Tseng, 2013) are terms researchers have used to refer to online learning self-efficacy or dimensions inclusive of the construct, for online learning self-efficacy is context-specific (Bandura, 1986), encompassing at least three dimensions (Zimmerman & Kulikowich, 2016):

- Technology (i.e., synchronous and asynchronous communication tools, overcoming technical issues, and accessing and using online support and resources),
- Learning management (i.e., meeting deadlines, overcoming procrastination and barriers, and planning), and
- Online learning environment and interactions (i.e., navigating the LMS, initiating learning, conducting online research, and completing individual and collaborative work online; seeking help from online support systems for research, tutoring, advisement, etc.).

The three dimensions demonstrate that online learning necessitates more than just skills to use technology. Knowing how to use technology or being confident in using technology will not automatically transfer to confidence and success in online learning. Students need to develop self-efficacy technology skills to persist and successfully complete online courses and programs. And, self-efficacy is something that can be developed.

Fortunately, theorists, such as Tinto (2017) and Bandura (2001), argue that self-efficacy can be learned or acquired through deliberate practice and interactions; it is not inherent. A student does not simply have online learning self-efficacy; he or she can learn it. Online learning self-efficacy can be cultivated through interactions and interventions the university or college provides. However, it is not simply learned through enrollment in an online course. Rather, it needs to be intentionally cultivated through a targeted intervention that promotes self-efficacy and other cognitive and non-cognitive competencies associated with it.

Sources of Self-efficacy in an Online Learning Environment

When developing targeted interventions aimed at building online learning self-efficacy, understanding the sources that cultivate it is essential. Bandura (1997) identified specific sources from which self-efficacy is developed, and these include mastery experiences (also known as performance accomplishment), vicarious experiences, verbal persuasion, and physiological and affective states.

Mastery experiences are experiences associated with online learning experiences. Mastery experiences are the most influential source of efficacy because they provide authentic evidence of whether a student can succeed. For example, a first-time online

student successfully logs into a learning management system and uploads an assignment. This mastery experience is likely to help the student build confidence that they can succeed in the online course, thus improving online learning self-efficacy. In contrast, a student's online learning self-efficacy may decrease if the student cannot remember how to log into the learning management system, so fails to submit an assignment by the deadline.

A student may also develop online learning self-efficacy by observing another. This source of self-efficacy is referred to as vicarious experience. When an online student sees a peer receive negative feedback on an online discussion forum, his or her online self-efficacy may decrease. Nonetheless, witnessing a peer receive praise from a faculty member for a thoughtful response to a discussion prompt may evoke increased efficacy.

Another source of self-efficacy, verbal persuasion, which is defined as encouragement or discouragement. When an online student receives positive feedback from their instructor for conducting a successful online article search via the universities' online databases, they are likely to become more confident in their ability to participate in online coursework effectively. However, an online student who receives minimal or no feedback from a peer on a discussion forum or an instructor on a submitted online assignment will likely experience a decrease in confidence to participate in online coursework.

A final source of self-efficacy is comprised of physiological and affective states. Bandura (1977) explained that self-efficacy develops from feelings and sensations and interpretations of these feelings and sensations. For example, when an online student encounters a technical issue in submitting their assignment through a learning management system, they may become easily frustrated and experience anxiety. He or she may consequently think, "I am never going to figure this out." Online self-efficacy decreases.

On the other hand, another student may decide to manage their time wisely on the first online assignment and submit two days before the deadline. In doing so, the student ensures she has sufficient time to use the self-help materials if a problem occurs with the submission. When she logs into the online learning management system, she experiences both anxiety and excitement. She tells herself, "I can do this." Thus, her online self-efficacy increases.

Each source is imperative when developing target interventions to help students increase their confidence and ultimately their persistence in an online course.

High-Impact Practices

High-impact practices (HIPs) have been given increased attention within the residential student success literature over the past decade and may serve as targeted interventions to cultivate online learning self-efficacy and other factors of human agency (Brewer & Yucedag-Ozcan, 2013; Kimbark et al., 2017). HIPs are active learning practices that promote student success through engagement (Kuh, 2008; Kuh &

O'Donnell, 2013), and Kuh (2008) identified ten residential learning experiences as high-impact practices:

- First-Year Seminars and Experiences
- Common Intellectual Experiences
- Learning Communities
- Writing Intensive Courses
- Collaborative Assignments and Projects
- Undergraduate Research
- Diversity/Global Learning
- Service Learning, Community-Based Learning
- Internships
- Capstone Courses and Projects.

While online learning has been a pervasive force in higher education and an abundance of studies exist regarding its efficacy, a lack of scholarly and practical literature exists on the experiences and outcomes of HIPs within the online environment and for online students. HIP experiences are not often offered in an online or blended format, and HIP experiences are rarely offered to online students. For example, the National Survey of First-Year Seminars demonstrates that most institutions (over 60%) only offer first-year seminars in residential formats (Young & Hopp, 2014). If FYSs are offered online, less than 10% of the FYSs are online and usually offered solely to residential students. Therefore, the practical and empirical literature on residential HIPs may provide inspiration and impetus for online learning (Kuep, 2018).

First-Year Seminars

If adapted, one HIP may be particularly useful in developing online students' human agency, and promoting their persistence is a first-year seminar (FYS). FYS is critical to residential student persistence as Tinto (2012) asserted that "regardless of the form and focus, evidence of the effectiveness of freshman seminars, when properly implemented, is widespread" (p. 34). Residential students who participate in a FYS demonstrate better awareness, confidence in seeking guidance and interacting with others in academic settings, and time management strategies and study skills (Al-Sheeb et al., 2018; Jenkins-Guarnieri et al., 2015; Kimbark et al., 2017). They are more likely to continue into their second year of study. While the research on first-year experiences for online students is limited, studies have been conducted on similar experiences that have been effective in helping online students to persist (Kuep, 2018). However, experiences for online students, such as orientation programs and interventions, have been limited in scope, focusing primarily on technology use (Liu & Adams, 2017; Taylor et al., 2015). While computer-based interaction and computer literacy are essential to online learning, it is also critical to incorporate additional objectives into experiences for online students to support their development of online learning self-efficacy.

A FYS is defined as a course specifically designed and structured to help first-year students develop personally, academically, and socially (Barefoot & Fidler, 1996; Hunter & Linder, 2005). FYS is comprised of "an combination of academic and co-curricular efforts within and across the post-secondary institutions" (Koch & Gardner, 2006, p. 2). Therefore, they typically incorporate instructional elements designed to promote active learning, critical inquiry, information literacy, writing, collaboration, and other cognitive and non-cognitive competencies necessary for success (e.g., self-regulation, self-directedness, study skills, time and stress management, relationship-building, awareness, sense of belonging, and self-efficacy) (Crisp & Taggart, 2013; Eckton & Palfreyman, 2017; Karp & Bork, 2014; Kimbark et al., 2017; Tinto, 2017). While the content and structure of a FYS can vary across institutions, the objectives are similar in their focus to promote learning, community, and human agency (e.g., self-efficacy, self-regulation, and self-directedness) (Barefoot, 2000, p. 14; Kuep & Young, 2018):

- Increase student-to-student interaction,
- Increase faculty-to-student interaction, including frequent, constructive, and timely feedback,
- Increase student involvement and time spent on campus,
- Align the curriculum and co-curriculum,
- Increase academic expectations, communicating high expectations for all learners,
- Increase levels of academic engagement through reflective, applied, diverse, and integrative learning practices, and
- Assist students who are inadequately prepared for college academics.

These objectives, coupled with an understanding of the four sources of self-efficacy and other human agency elements, may be adapted for online FYS (see Table 10.1) and deliberately inform strategies used in the course (see Table 10.2). For example, an interactive tutorial or scavenger hunt may increase student involvement with the virtual campus environment. To promote self-efficacy through mastery experiences, students may complete an interactive, personalized learning management system (LMS) tutorial to develop confidence in using the LMS for learning. Through vicarious experiences, self-efficacy may be supported by including in the course video testimonials from past students on behaviors and actions that led to their online learning success. Ongoing and timely instructor and peer feedback through asynchronous and synchronous engagement methods can further support student self-efficacy development and encourage faculty-to-student and student-to-student interaction.

Reflection as a Strategy for an Online HIP FYS Experience

In addition to the aforementioned strategies, ongoing reflection activities are also recommended for inclusion in a FYS (Kuep, 2018). Lin et al. (1999) argued that students have to pause and reflect on their decisions and the appropriateness of the

Table 10.1 Adaptation of first-year seminar objectives for online students

The objective for the residential first-year seminar	Adapted objective for the online first-year seminar
Increase student-to-student interaction	Increase student-to-student interaction through the use of virtual tools and collaborative activities
Increase faculty-to-student interaction beyond the classroom	Increase faculty-to-student interaction through the use of virtual tools and activities
Increase student involvement and time spent on campus	Increase student involvement with virtual campus resources
Align the curriculum and co-curriculum	Align the curriculum and co-curriculum
Increase academic expectations	Increase academic and distance learning expectations (e.g., etiquette for online communication and technology use)
Increase levels of academic engagement	Increase levels of academic engagement through the use of virtual tools, resources, services, and activities
Assist students who are inadequately prepared for college academics	Assist students in adequately obtaining competencies and attitudes for online college academic success

strategies they have used to help them identify improvements, if any, they must make in their future learning. Meta-analyses (Panadero et al., 2017) found activities such as learning logs and self-assessments positively affect student online learning self-efficacy.

For example, a student may be assigned journaling or learning log reflection upon which they are asked to reflect on the effectiveness of the strategies they used to complete an online quiz and whether they would use these same strategies to complete an online quiz in the future. This reflection process can help students develop an awareness of what they did before, during, and after a learning experience and increase their confidence in taking online quizzes (Lin et al., 1999). Prompts may be used to engage students in reflection after a learning experience or at established intervals throughout a course. Toward the beginning or middle of a course, students may be asked to reflect on discussion forums about personally established learning goals for the course, helpful and unhelpful strategies used in the course, or time management plans that work. Students may be asked to reflect in discussion forums about learning goal accomplishment, performance, strategy use, or overcoming barriers at the end of a course. Developing an awareness of what they did before, during, and at the end of a module or course could help students formulate goals for the next module or course, determining whether they need to adapt their actions and behaviors.

Table 10.2 Adapted objective for an online first-year seminar and strategies for application

Adapted objective for online first-year seminar	Strategies for course instructors	Source of self-efficacy
Increase student-to-student interaction through the use of virtual tools and collaborative activities	• Schedule regular synchronous virtual course meetings • Create opportunities for building online academic community through group-based asynchronous discussions, peer reviews, collaborative exercises, and online collaborative work spaces • Create introductory discussion activities that are low stakes and fun, requiring students to interact and learn about each other (e.g., create a moto and bumper sticker as an introduction; three truths and a lie; web of connection) • Videos of previous students discussing successes and strategies for the course	• Vicarious experience
Increase faculty-to-student interaction through the use of virtual tools and activities	• Establish synchronous virtual office hours with hours to accommodate students' lives (e.g., evening hours) • Communicate regularly through asynchronous methods (e.g., email, course announcements, and welcome videos) • Provide timely feedback	• Verbal persuasion
Increase student involvement with virtual campus resources	• Create instructional activities that require one-on-one or small-group virtual consultations with academic and administrative resources (e.g., librarian, tutor, advisor, financial aid, counseling, and careers)	• Mastery experience

(continued)

Table 10.2 (continued)

Adapted objective for online first-year seminar	Strategies for course instructors	Source of self-efficacy
Align the curriculum and co-curriculum	• Provide students with examples that illustrate how what their learning is transferable to other courses (i.e., time management, use of technology, use of services, and study skills) and the real world • Incorporate activities that encourage student use of the university materials (e.g., catalog) to search for information relevant to their program of study	• Vicarious experience • Mastery experience
Increase academic and distance learning expectations	• Use the course syllabus to communicate expectations about course • Provide interactive online experiences that orient learners to the learning management system (LMS), expectations for distance education, and etiquette for online and mobile spaces • Incorporate activities that encourage student use of the syllabus and university materials such as the student handbook	
Increase levels of academic engagement	• Create instructional activities that promote engagement with academic support systems (e.g., library, tutor, and writing center) • Develop assignments that require students to engage in the online learning space at least twice a week • Develop assignments that are problem-based, require active experimentation, case studies, and hands-on application	• Mastery experience

(continued)

Table 10.2 (continued)

Adapted objective for online first-year seminar	Strategies for course instructors	Source of self-efficacy
Assist students who are inadequately prepared for online college academics	• Present and encourage use of strategies for studying, time management, note-taking, listening (i.e., video and audio content), critical thinking, online test-taking, and reading • Reflection on physiological and affective experiences in the online space	• Mastery experience • Physiological and affective states

A Model for an Online HIP FYS Experience to Promote Online Learning Self-efficacy

An online HIP FYS can be designed to prepare and orient undergraduate students to college-level online learning. To promote student development of online learning self-efficacy, outcomes of the seminar should emphasize time management, study habits, technology use, information literacy skills, and access to academic support services and resources. Modules can be used to structure and present information and guide students through the learning process.

At a small private university, an online HIP FYS was designed to promote both cognitive and non-cognitive competencies. The course activities were developed around Barefoot's (2000) objectives in consideration of the three elements of human agency, including self-efficacy. Within their online programs, the online HIP FYS is the first course that students take. It is a three-credit course delivered across 8 weeks. The course is comprised of four modules spanning across two weeks each.

In the first week of each module, the instructor meets with all students via synchronous videoconference events as an opportunity for meaningful engagement with the faculty and fellow peers. The live online events provide students with the opportunity for personal and academic engagement with one another and the faculty, which is a hallmark of Kuh's(2008) HIPs model (e.g., academic engagement), and provides essential interaction to overcome student dissatisfaction and loneliness that is often prominent in online courses (Parahoo et al., 2016; Moore, 1993). These events also allow studentss to share their successes and needed areas for improvement, providing various learning opportunities that promote self-efficacy. The events also allow students to commiserate and reflect on feelings for excitement and anxiety related to their online learning experiences. The live synchronous events are supplemented with ongoing personal reflections via journal "learning log" activities and collaborative reflections through asynchronous discussion forums.

During the first module, academic and distance learning expectations are communicated via a syllabus. A section of the syllabus provides a description of the online learning environment and best practices for student success. Students are

then directed to an online syllabus quiz, with unlimited attempts to achieve a full mark. A syllabus quiz helps students understand course policies and clarifies expectations (Parkes & Harris, 2002; Raymark & Connor-Greene, 2002). Module 1 also incorporates opportunities to help students prepare for online college academics by developing a study and coursework schedule and completing a self-paced, hands-on orientation to the LMS. An orientation to the LMS prepares students for the educational experience (Jones, 2013; Liu & Adams, 2017; Taylor et al., 2015), and constructing a coursework plan helps students develop an awareness of effective and efficient use of time (i.e., planning) to meet deadlines. Time management is associated with all three elements of human agency because it supports a student's commitment to their goals (Broadbent & Poon, 2015). Thus, online students who demonstrate time management skills are more likely to persist in an online class.

Instructional activities in Modules 2, 3, and 4 were developed based on the adaptation of Barefoot's (2000) objectives for a FYS. Students engage in instructional activities aimed at increasing their involvement with virtual campus resources and aligning the curriculum and co-curriculum. Assignments are centered on student-initiated synchronous videoconference consultations and asynchronous interactions with academic advisors, librarians, career counselors, online writing lab, and math online tutors. The virtual asynchronous and synchronous events provide students with further opportunity for personal and academic engagement. Students engage in virtual activities with their advisors and other support systems and resources across the campus to complete coursework. Academic engagement is an essential component of the student learning experience (Kuh, 2008), and self-efficacy is a manifestation of a student's interactions with others (Tinto, 2017). Thus, online learning self-efficacy is acquired through virtual interactions with peers, instructors, advisors, support systems, and resources.

Throughout each week of the course, student involvement in resources and preparation for online learning is addressed through interactive content and activities, chuncked across the modules rather than presented in lengthy lectures, as is traditional in residential environments. Chuncking content, according to cognitive science theory (Mayer, 2005), increases engagement and attentiveness. Content presentations are provided and supplemented with reflective journaling, online quizzes, self-assessments, collaborative group work, and relevant assignments. The journal "learning log" activity is vital as it encourages students to continuously engage and reflect in the learning process through goal-setting, planning, self-monitoring, and self-assessment. As Zimmerman (1989) noted, students' self-efficacy beliefs influence their decisions to persist by engaging in the learning process, and the process of reflection can help students develop an awareness of what they did before, during, and after a learning experience (Lin et al., 1999). Thus, the journal "learning log" activity during each module encourages students to pause and reflect on their learning, strategy use, and time management and plan accordingly for future learning.

Activities are high frequency and designed to be low-stress engagement opportunities to build mastery. As each student completes the journal "learning log", the instructor provides feedback within 24–48 h in the form of praise, encouragement, suggestions and/or recommendations for different strategies, and resources.

@@Similarly, as students complete coursework, the instructor provides ongoing feedback and maintains an updated gradebook.

Table 10.3 illustrates a model for a structure of an online HIP FYS with corresponding activities and assignments aimed at helping students develop their online learning self-efficacy.

Recommended Practices for Instructors

While the activities presented in the model are student-centered, instructor immediacy and presence remain critical to student development of online learning self-efficacy and are congruent with the tenets of HIPs. Effective instructor–student interactions are often a precursor to successful learning experiences (Kuh et al., 2005) and, as Pogue and AhYun (2006) noted, instructor immediacy facilitates student learning and affect. Thus, it is recommended that instructors and course designers give thought to organization and appropriate layering of course material; provide clear communication about course objectives and expectations; and plan and implement timely encouragement and feedback.

Integrating technology into a FYS is also vital. However, technology integration needs to increase self-efficacy and engagement and not, as the old adage goes, be the "tail wagging the dog." In integrating technology, faculty and course designers need to be responsible for (Garner, 2012, p. 104):

> a) remaining abreast of current technologies, b) assessing the degree to which emerging technologies can be applied in the classroom, and c) creating ways to integrate technology … in a manner that enhances the learning experience.

Summary

As course designers and faculty look to the future and seek to promote online persistence, cultivating online learning self-efficacy and non-cognitive competencies, such as other elements of human agency, through targeted interventions, is needed. HIP experiences originally developed for residential students show great promise for this, especially the FYS. However, as this chapter highlights, there is a need for ongoing development and evaluation of online FYS. Practices and models that uphold tenets of HIPs and promote online self-efficacy need to be developed and identified; their effectiveness needs to be determined, and then, faculty development initiatives need to be developed for effective implementation. Ongoing research and development in this area are imperative and valuable as online learning continues to be pervasive in higher education.

Table 10.3 Model for an online HIP FYS with corresponding activities to promote student online learning self-efficacy

Module	Adapted objective for online FYS	Corresponding student activities and assignments
1	• Increase student-to-student interaction through the use of virtual tools and collaborative activities • Increase faculty-to-student interaction through the use of virtual tools and activities • Increase academic and distance learning expectations • Increase levels of academic engagement • Assist students who are inadequately prepared for online college academics	• Engage in an asynchronous group discussion with peers • Participate in an instructor-led synchronous virtual course meeting • Complete a syllabus quiz • Maintain a learning log to plan Module 1 coursework activities, set goals, and reflect on strategies and performance • Develop a study and coursework schedule • Complete a self-paced, hands-on orientation on the use of various functions and tools of the LMS
2	• Increase student-to-student interaction through the use of virtual tools and collaborative activities • Increase faculty-to-student interaction through the use of virtual tools and activities • Increase academic and distance learning expectations • Increase levels of academic engagement • Increase student involvement with virtual campus resources	• Employ a note-taking technique for a reading assignment, and engage in a small-group discussion to compare/contrast notes and reflect on effectiveness of the technique • Participate in an instructor-led synchronous virtual course meeting • Employ a time management technique for one week, and reflect on the results and its effectiveness for future application • Maintain a learning log to plan Module 2 coursework activities, set goals, and reflect on strategies and performance • Consult with a career counselor through virtual synchronous or asynchronous methods on the results of the personality and learning preferences self-assessments, and reflect on the impact of these findings
3	• Increase student-to-student interaction through the use of virtual tools and collaborative activities • Increase faculty-to-student interaction through the use of virtual tools and activities • Increase levels of academic engagement • Increase student involvement with virtual campus resources • Align the curriculum and co-curriculum	• Engage in an asynchronous group discussion with peers • Participate in an instructor-led synchronous virtual course meeting • Maintain a learning log to plan Module 3 coursework activities, set goals, and reflect on strategies and performance • Initiate a one-on-one virtual synchronous consultation with a librarian for assistance in locating peer-reviewed articles • Initiate a meeting with an academic advisor, and construct a course plan

(continued)

Table 10.3 (continued)

Module	Adapted objective for online FYS	Corresponding student activities and assignments
4	• Increase student-to-student interaction through the use of virtual tools and collaborative activities • Increase faculty-to-student interaction through the use of virtual tools and activities • Increase levels of academic engagement • Increase student involvement with virtual campus resources	• Engage in an asynchronous group discussion with peers • Participate in an instructor-led synchronous virtual course meeting • Maintain a learning log to plan Module 4 coursework activities, set goals, and reflect on strategies and performance • Initiate a virtual synchronous meeting with the online math tutor to verify understanding of a quantitative article • Submit a draft of an essay to the online writing lab, and reflect on plans to incorporate the feedback

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Part IV
Empirical Studies on Influence of Academic Self-efficacy

Chapter 11
Relationship Between Learning Environment and Academic Achievement: Mediating Role of Academic Self-efficacy

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Abstract Past research has consistently revealed that students' academic self-efficacy is strongly related to academic achievement. Furthermore, some researchers have suggested that academic self-efficacy is associated with learning environment constructs of involvement, teacher support, investigation and cooperation. The purpose of this study was to investigate the effect of academic self-efficacy on mathematics achievement. Additionally, the mediating role of academic self-efficacy in the relationship between students' perception of the learning environment and academic achievement was examined. The learning environment was assessed with one scale (involvement) from What Is Happening In this Class? (WIHIC) questionnaire. The academic self-efficacy scale was based on the Morgan-Jinks Student Efficacy Scale (MJSES). The study analysed the data collected from 352 mathematics students attending three colleges in Abu Dhabi, United Arab Emirates, using structural equation modelling to validate the questionnaires and to investigate the hypothesized relationships. The mediating effect of academic self-efficacy on the relationship between involvement and mathematics achievement was examined. The results of this study indicated that students' academic self-efficacy could play a mediating role in the relationship between students' involvement and mathematics achievement. In addition, involvement was an influential predictor of academic self-efficacy.

Keywords Learning environments · Academic self-efficacy · Involvement · Structural equation modelling

Introduction

A substantial body of literature has consistently established the relationship between learning environments and students' academic self-efficacy (Alt, 2015; Dorman & Fraser, 2009; Velayutham & Aldridge, 2013). Several years ago, Bandura (1977) speculated that a strong influence on student behaviour is the beliefs that they hold

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about their potentials. Students are more likely to be motivated to learn if they believe that they can produce the desired results (Bandura, 1986). According to Bandura (1997) and Schunk and Ertmer (2000), academic self-efficacy refers to students' beliefs and attitudes towards their capabilities to achieve academic success, as well as belief in their ability to fulfil academic tasks and the successful learning of the materials. Hence, academic efficacy beliefs are powerful predictors of the choices that students make and their persistence in facing difficulties.

According to Elias and MacDonald (2007), academic self-efficacy is intimately related to students' self-regulated learning. Students with high academic self-efficacy are more likely to put in more effort, consistently evaluate their progress and apply self-regulatory strategies (Schunk & Pajares, 2009). Academic self-efficacy is perceived as a constituent of student motivation and is clarified as the beliefs that students possess in their capability to learn or conduct specific tasks (Bandura, 1986, 1997). Those students who have high academic self-efficacy go through demanding tasks regularly and have tendency to gain higher than students with low academic self-efficacy (Pajares, 1996). On the other hand, those students who have low academic self-efficacy stop continuing their attempts in the case of failure which reduces their success and sense of academic self-efficacy (Daemi et al., 2017).

Research suggests that when teachers create a positive learning environment, where students can cooperate and increase their involvement in class activities, it has the potential to improve academic self-efficacy and performance (Lee & Seo, 2021; Zheng et al., 2021). We undertook this study in the hope that establishing the relationship of psychosocial aspects of the classroom environment (such as involvement) on college students' academic self-efficacy and their mathematics achievement would have some implications for realizing Abu Dhabi's Educational goals.

The present study, therefore, aimed to investigate the effect of academic self-efficacy on mathematics achievement using data from Abu Dhabi college students. The findings of this study suggest that it could be informative for researchers, teachers, curriculum developers and policymakers.

Relations Between Academic Self-efficacy and Academic Achievement

One of the important factors that affects academic achievement is academic self-efficacy (Hayat et al., 2020). According to Bandura (2012) and Schunk & Parajes (2009), social cognitive theory proposes that a combination of external social systems and internal self-influence factors motivate and regulate behaviour. Cognitive abilities and academic self-efficacy have been recognized in the literature as well-established predictors of academic achievement (Lane & Lane, 2001). Academic self-efficacy is a major component of these self-influence factors and refers to an individual's judgement of their capabilities to organize and execute courses of action required to achieve desired achievement (Bandura, 1997). According to Pintrich (2003),

academic self-efficacy beliefs lead to individuals' excellent achievement through increasing commitment, endeavour and perseverance.

A study by Musa (2020) that investigated the relationship between academic self-efficacy and academic achievement among university undergraduate students in Uganda revealed that there is a statistically significant relationship between academic self-efficacy and academic achievement.

Another study by Jung et al. (2017) found that academic self-discipline mediated the relationship between academic self-efficacy and academic achievement, after controlling for conscientiousness and ACT scores. According to Jung et al. (2017), academic self-efficacy is a key component of the cognitive and behavioural effort needed for both academic retention and academic achievement.

Relations Between Academic Self-efficacy and Learning Environment

The association between academic self-efficacy and learning environment has been established, starting with the research undertaken by Dorman (2001). His results revealed that mathematics classroom environment is positively related to students' academic self-efficacy. A study of classroom environment, perceptions of assessment tasks, academic self-efficacy and attitude to science revealed significant relationships between classroom environment and academic self-efficacy (Dorman & Fraser, 2009). A study by Velayutham and Aldridge (2013) identified aspects of the psychosocial learning environment that impact student motivation (including academic self-efficacy).

Research Model

The purpose of this study was to examine the interrelationships among involvement, academic self-efficacy and mathematics achievement in Abu Dhabi. The research also focused on investigating whether academic self-efficacy may mediate the relationship between involvement and mathematics achievement. Based on theory and past research discussed above, we proposed a research model for our study, which is presented in Fig. 11.1. The research model hypothesizes that the psychosocial aspects of the learning environment (involvement) impact academic self-efficacy. Additionally, academic self-efficacy is predicted to affect mathematics achievement.

Hypotheses

H1: Academic self-efficacy has a direct effect on mathematics achievement.
H2: Involvement has a direct effect on mathematics achievement.
H3: Involvement has a direct effect on academic self-efficacy.

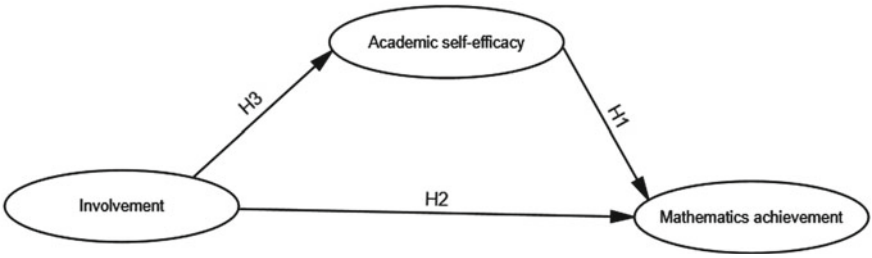

Fig. 11.1 Hypothesized model

Methods

Participants

The participants for our study involved 352 students (231 were female, and 121 male) attending three college-level public institutions located in the United Arab Emirates (UAE). The sample was randomly selected from colleges in the UAE. All the participants were in the foundation program of their respective universities and were preparing for careers in primary-school teaching, engineering, and business. Approximately 95% of the students were UAE nationals, while the remaining 5% of students were from other Arab nations. The students' ages ranged between 18 and 35 years. There were no missing data, since all 352 students returned a fully completed questionnaire.

Measures

Involvement Questionnaire

We adapted the involvement scale, consisting of eight items, from the widely used WIHIC learning environment instrument (Aldridge et al., 1999; Fraser, 2012). The involvement scale assesses the extent to which students have attentive interest, participate in discussions and enjoy the class. The response format for the involvement scale involves a five-point frequency scale of almost always, often, sometimes, seldom and almost never. A typical item is "I explain my ideas to other students." In our study, the internal consistency (Cronbach's alpha) of the involvement scale was 0.87 and considered to be satisfactory.

Table 11.1 Scale description and sample Item for each questionnaire scale

Scale name	Scale description	Sample item
	The extent to which …	
Academic self-efficacy	students have confidence in their academic competence	I find it easy to get good grades in mathematics
Involvement	Students have attentive interest, participate in discussions and enjoy the class	I explain my ideas to other students

Note All items used the response alternatives of almost always, often, sometimes, seldom, and almost never

Academic Self-efficacy Questionnaire

The eight-item academic self-efficacy scale was based on the Morgan-Jinks Student Efficacy Scale (MJSES) (Jinks & Morgan, 1999). The academic self-efficacy scale assesses the extent to which students have confidence in their academic competence. The frequency response alternatives for each item are almost always, often, sometimes, seldom and almost never. Examples of items are "I find it easy to get good grades in mathematics" and "I feel that I am an intelligent student." In our study, the Cronbach alpha reliability for the academic self-efficacy scale was 0.94 and considered to be satisfactory. Table 11.1 provides a scale description and sample item for each of the scales used in our study.

Mathematics Achievement

To assess students' mathematics achievement, their final exam scores in that semester were considered. Scores in the course which were obtained on the midterm, final exams, quizzes and assignments were all considered as indicators of mathematics achievement.

Data Analytic Strategy

We used structural equation modelling approach with *Mplus*8.3 software (Muthen & Muthen, 1998–2019) to test the hypothesized mediation model. Exploratory factor analysis (EFA) was conducted to examine the dimensionality of the involvement scale and the academic self-efficacy scale. Confirmatory factor analysis (CFA) was then used to assess the measurement properties through an examination of convergent validity and discriminant validity. Convergent validity assesses whether scores on items assessing a single construct are strongly intercorrelated and measure the same underlying dimension. We used composite reliability (CR) to examine the reliability and validity of the constructs in the research model. CR value of 0.70 or higher reflects

adequate reliability (Nunnally & Bernstein, 1994) and average variance extraction (AVE), with the value of 0.50 and above, indicating adequate reliability (Fornell & Larcker, 1981). The discriminant validity is the extent to which a scale is unique in the dimension that it covers. The criterion of discriminant validity was that the square root of average variance extracted (AVE) for each construct is larger than the inter-construct correlation (Barclay et al., 1995).

Chi-square statistics and fit indices including comparative fit index (CFI, Bentler, 1990) and Tucker–Lewis index (TLI, Bentler & Bonett, 1980) were used to evaluate the fit of the research model. The cut-off for an acceptable fit for a CFI value and TLI value is greater than and equal to 0.90 (Bentler & Bonett, 1980). This indicates that 90% of the covariation in the data can be reproduced by the model (Collier, 2020).The root mean square error of approximation (RMSEA) and the standardized root mean square residual (SRMR) were reported. A good model fit is present if RMSEA is below 0.05. There is an adequate fit if it is 0.08 and below, and poor fit for values over 0.10 (MacCallum et al., 1996). SRMR value of 0.05 and below is considered a good fit, and a fit of 0.05–0.09 is considered an adequate fit (MacCallum et al., 1996).

Specification of the hypothesized mediation model was constructed to examine the direct effect of the involvement scale on mathematics achievement and its indirect effect via academic self-efficacy. The hypothesis outlined in the research model was tested. The path coefficients, whether they were positive or negative, and the magnitudes of the hypothetical relationships were calculated. This was to determine which constructs were significantly related in the research model.

Results

The descriptive statistics, means, standard deviation, factor loadings, Cronbach's alpha coefficients and composite reliability are reported in Table 11.2. The Cronbach alpha reliability coefficient was used as an index of scale internal consistency. The results of the Cronbach alpha reliability indicated high internal consistency among the items of the involvement scale ($\alpha = 0.90$) and academic self-efficacy scale ($\alpha = 0.94$). To examine the internal structure of the involvement and the academic self-efficacy scales, principal axis factoring with varimax rotation was used. The results of the exploratory factor analysis indicated that two constructs were extracted with a total variance of 62.41%. The factor loadings of all the items were satisfactory (higher than 0.6), as suggested by Hulland (1999).

At the construct level, an alpha coefficient of 0.70 or higher was recommended by Nunnally and Bernstein (1994) to reflect adequate reliability. Table 11.2 shows that the composite reliability of the involvement scale was 0.90 and that of the academic self-efficacy scale was 0.95, resulting in a good level of reliability.

The final criterion for convergent validity used was a measure of the average variance extracted (AVE) for each construct. Fornell and Larcker (1981) and Nunnally and Bernstein (1994) recommended a minimum value of 0.5 for AVE. Results of the

Table 11.2 Descriptive statistics of the measurement constructs

Construct	Item	Mean	SD	Factor loadings (EFA)	Factor loadings (CFA)	Cronbach alpha	Composite reliability
Involvement						0.90	0.90
	INV1	3.84	1.07	0.76	0.60		
	INV2	4.02	1.05	0.76	0.79		
	INV3	3.49	1.00	0.68	0.79		
	INV4	3.56	0.98	0.73	0.67		
	INV5	3.59	1.11	0.76	0.80		
	INV6	3.76	1.00	0.67	0.77		
	INV7	3.78	0.98	0.78	0.75		
	INV8	3.61	0.93	0.82	0.67		
Academic self-efficacy						0.94	0.95
	ASE1	3.78	1.18	0.80	0.79		
	ASE2	3.88	1.08	0.88	0.87		
	ASE3	3.50	1.26	0.81	0.80		
	ASE4	3.58	1.12	0.90	0.88		
	ASE5	3.44	1.03	0.86	0.87		
	ASE6	3.92	1.15	0.81	0.82		
	ASE7	3.67	1.15	0.83	0.91		
	ASE8	3.68	1.60	0.76	0.72		

analysis showed that the AVE values for both scales were above 0.5. Therefore, the criteria of convergent validity was established.

Discriminant validity assesses the degree to which the constructs are empirically different. Table 11.3 reports the inter-construct correlations and square root of average variance extracted. The results support the discriminant validity because, for each construct, the square root of the AVE is larger than inter-construct correlation. Overall, the results supported that the individual constructs could be discriminated from each other.

The results of the final model fit indices for the measurement model (via confirmatory factor analysis) and the structural model in Table 11.4 indicated that the models had acceptable fit to the data.

Table 11.3 Correlation matrix and average variance extracted

Construct	Involvement	Academic self-efficacy
Involvement	**(0.73)**	
Academic self-efficacy	0.40**	**(0.83)**

Note The bold elements in the main diagonal are the square roots of average variance extracted

Table 11.4 Model fit indices for the measurement model and the structural model

Model	χ^2 ($p$value)	df	χ^2/df	CFI	TLI	SRMR	RMSEA
Measurement model	180.18 ($p = 0.001$)	98	1.84	0.97	0.96	0.039	0.049
Structural model	126.90 ($p = 0.175$)	113	1.12	0.98	0.98	0.060	0.037
Recommended values	$p > 0.5$		<3.0	>0.95	>0.95	<0.08	<0.08

The results of the final structural model with the standardized path coefficients are presented in Fig. 11.2. The results of the model suggest that 25.4% of the variance of academic self-efficacy was explained by involvement. The results showed that the path from involvement was significantly and positively related to academic self-efficacy ($\beta = 0.49, SE = 0.11$). Academic self-efficacy was also significantly and positively correlated with mathematics achievement ($\beta = 0.65$, SE $= 0.14$). However, involvement yielded a positive and non-significant effect on mathematics achievement ($\beta = 0.12$, SE $= 0.14$).

The indirect effect from involvement to mathematics achievement through academic self-efficacy was statistically significantly positive. Involvement had statistically significant indirect effects on mathematics achievement through a mediator of academic self-efficacy (estimate $= 0.92$, SE $= 0.27$). As suggested by Cohen (1992) and Kline (2016), the effect sizes with values 0.2 were considered small, 0.5 were considered medium, and values 0.8 or greater were considered large. Table 11.5 shows a large indirect effect of involvement through academic self-efficacy on mathematics achievement. The results suggest that students who have positive perceptions of involvement are likely to have moderately more positive academic self-efficacy. Also, students who have positive perceptions of academic self-efficacy are likely to have high mathematics achievement.

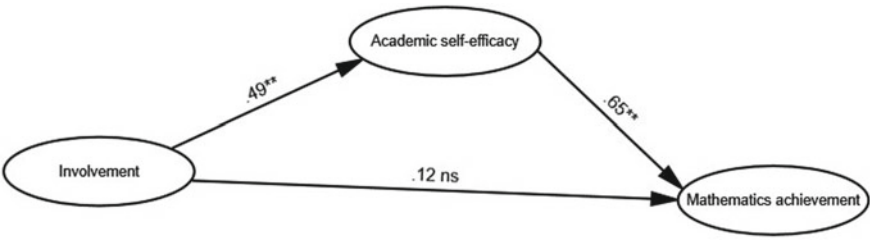

Fig. 11.2 Final structural model (standardized path coefficients)

Table 11.5 Indirect effects of involvement on mathematics achievement

Path	Estimate	SE	t-value
Involvement → academic self-efficacy → mathematics achievement	0.92**	0.27	3.41

** $p < 0.01$

Discussion

The main purpose of this study was to examine the effect of academic self-efficacy and one aspect of the learning environment, involvement on students' mathematics achievement. The hypothesized paths in SEM were all significant, and the goodness-of-fit indicators revealed that the model fits the data well. The findings suggest that involvement had a statistically significant impact on students' academic self-efficacy, which is consistent with findings from studies of learning environment and academic self-efficacy (Aldridge et al., 2013; Sökmen, 2021). Also, the relationship between academic self-efficacy and mathematics achievement was statistically significant. Our findings strongly support an association between academic self-efficacy and academic performance, which is consistent with the results of some past studies which have confirmed a positive relationship between academic self-efficacy and academic performance (Bandura, 1997; Boahene et al., 2019; Hayat et al., 2020; Honicke & Broadbent, 2016). It can therefore be expected that when students believe in their ability to accomplish certain academic task successfully, their academic performance might be enhanced.

Our findings showed that students who have perceived their academic self-efficacy as positive also appeared to possess confidence in their academic competence in mathematics (Arslan, 2016). This is consistent with results of Daemi et al. (2017) and (Sökmen, 2021). Teachers should therefore be encouraged to nurture students' academic self-efficacy beliefs as these are related to academic success.

The current study also showed that students' academic self-efficacy was more positive in classrooms with greater involvement. Hence, teachers might promote students' academic self-efficacy by creating classroom environments that emphasise involvement (Hwang et al., 2016). Our results also showed a significant indirect effect of involvement on the students' mathematics achievement, mediated by academic self-efficacy. These findings are consistent with the results of other studies (Lv et al., 2018; Tosto et al., 2016; Zhen et al., 2017).

This study involved a relatively small number of students, and so the generalization of the findings to other populations should be made with caution. The study used students' self-reports data and may not be the most accurate source of data. It was not possible to precisely show the cause and effect relationship between the variables, since this study was a cross-sectional quantitative study. Therefore, longitudinal studies are warranted to identify the causal relations between the variables in a future study.

The research reported in this chapter is significant because it is one of the few studies conducted in the UAE for which SEM has been used to develop a comprehensive model of relationships among classroom environment and mathematics achievement, mediated by academic self-efficacy. Teachers could improve students' academic self-efficacy by providing supportive, calm and friendly environment which could lead to academic success. Hopefully, the results of this study could encourage teachers—especially in the UAE—to improve students' academic self-efficacy by providing supportive, calm and friendly environment which could lead to academic success.

Conclusion

This study investigated the interrelationship between involvement and mathematics achievement, mediated by academic self-efficacy. The results revealed that students who have attentive interest, participate in class discussions and enjoy the class could most likely obtain better mathematics achievement. The results of this study indicated that students' academic self-efficacy could mediate the relationship between students' involvement and mathematics achievement.

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Chapter 12
The Impact of Academic Self-efficacy on Academic Motivation: The Mediating and Moderating Role of Future Orientation Among Italian Undergraduate Students

Shanyan Lin, Claudio Longobardi, and Paolo Bozzato

Abstract The literature recognizes that students' beliefs concerning their academic skills play a fundamental role in their motivation to achieve academic success. In this chapter, we focused on the investigation of the role of future orientation on education (i.e., conscious ideas about one's future education) in the relationship between academic self-efficacy and academic motivation. To this purpose, a cross-sectional study was performed on a sample of 1008 undergraduate Italian students (49.1% males) aged 19–23 years old (mean = 20.23; standard deviation = 0.97). The participants filled in an online questionnaire with the Italian versions of the Perceived Academic Self-Efficacy Scale, Academic Motivation Scale, and Future Education Scale of the Prospective Life Course Questionnaire. Controlling for age and main academic subjects, path analysis showed that academic self-efficacy positively predicted future orientation and that students' future orientation played a full mediating role between academic self-efficacy and extrinsic motivation and amotivation, as well as performing a partial mediating role between academic self-efficacy and intrinsic motivation. Moreover, future orientation moderated the pathway from academic self-efficacy to amotivation, which suggests that high future orientation can buffer the negative effect of low academic self-efficacy on students' academic amotivation. The findings of this study have significant implications for improving academic motivation.

Keywords Motivation · Amotivation · Academic self-efficacy · Achievement · Mediation

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Introduction

Academic motivation has been identified as a central component of learning (Wentzel, 2020) and has a strong connection with academic achievement (Steinmayr et al., 2019). It is well established that self-efficacy beliefs deeply affect academic motivation. In other words, students who believe themselves to be capable are more likely to develop greater motivation to achieve academic success compared to those who consider themselves incapable (Pajares, 1996; Schunk, 1995; Seitfert, 2004). In particular, self-efficacy researchers have revealed that academic self-efficacy (i.e., an individual's confidence that they can successfully complete certain academic tasks) greatly influences academic motivation (e.g., Pajares, 2009; Pajares & Miller, 1994; Schunk, 1995). This means that students with higher levels of academic self-efficacy study more and struggle longer against educational obstacles, thus making them more successful (Schunk & Pajares, 2002).

However, self-efficacy is not the only antecedent factor influencing the motivation to learn (Pajares, 2009), and there are some other factors that may mediate and/or moderate the impact of academic self-efficacy on academic motivation. Among these factors, we propose that a future orientation in education (i.e., conscious ideas about one's future education) plays an important role and that, together with academic self-efficacy, it contributes to predicting academic motivation. Empirical evidence has already linked future orientation to academic achievement motivation; that is, the activation of future thinking leads individuals to understand the importance of their present behavior for their future education and careers (Husman & Lens, 1999; Nuttin, 2014).Thus, when teachers are able to support students' future thinking regarding their education, they can also increase students' motivation to study.

In this chapter, we first analyze the constructs of academic motivation, academic self-efficacy, and future orientation. Subsequently, the interrelationship between academic self-efficacy, academic motivation, and future orientation is explored through original research. More precisely, drawing on self-determination theory (Decy & Ryan, 2000), social cognition theory (Bandura, 1977), and the three-component model of future orientation (Seginer, 2009), the study presented in this chapter aims to explore the mediating and moderating role of future orientation in the relationship between academic self-efficacy and the academic motivation to do academic work in a sample of Italian undergraduate students. We conclude by emphasizing the implications of the current study for the field of education.

Academic self-efficacy. There is widespread agreement among scholars that self-efficacy belief is a crucial factor in all kinds of educational processes. Educational psychologists have investigated the role played by competence perceptions in students' academic lives, in general, and in specific subjects or skills. According to Schunk (1991), academic self-efficacy can be defined as the degree to which an individual believes that they can successfully perform given academic tasks at certain levels. A similar definition has been proposed by Pajares (1996), who stated that the construct of self-efficacy includes beliefs about one's capabilities to complete a task successfully in an academic setting. Academic self-efficacy beliefs affect numerous

aspects of students' lives: how they face academic challenges; self-regulate cognition and behavior; display resilience in the face of stress, anxiety, and depression; and motivate themselves (Pajares, 2009; Pajares & Miller, 1994; Schunk, 1995). Several authors (e.g., Pajares, 1996; Schunk, 1991) have suggested how teachers are rewarded by paying attention to students' perceptions of competence because they get to know their students better. As noted by Pajares (1996), assessing students' academic self-efficacy can provide teachers with important insights. For example, unrealistically low self-efficacy in a specific subject may be partly responsible for course and career avoidance related to that specific academic field.

Students form their academic self-efficacy beliefs by interpreting information coming from four distinct sources (Bandura, 1977). Self-efficacy perceptions are commonly acquired through the interpretation of the results of one's previous performance or *mastery experience*. Outcomes interpreted as successful become the basis for developing beliefs regarding one's capabilities in an academic setting and for further engaging in different academic tasks. The implication of this fundamental fact is that teachers must help students to build a success story. A second way by which students can acquire self-efficacy is through *vicarious learning*, that is, by watching an academic task being successfully performed by people whom they view as being similar to themselves. Thus, if students face a difficult academic task, teachers can support them by demonstrating how to handle it or by pointing out "model classmates" who are doing it. Vicarious experience is particularly powerful when students have limited experience in a certain academic task or feel uncertain about their own competence. Academic self-efficacy is also formed by *social persuasions* and *verbal judgments* coming from teachers and other meaningful people. Positive persuaders encourage and empower, whereas negative precursors can weaken students' academic self-efficacy. Last but not least, the final source of self-efficacy is a student's *emotional state*, including arousal, stress, and mood states. Positive mood states can boost one's academic self-efficacy beliefs, whereas stress and excessive anxiety can undermine them. The most important implication for teachers is that students' motivation can be influenced by their emotional tone and non-verbal communication. When simply announcing a test, for example, their tone of voice, gaze, and facial expressions can make a group of students anxious or not.

Academic motivation. From a psychoeducational perspective, "academic motivation" has been described as a student's inner force and is behind the learning of school subjects, participation in school activities, and actions necessary for academic success across their entire academic life span (Martin, 2009; Pintrich & De Groot, 1990). Children are naturally motivated to explore their environment and gain knowledge of the world around them. Afterward, positive experiences in school can underpin their motivation to learn, whereas negative experiences can decrease their academic motivation because they may begin to think that there is no reason to study hard. In high school, a lack of motivation can easily lead to a decline in school attendance and grades and enhance the risk of dropping out of school (Archambault et al., 2009; Fan & Wolters, 2014). In college and university students, academic motivation has been shown to be related to a great number of cognitive and noncognitive factors, including academic performance (Farruggia et al., 2018), persistence

(Vanthournout et al., 2012), self-concept (Liu, 2010), and retention in the sophomore year (Davidson & Beck, 2006).

Self-determination theory (Deci & Ryan, 1985, 2000, 2008) posits three main types of motivation: (i) intrinsic, (ii) extrinsic, and (iii) amotivation. A student is intrinsically motivated when they do an activity mainly for the pleasure and satisfaction that is derived from doing that activity. The development of intrinsic motivation depends on the degree to which the basic psychological needs of autonomy, relatedness, and competence are satisfied by the social context (Ryan & Deci, 2000). In the educational field, the need for autonomy refers to students' need to be protagonists of their own learning and their sense of psychological freedom when engaging in an academic activity. The need for competence refers to students' feelings of mastery of academic tasks and their need to feel self-confident when achieving expected results. The need for relatedness refers to students' experiences of positive and pleasant relationships, characterized by a sense of friendliness and trust. As a practical matter, several factors can contribute to the satisfaction of these three needs, but among them, the most important is a teacher's way of engaging with students (Niemiec & Ryan, 2009). Teachers can support these three basic psychological needs by adopting a warm, well-organized, and autonomy-supportive motivation style, rather than a controlled, confused, and cold one. In this way, they can increase intrinsic motivation and the internalization of learning content. Thus, motivation strategies should include positive feedback, empathic communication, and the provision of choice alternatives.

By contrast, a learner is extrinsically motivated when an academic activity is pursued not for its own sake, but for external reasons (e.g., pressures, rewards, or punishments). The third macrocategory of motivation proposed by self-determination theory is amotivation, which can be described as a situation in which a student lacks the will to pursue an activity that is perceived as being outside of their control or competence.

According to this theory, intrinsic motivation leads to positive outcomes, whereas the less autonomous forms of motivation (especially amotivation) bring about negative effects. In fact, in the educational domain, research studies have revealed that intrinsic motivation is associated with the use of the most advantageous learning strategies (Yamauchi et al., 1999), high academic performance (Soenens & Vansteenkiste, 2005), academic achievement (Deci et al., 1991; Taylor et al., 2014), and increased amounts of pleasure while doing academic work (Vallerand et al., 1989).

Future orientation. The construct of future orientation refers to an individual's conscious representation of their future, which comprises thoughts, plans, motivations, and feelings (Nurmi, 2005; Seginer, 2009). This psychological dimension develops across the entire life span (Nurmi, 2005) from childhood (Bozzato, 2020; Haith et al., 1994) to old age (Lawton et al., 2002).However, most studies on future orientation refer to adolescents because of their more developed cognitive skills compared to children and based on the perception that they need to prepare for adulthood (Nurmi, 1991). In emerging adulthood, orientation toward the future remains a crucial factor because individuals have to face many life transitions and may

consciously perceive the fundamental role of future thinking in terms of organizing their lives (Nurmi, 2005).

Research suggests that future orientation can be a powerful motivator of current behavior. For example, future-oriented people with a propensity for planning showed greater determination in the pursuit of their goals (Greene & DeBacker, 2004; Husman & Shell, 2008). "It is so important for your future that you do your best at school" is a common expression used by teachers worldwide to motivate their students. The importance of future orientation in the educational domain has received extensive empirical attention. Researchers have found that students with long-term future thinking are more motivated to study than those with short-term future thinking (Lens, 2001; Lens et al., 2002). A growing body of research has revealed that future orientation indeed plays an important role in predicting students' academic functioning with regard to learning, performance, persistence (Simons et al., 2004), and achievement (Adelabu, 2008; Seginer, 2009). Moreover, future intrinsic goals are more likely to result in deep engagement with study material compared to future extrinsic goals (Simons et al., 2004).

Drawing on previous theoretical positions (Nurmi, 1991; Nuttin & Lens, 1985; Trommsdorff, 1983), the three-component model (Seginer, 2009; Seginer & Mahajna, 2018; Seginer et al., 1991) describes future orientation as being composed of three different aspects: (i) motivational, (ii) cognitive, and (iii) behavioral. The motivational component refers to what prompts individuals to think about the future and invest in this form of thinking. In the educational domain, this component relates to the following questions, for example: "How is education important for your future life?" and "How determined are you to fulfill your educational plans?" The cognitive component pertains to both hopes and fears and how often a person thinks about them—for example, "How worried do you feel about your future education?" and "How often do you think hopefully about your future education?" The behavioral component is indicated by the exploration of future options by seeking advice, gathering information, and being committed to one specific option on the basis of its suitability with respect to the individual's personal characteristics and environmental circumstances. This dimension relates to questions such as "How often do you engage in activities that bring you closer to your educational plans?" and "Are you making serious preparations for your future education?" According to this model, the three components are in a dynamic relationship: The motivational dimension directly influences the other two components and indirectly affects the behavioral component because of its effect on the cognitive representation component. On this basis, the behavioral component regulates various aspects of present behavior.

The current study explores the impact of academic self-efficacy on academic motivation in a sample of Italian undergraduate students facing their transition to university. The study examines the effect of academic self-efficacy and future orientation on the three different macrodimensions of academic motivation (i.e., intrinsic, extrinsic, and amotivation). Based on studies that have found a direct relationship between academic self-efficacy and academic motivation (e.g., Pajares, 2009; Pajares & Miller, 1994; Schunk, 1995) and those that have found relationships between future orientation and academic motivation (e.g., Lens, 2001; Lens et al.,

2002), it seems reasonable that future orientation mediates and moderates the relationship between academic self-efficacy and academic motivation. Thus, the current study raises three hypotheses. The first hypothesis postulates that high academic self-efficacy is associated with more future-oriented thinking about one's education. The second hypothesis is that both academic self-efficacy and future orientation are positively associated with intrinsic and extrinsic academic motivation and negatively associated with amotivation. The third hypothesis predicts that future orientation will mediate and moderate the relationship between academic self-efficacy and academic motivation. Moreover, as academic motivation comprises different dimensions, the study aims to explore the mediation and moderation role of future orientation in each dimension of academic motivation. The hypothetic models are illustrated in Figs. 12.1 and 12.2.

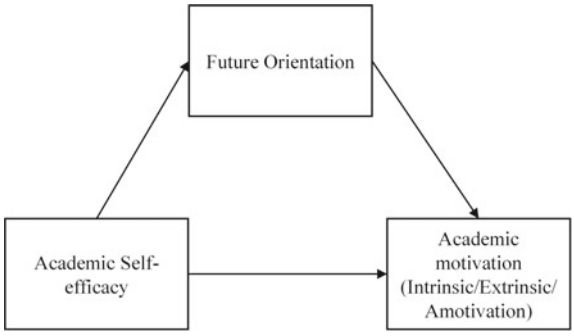

Fig. 12.1 Hypothetic mediating role of future orientation between academic self-efficacy and academic motivation

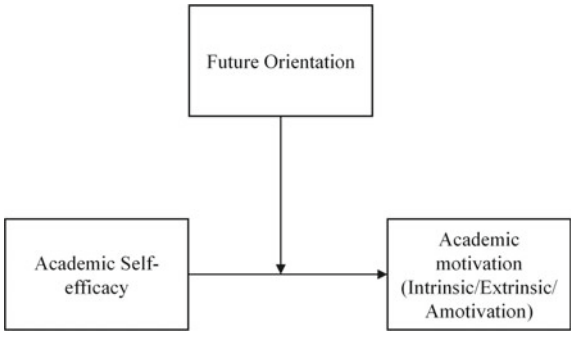

Fig. 12.2 Hypothetic moderating role of future orientation between academic self-efficacy and academic motivation

Method

Participants

The participants included 1008 college students (563 females, one did not report their gender) recruited from a university located in the north of Italy and who were aged 19–23 years old (mean [*M*] = 20.23, standard deviation [*SD*] = 0.968). Of the students, 493 (44.5%) were in their first year of university, and 615 in their sophomore year; 178 (17.0%) of the participants' fathers and 192 (18.4%) of their mothers had an academic degree. The participants were majoring in different disciplines: health and wellness sciences (n = 373, 33.7%); mathematics, science, and computer science (n = 389, 35.1%); human sciences (n = 262, 23.6%); law (n = 38, 3.4%); and economics (n = 46, 4.2%).

Measures

Academic Self-efficacy

The Italian version of the Perceived Academic Self-Efficacy Scale (Burgalassi et al., 2016) was used to measure students' academic self-efficacy. It consists of ten items that were adapted from Bandura (1990). Sample items from this scale are "How well can you study when there are other interesting things to do?" and "How well do you plan your university activities (e.g., lectures, self-and group study, and exam sessions)?" The participants rated the strength of their self-efficacy beliefs on a 4-point response scale (1 = *not well at all*, 2 = *not well*, 3 = *well*, and 4 = *very well*). The final score was given by the sum of all the items.

Future Orientation

Future orientation was assessed through five items belonging to the future education section of the Prospective Life Course Questionnaire (Seginer, 2009; Seginer et al., 1991, 1994). Each question of this questionnaire has its own response scale, comprising five response categories. For the Italian version, conventional translation and back-translation procedures were performed independently by two Italian bilingual academics and one bilingual psychologist to ensure the equivalence of the meaning and accuracy of their translations. Sample items are "How important a role do you think education plays in your future life?" (response scale: 1 = *not at all important*, 2 = *not very important*, 3 = *somewhat important*, 4 = *rather important*, and 5 = *very important*) and "How determined are you to fulfill your educational plans during the coming years?" (response scale: 1 = *not at all determined*, 2 = *not*

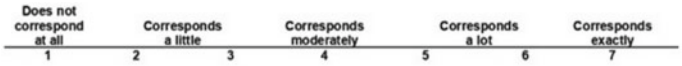

Fig. 12.3 7-point response scale of the Academic Motivation Scale—college version (Vallerand et al., 1992)

very determined, 3 = *somewhat determined*, 4 = *rather determined*, and 5 = *very determined*).The final score was given by the sum of the five items.

Academic Motivation

The Italian version of the Academic Motivation Scale for university students—developed by Vallerand et al. (1992)and validated by Burgalassi et al. (2016)—was used to measure the three dimensions of students' academic motivation (i.e., intrinsic, extrinsic, and amotivation). Students were asked why they attended university. Sample items for each dimension are "Because I experience pleasure and satisfaction while learning new things" (intrinsic); "Because I think that a university education will help me better prepare for the career I have chosen" (extrinsic); and "Honestly, I don't know; I really feel that I am wasting my time in school" (amotivation). The participants rated their agreement with each item on a 7-point response scale, ranging from 1 = *does not correspond at all* to 7 = *corresponds exactly*. In this scale only categories 1, 4, and 7 are anchored meaning-wise. Between points 2 and 3, a meaning is provided, and the same occurs between categories 5 and 6 (see Fig. 12.3). A motivation score was calculated for each category (intrinsic, extrinsic, and amotivation) by averaging the score of all the items in the subscales within the category.

Procedure and Ethics

The study was carried out in accordance with the ethical guidelines of the Italian Psychological Association. Data were collected through an online form sent via e-mail to all the first- and second-year students of the university involved in the study. Before filling out the main scales, the participants answered demographic questions and provided informed consent to the research, agreeing to voluntarily take part in the study and have their data aggregated, anonymized, and published in scientific publications. No compensation was provided, and the participation rate was 45.6%.

Data Analysis Strategy

SPSS (Statistical Package for the Social Sciences, v.22.0; IBM Corporation, 2013) and Mplus 8.3 (Muthén & Muthén, 2017) were used to conduct all the data analyses. First, gender/age/discipline differences were examined in the main variables of interest to decide whether to control for these variables or not. Second, descriptive analysis was conducted, and Pearson's correlations were calculated for the main variables. Finally, path analysis with multiple dependent variables was performed to explore the mediating and moderating role of future orientation in academic self-efficacy and the three subdimensions of academic motivation. Bias-corrected bootstrapped samples ($N = 5000$) were used to estimate the 95% confidence interval (CI), which indicates a significant indirect effect if zero is not included in it. A simple slope test was performed to explore the essence of the possible moderating role of future orientation.

Results

Gender/Age/Discipline Differences in Academic Efficacy, Future Orientation, and Academic Motivation

For male and female students, there was no significant difference in perceived academic self-efficacy ($t_{1105} = 0.34$, $p = 0.74$), future orientation ($t_{1105} = 0.35$, $p = 0.72$), intrinsic motivation ($t_{1105} = 0.21$, $p = 0.84$), extrinsic motivation ($t_{1105} = -0.23$, $p = 0.82$), or amotivation ($t_{1105} = 0.32$, $p = 0.75$).

A one-way analysis of variance indicated that there were significant age differences in students' future orientation ($F_{4,1103} = 2.85$, $p < 0.05$), whereas there were no significant differences in their academic self-efficacy and different dimensions of motivation. Also, significant differences in future orientation ($F_{4,1103} = 15.27$, $p < 0.001$) and intrinsic motivation ($F_{4,1103} = 4.79$, $p < 0.01$) were observed among students who majored in different disciplines.

Considering these significant differences and in order to capture the unique relationship among the main variables studied, students' age and majors were added as control variables in the following path analyses. Gender was dummy coded as "1 = male" and "2 = female," and majors were coded as: "1 = health and wellness sciences," "2 = mathematics, sciences, and computer science," "3 = human sciences," "4 = law," and "5 = economics."

Descriptive Analysis Results

The descriptive analysis results are presented in Table 12.1.

These results are consistent with the previous literature proposing an association between academic self-efficacy and academic motivation to do academic work (e.g., Pajares, 2009; Pajares & Miller, 1994; Schunk, 1995), as well as between future orientation and academic motivation (e.g., Greene & DeBacker, 2004; Husman & Shell, 2008). As assumed by our first hypothesis, a positive and significant relationship was also found between academic self-efficacy and future orientation in education. This means that high levels of academic self-efficacy are associated with greater future orientation, and the more students develop their future thinking, the stronger their academic self-efficacy. This result is consistent with Bandura's theory of social cognition, which postulates that most human actions are designed to be goal-directed and that people develop outcome expectations regarding their actions. Self-efficacy beliefs and outcome expectations combine to generate a certain level of motivation to use one's own initiative (Bandura, 1986).

Another finding of this study is that positive and significant relationships were observed between academic self-efficacy and both intrinsic and extrinsic academic motivation, whereas a negative and significant relationship were identified between academic self-efficacy and amotivation. This finding, while confirming our second hypothesis, can also be explained using the conceptual framework of social cognition theory, which posits that individuals' expectations of outcomes rely on the self-evaluations of their performance in given situations (Bandura, 1986). This is in agreement with the studies of different scholars who documented the role of self-efficacy in academic motivation. For example, Chowdhury and Shahabuddin (2007) found a significant and positive correlation between self-efficacy beliefs and both intrinsic and extrinsic motivation in college students. On the other hand, in their study involving college students, Walker et al. (2006) discovered a significant negative correlation between self-efficacy and amotivation.

Table 12.1 Means, standard deviations, and correlations of variables ($N = 1108$)

Variables	1	2	3	4	5
1. Academic self-efficacy	–				
2. Future orientation	0.41***	–			
3. Intrinsic motivation	0.38***	0.46***	–		
4. Extrinsic motivation	0.21***	0.41***	0.65***	–	
5. Amotivation	−0.21***	−0.37***	−0.13***	−0.07*	—
M (*SD*)	26.94 (4.54)	20.01 (3.50)	50.52 (14.95)	57.60 (13.71)	6.02 (4.06)
Cronbach's alpha	0.79	0.73	0.93	0.88	0.90

Note M = mean; SD = standard deviation.* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Another finding of the current study is that future orientation was positively and significantly correlated with intrinsic and extrinsic academic motivation, whereas students' orientation toward their future education was negatively and significantly correlated with amotivation. In other words, a student engages in academic work at the present time if they believe that success in terms of their future education will lead to internal satisfaction or external recognition. Also, this result is consistent with prior research showing that the degree to which a student orients themselves toward the future is likely to have an effect on their academic motivation. For instance, Agarwal and Tripathi (1980) found that future orientation was correlated with the need for achievement, but only in success-oriented students and not in failure-threatened participants. Wolf and Savickas (1985) demonstrated that students with a more integrated time perspective were more prone to believe that their future outcomes would dependably follow their present efforts regarding their academic work.

The Mediating Role of Future Orientation

The path analysis results without a mediator are shown in Fig. 12.4. These findings indicate that the direct effects of academic self-efficacy on the three subdimensions of academic motivation were all significant. Specifically, the direct path coefficients from academic self-efficacy to intrinsic motivation ($\beta = 0.38$, $p < 0.001$; *Note*: the beta here is the standardized regression coefficients, and the same applies below) and extrinsic motivation ($\beta = 0.21$, $p < 0.001$) were positive and significant. The

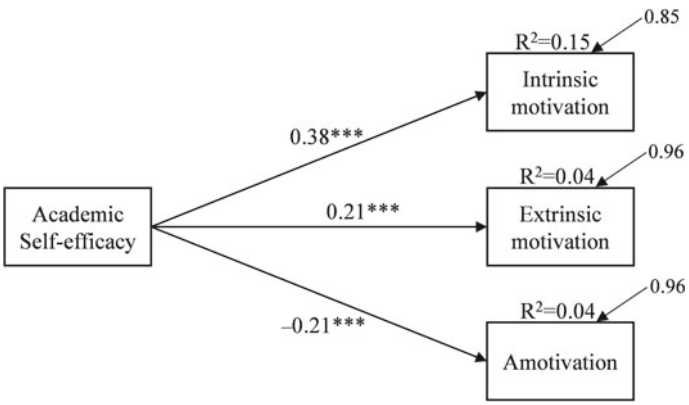

Fig. 12.4 Direct effect of academic self-motivation on academic motivation (without a mediator). *Note* Control variables (students' age and majors) were included, but they are not presented here for simplicity (only the students' majors negatively predicted intrinsic motivation, $\beta = -0.06$, $p < 0.05$). The path values are the standardized regression coefficients.*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

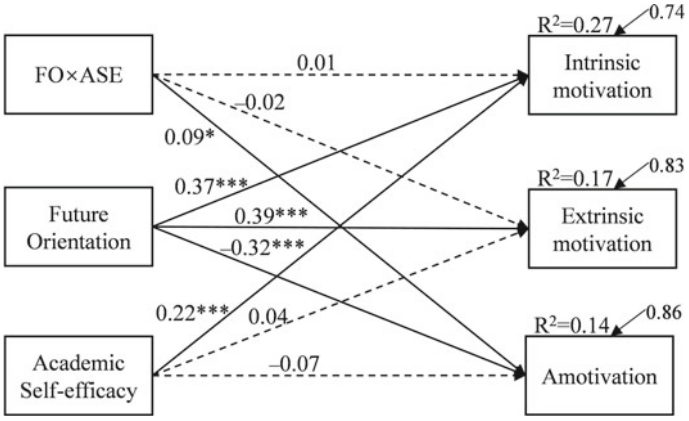

Fig. 12.5 Mediating role of future orientation between academic self-efficacy and academic motivation. *Note.* Control variables (students' age and majors) were included, but they are not presented here for simplicity. Students' age positively predicted intrinsic motivation ($\beta = 0.07, p < 0.05$), while it negatively predicted future orientation ($\beta = -0.06$, $p < 0.05$). The students' majors negatively predicted future orientation ($\beta = -0.06, p < 0.05$). The path values are the standardized regression coefficients. The dotted lines indicate the nonsignificant paths.*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

direct path coefficient from academic self-efficacy to amotivation was negative and significant ($\beta = -0.21$, $p < 0.001$).

Future orientation was added to analyze its mediating role between academic self-efficacy and academic motivation. As shown in Fig. 12.5, academic self-efficacy positively predicted future orientation ($\beta = 0.41, p < 0.001$), which in turn positively predicted intrinsic motivation ($\beta = 0.37$, $p < 0.001$) and extrinsic motivation ($\beta = 0.39, p < 0.001$), as well as negatively predicting amotivation ($\beta = -0.34, p < 0.001$). At the same time, the residual direct relationship between academic self-efficacy and intrinsic motivation remained significant ($\beta = 0.22$, $p < 0.001$), whereas those between academic self-efficacy and extrinsic motivation ($\beta = 0.04$, $p = 0.20$) and amotivation ($\beta = 0.04$, $p = 0.06$) were nonsignificant. These results, in line with our third hypothesis, indicate that students' future orientation plays a full mediating role between academic self-efficacy and extrinsic motivation and amotivation and a partial mediating role between academic efficacy and intrinsic motivation.

To further analyze the indirect effects of future orientation on academic self-efficacy and academic motivation, the bootstrap procedure was used to generate 95% CIs for all the indirect effects. As presented in Table 12.2, the indirect effects of academic self-efficacy on intrinsic motivation, extrinsic motivation, and amotivation mediated by future orientation were estimated as being 0.154 (95% CI: ~0.125–0.187), 0.163 (95% CI: ~0.133–0.197), and −0.140 (95% CI: ~−0.175 to −0.110), respectively. Zero was not included in all the 95% CIs, indicating that academic self-efficacy significantly exerted indirect effects on each subdimension of academic motivation via future orientation.

Table 12.2 Standardized indirect effects and their 95% CIs

Model path	Estimated effect	95% CI	
		Lower	Upper
ASE → FO → In_Mo	0.154	0.125	0.187
ASE → FO → Ex_Mo	0.163	0.133	0.197
ASE → FO → Amotivation	−0.140	−0.175	−0.110

Note ASE = academic self-efficacy; FO = future orientation; In_Mo = intrinsic motivation; Ex_Mo = extrinsic motivation; 95% CI = 95% confidence interval; bootstrap sample size = 5000

Thus, the current study expands the existing literature by documenting that, across a single sample of Italian undergraduate students, future orientation in education fully mediates the relationship between academic self-efficacy and extrinsic motivation, on the one hand, and between academic self-efficacy and amotivation, on the other. Moreover, academic self-efficacy influences university students' intrinsic motivation both directly and indirectly through its effect on future orientation. Therefore, the link between academic self-efficacy and academic motivation is not simply direct; rather, future orientation seems to serve as an important factor through which self-efficacy beliefs affect academic motivation, especially in the case of extrinsic motivation and amotivation.

The Moderating Role of Future Orientation

After the variables were standardized, the interaction item (future orientation × academic self-efficacy) was constructed to analyze the moderating role of future orientation in academic self-efficacy and academic motivation. As shown in Fig. 12.6, the interaction item only significantly predicted amotivation ($\beta = 0.74$, $p < 0.05$), which indicates that future orientation moderated the relationship between academic self-efficacy and amotivation.

A simple slope test was conducted to further analyze the moderating role of future orientation in academic self-efficacy and amotivation (see Fig. 12.7).

The results showed that for students with high future orientation (1 *SD* greater than the mean), academic self-efficacy was nonsignificantly associated with amotivation ($\beta = 0.08$, $p = 0.66$). However, for those with low future orientation (1 *SD* less than the mean), the negative relationship between academic self-efficacy and amotivation was significant ($\beta = -0.58$, $p < 0.001$).

Thus, another finding of the current study, in line with our third hypothesis, is that future orientation in education moderates the relationship between academic self-efficacy and amotivation. This means that the negative relationship between academic self-efficacy and amotivation is stronger for students with low levels of future orientation. On the contrary, when the degree of future orientation becomes higher, this negative relationship becomes weaker. Consequently, it can be said that

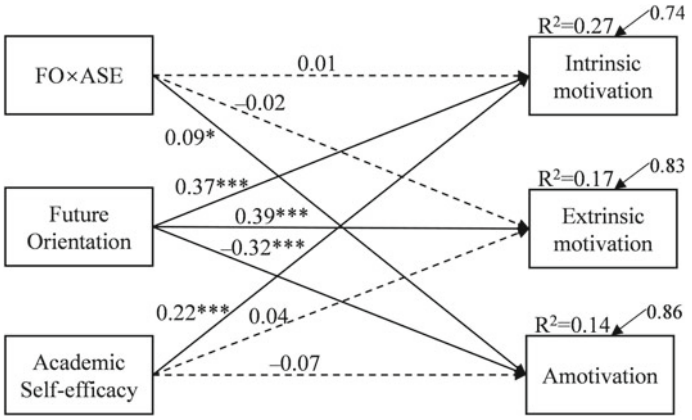

Fig. 12.6 Moderating role of future orientation between academic self-efficacy and academic motivation. *Note* FO = future orientation; ASE = academic self-efficacy. Control variables were included (students' age and majors), but they are not presented here for simplicity (only the students' age positively predicted intrinsic motivation, $\beta = 0.07$, $p < 0.05$). The path values are the standardized regression coefficients. The dotted lines indicate the nonsignificant paths. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

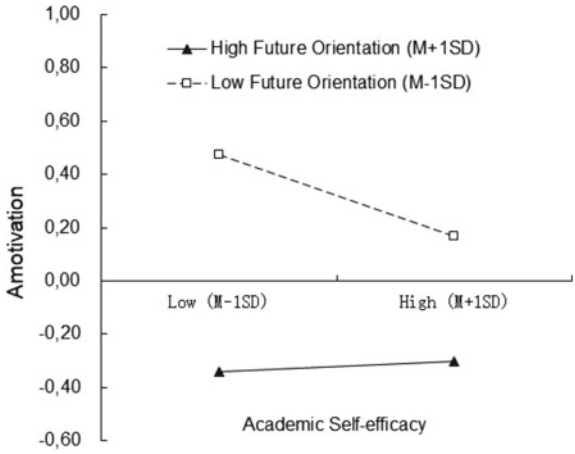

Fig. 12.7 How future orientation moderate the relationship between academic self-efficacy and amotivation

high future orientation can buffer the negative effect of low academic self-efficacy on students' academic amotivation. For example, if a student has low academic self-efficacy, they probably have a high level of amotivation. But if this student has a high level of future orientation, they may still have a low level of amotivation. This finding extends the previous literature, which only examined the relationship between self-efficacy and academic motivation or between future orientation and the motivation to achieve academic success.

Limitations, Implications, and Conclusion

Before discussing the implications of these findings, several limitations warrant mentioning. First, because of the lack of research funds, we could only conduct a cross-sectional study using convenience sampling. Second, the data are self-reported and therefore liable to well-known biases, regarding the proper understanding of the questions and response scales, the authenticity of the answers provided, and social desirability. In particular, although employed in several studies, the response scale of the Academic Motivation Scale with the meaning anchors that exist between some of the response categories might have been difficult to interpret. Third, given that social status (McLoyd et al., 2011) and culture (Seginer, 2019) can influence youths' future orientation, future research with large and representative samples is necessary to examine the impact of academic self-efficacy on academic motivation through future orientation. Thus, caution is needed when generalizing the findings of this study. Fourth, the cross-sectional nature of the data only highlights associations and does not provide any causal assumptions. Specifically, some relationships may be bidirectional, and it would be inappropriate to make statements about the causal direction of the observed effects. Future longitudinal studies would shed light on the direction of these effects.

Despite the above limitations, the present study contributes to the growing body of research on academic self-efficacy. In particular, this study helps to bring together previous work on academic self-efficacy with the literature on future orientation in the study of academic motivation. Furthermore, the results presented here support the usefulness of a theoretical model in which self-efficacy and future orientation jointly make important contributions to the prediction of academic motivation. New research could further investigate the link between these three constructs. The results of the present study give us confidence that such research could yield important, meaningful, and useful information.

Having established the mediating and moderating role of future orientation in the relationship between academic self-efficacy and academic motivation, the present study has important implications for the educational domain. First, the study results suggest that one possible way to enhance academic motivation and reduce amotivation with regard to academic work is to strengthen students' academic self-efficacy beliefs and future orientation in terms of their education. Simply having strong academic self-efficacy beliefs, without ideas about one's future education, may not be enough to develop meaningful academic motivation. A student lacking future orientation may say, "I am good at informatics, but I do not know if I want to study this subject in the next years." Their motivation to study may not be high at present or may decrease over time. On the contrary, a more future-oriented student may say, "I am good at biology and psychology and I would like to specialize in neuroscience," and these two factors (academic self-efficacy and future orientation) taken together are likely to have a great impact on their academic motivation. Moreover, it has been found that future orientation seems to buffer the negative effect of low academic self-efficacy on students' academic amotivation. This means that when self-efficacy

beliefs are weak, if counseling or other academic activities strengthen future thinking, the increased future orientation is likely to improve the level of motivation with regard to academic work despite low self-efficacy. Consequently, it is advisable that college or university psychologists, teachers, and educators inform and educate students on the role of self-efficacy and their future beliefs in academic motivation. If professionals help individuals develop strategies to increase academic self-efficacy and also to design and commit to a valued, achievable, and controllable future educational plan, students might become more motivated to do academic work. When students are guided to explore and improve their self-efficacy beliefs and, in parallel, establish future educational goals viewed as attainable, this challenges them and probably increases their academic motivation. For this purpose, specific training activities to improve goal-setting abilities can be designed by educational professionals.

Self-determination theory posits that two of the basic needs of human beings are autonomy and competence. Thus, as suggested by Simons et al. (2004), if students are encouraged to realize that the importance of their future education is in line with their needs for autonomy and competence, this might further enhance their academic motivation. For example, students could be stimulated to reflect on the possible professional careers they would like to pursue and the necessary educational steps they have to take to attain their goals.

In conclusion, the findings of this study highlighted the significant role of students' self-efficacy and future orientation in academic motivation. On the basis of the literature and empirical studies, it can be stated that students who perceive themselves as capable of learning and maintaining an effective vision of their future education are more motivated to do academic work than their counterparts. Hence, students must have faith in their academic abilities and future education to foster brilliant motivation to study.

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Chapter 13
Academic Self-efficacy Trajectories: Applying a Development Perspective to Differentiate Between Freshmen Reporting High Versus Low Intentions to Drop Out

Pascale Stephanie Petri and Edith Braun

Abstract Dropout is a widespread phenomenon in higher education: About every third student in the OECD countries drops out from studying. Most of them are lost in their first year in higher education. Empirical results suggest that academic self-efficacy is a strong predictor for dropout intentions and study success, operationalized as academic achievement or student satisfaction. While the fact that the more specific academic self-efficacy is assessed, the better the prediction, is widely accepted and accounted for, the dynamics inherent in the nature of this construct are often neglected. This chapter intends not only to add to the current perspectives on academic self-efficacy in an empirical way but also to add with respect to the practical implications. We present an empirical example about trajectories of self-efficacy in a sample of $N = 424$ freshmen, with three points of measurements within 9 months. Hereby, we show that students highly prone to dropout show a different shape of academic self-efficacy growth curve compared to those not intending to drop their studies. Further, we outline that the trajectories of academic self-efficacy might be even more predictive for several (academic) outcomes than single-shot assessment highlighting the importance of longitudinal assessment. Finally, our findings show practical implications: We question the prevalent perception of academic self-efficacy as a fixed predictor and suggest to apply a developmental perspective. Self-efficacy might be one of the most promising starting points for student support, and the promotion of academic self-efficacy can therefore be seen as a central task for lectures as well as counselors. As a possible practical implementation for monitoring trajectories of academic self-efficacy, we outline the online self-assessment approach.

Keywords Dropout intention · First year in higher education · Freshmen · Growth curves · Longitudinal assessment

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Introduction

Dropout is a widespread phenomenon in higher education: About every third student in the OECD countries drops out from studying: This holds true in general on average across OECD countries (Vossensteyn et al., 2015) and in specific for Germany (Heublein et al., 2017; Neugebauer et al., 2019). Most of them are lost in their first year at higher education (Heublein et al., 2017; Vossensteyn et al., 2015) which can therefore be seen as a critical phase. For that dropout is costly not only on the micro-level (individual) but also on the meso- and macro-level, most higher education policies have high completion rates at the top of their agendas (European Commission, 2010, 2019; Vossensteyn et al., 2015).

Consistently, ideas for preventing dropout are in demand on the institutional level. Considering research on predictors of study success as well as dropout appears to be a reasonable starting point.

As literature reveals, academic self-efficacy is one of the best predictors for academic outcome like GPA or persistence or even dropout (intentions) as the opposite. Hereby, academic self-efficacy is defined as the belief in one's own capability to overcome certain challenges within the academic context. Besides primary evidence, the strong association between academic self-efficacy and measures of study success versus dropout is proved even meta-analytically (Richardson et al., 2012; Robbins et al., 2004; Schneider & Preckel, 2017).

The fact that the more specific academic self-efficacy is assessed, the better the prediction, is widely accepted and accounted for (Bandura,2001; Betz and Hackett, 2006; Brunswik, 1955). However, as Bandura(2010) reflects for self-efficacy in general, this construct is not a more or less stable attribute as core personality attributes like the big five (factors) (McCrae et al., 2000). Instead, the dynamics inherent in the nature of this construct often appear to be neglected when it comes to employing it as a predictor for a specific outcome.

Academic self-efficacy (as well as all sorts of context-specific self-efficacy) is a construct underlying permanent influences through experiences of (academic) success and failure. The same is true for the appraisals of self-efficacy specific for the first year of study.

With this in mind, we focused on the first year in higher education—as a significant phase with its characteristic challenges freshmen have to overcome. In the following, we refer to the specific form of academic self-efficacy that is defined as freshmen's belief in their ability to master these challenges ahead of them as *Freshmen Self-Efficacy* (FSE).

We consider FSE as a promising candidate for the prediction of intentions to drop out at the end of the first year of study. Moreover, building on the recommendations made by Richardson et al. (2012), we regard longitudinal (i.e., repeated) assessment of this predictor as an essential cue for timely identifying students prone to drop out in order to provide support to those potentially at risk. We therefore address the question if students prone to drop out versus those not prone to drop out differ in the FSE development over the course of their first year in higher education.

In concrete, we examined the three research questions (RQ) outlined below:

1. Do students prone to dropout differ significantly in their level of self-efficacy from those not prone to dropout?
2. Is the combination of repeated assessments of FSE a better predictor for dropout intentions as the single-shot assessment of self-efficacy (at any point in time during the first year of study)?
3. Do students prone to dropout show a differently shaped FSE trajectory than those not prone to dropout?

Method

To study the above-mentioned research questions, we conducted three longitudinal studies (three cohorts), surveying freshmen repeatedly over the course of their first year of study.[1] Hereby, participants filled in three surveys over the course of the first two semesters: at the beginning of their first semester (t1), at the end of their first semester (t2) and at the end of their second semester (t3). In sum, this longitudinal data collection spanned nine month in each of the three cohorts.

Sampling Procedure

Starting with the cohort in winter 2016/2017, we sampled freshmen at different higher education institutions in Germany, including a variety of study fields. For recruiting purposes, we used three strategies: First, we searched a popular and contemporary social network for freshmen groups and posted calls for participation. Second, we sent emails to all students at a medium-sized German university. Third, we advertised the study on our institute's Web page and social media outlets.

The study design was the same for all three cohorts. After initial sampling at the beginning of the first semester, only those participating at the first point of measurement were invited by email to take part in the second (i.e., the end of the first semester) and third (i.e., the end of the second semester) point of measurement. At every point of measurement, participants filled in an online questionnaire, which took between 15 and 20 min. As an incentive, participants could take part in a lottery for online shopping vouchers (4×25 €).

[1] Note that a former version of this manuscript is part of a finished dissertation: Petri (2021).

Table 13.1 Demography of the three cohorts and the aggregated sample

Sample	Gender (% female)	Age (years)	Study fields (%)				
			1	2	3	4	5
Aggregated ($N = 424$)	80.4	M = 20.9 (SD = 3.8)	21	25	14	22	18
Cohort I ($N = 145$)	79.3	M = 20.3 (SD = 2.5)	19	29	14	30	8
Cohort II ($N = 119$)	82.4	M = 21.0 (SD = 4.4)	29	17	14	26	14
Cohort III ($N = 160$)	80.0	M = 20.7 (SD = 3.4)	17	27	13	12	31

Note Fields of study: 1 = STEM, 2 = medicine and psychology, 3 = language, culture and social sciences, 4 = pedagogy, 5 = economics, law and others

Sample

The final sample for analysis encompassed $N = 424$ freshmen. Over the course of the study (nine months), we registered panel attrition: In each cohort, we observed approximately 50% attrition from t1 to t3. Note that students were allowed to participate at t3 even if they did not take part at *t*2. Therefore, sample sizes per point of measurement vary: At t2, only $N_{t2} = 401$ students filled in the survey. The demography of each cohort and the aggregated sample is displayed in Table 13.1.

The samples drawn from the three cohorts were comparable not only concerning the average age of participants (between 20 and 21 years), but also with respect to the distribution concerning gender and the fields of study. Furthermore, our samples appear to be very heterogeneous when it comes to the fields of study.

Instruments

The three surveys encompassed several instruments. In the following, we outline only those relevant for this chapter.

Self-Efficacy. Leaning on the previous work, we decided to assess self-efficacy context-specific (Bandura, 2010; Betz & Hackett, 2006) with a focus on the first year of study. As there was no such scale tailored to the challenges freshmen face (in Germany), we constructed one on our own. A detailed description of the construction and validation procedure can be found elsewhere (Petri, 2020). In this FSE scale, freshmen are asked to rate their agreement with several statements concerning overcoming challenges in this particular phase of their academic careers. They could provide their answers on a five-point response scale (1 = 'totally disagree', 2 = 'disagree to some extent', 3 = 'indifferent', 4 = 'agree to some extent', 5 = 'totally agree').

Table 13.2 Instruments used, including means, standard deviations and reliability

Construct	Reference	No. of items	Time	M (SD)	Reliability (Cronbach's α)	Example item[1]
Freshmen self-efficacy	Petri(2020)	13	*t*1	3.62 (0.47)	0.82	Please rate how confident you are that you will be able to organize your schedules on your own
			*t*2	3.76 (0.47)	0.84	
			*t*3	3.78 (0.52)	0.87	
Intentions to drop out	Adapted from, e.g., Respondek et al.(2017)	2	*t*3	2.87 (1.83)	–	I plan to leave university permanently

Note. Aggregated sample, $N = 401–424$. Different sample sizes for different instruments because not all participants filled in all items. Time = point of measurement

[1]For descriptive purposes, we translated one item per construct from German into English. In our studies, all items were administered in German

The FSE score was calculated as the mean of all 13 items. Cronbach's α for the FSE scale was between 0.82 and 0.87. Table 13.2 displays the respective reliability estimation per point of measurement as well as the descriptive statistics for all instruments.

Intentions to drop out. Further, we asked students to rate their agreement with two statements about intentions to drop out at timepoint three (see Table 13.2) on a seven-point response scale (only the lowest and the highest category were named: 1 = 'totally disagree' to 7 = 'totally agree') which were aggregated by calculating the mean score. Based on that, we separated two groups: Students reporting at least a medium agreement to the dropout statements ('4' or higher) were assigned to the so-called dropout group (DG, $N = 77$, 83% female), and the others were assigned to the 'persistence group' (PG, $N = 347$, 80% female).

All data analyses were conducted with SPSS Statistics 21(IBM Corp, 2012) and RStudio (RStudio Team, 2021), using in particular the *lavaan* (Rosseel, 2012), the *QuantPsyc* (Fletcher, 2012), the *lme4* (Bates et al., 2015), the *jtools* (Long, 2020), the *sandwich* package (Zeileis, 2004; Zeileis et al., 2020) as well as the *semTools* package (Jorgensen et al., 2018).

For a better comprehensibility, we will explain which analysis has been applied for each research question separately when reporting the results.

Results

Differences in FSE Level

For our first research question, whether students prone to dropout differ in their average FSE level from those not prone to dropout, we looked at the group means. As displayed in Table 13.3, at every single point of measurement, the dropout group and the persistence group differed in their average FSE level: Comparing the FSE level across the three points of measurement, student in the dropout group showed on average lower rates as those in the persistence group, as can be seen in Fig. 13.1, too.

Table 13.3 Descriptives for the dropout group (DG) and persistence group (PG) as well as *t*-test for all three points of measurement

Time	*M (SD)*		*t*-test
	DG ($N_{DG} = 77$)	PG ($N_{PG} = 347$)	
*t*1	3.46 (0.55)	3.65 (0.45)	$t\ (99.06) = 2.83$ ($p < 0.001$)
*t*2	3.58 (0.52)	3.79 (0.45)	$t\ (93.77) = 3.27$ ($p = 0.002$)
*t*3	3.31 (0.56)	3.88 (0.45)	$t\ (99.30) = 8.29$ ($p < 0.001$)

Note Time = point of measurement

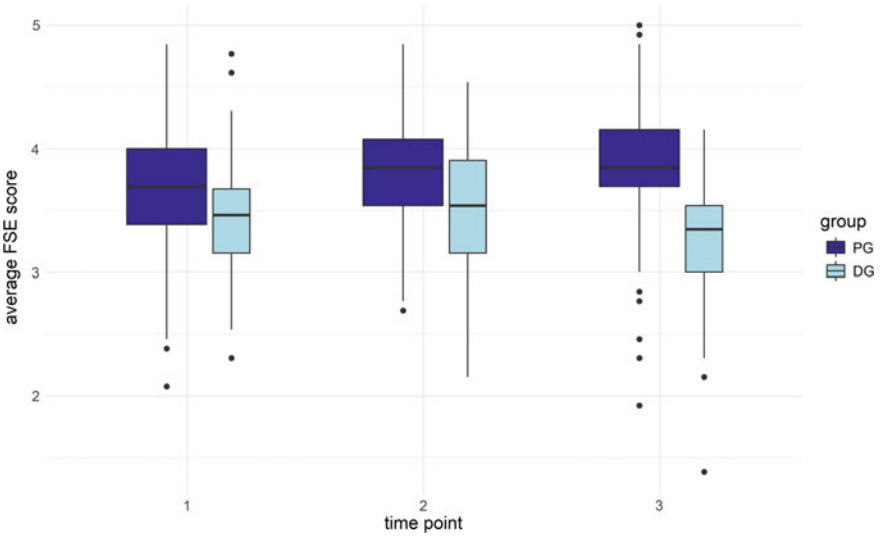

Fig. 13.1 FSE trajectories within the two groups (PG = persistence group, DG = dropout group), N = 401–424

From the first to the second point of measurement (t1 to t2), the average FSE level increased in both groups, but the increase is nominally smaller in the dropout group. Comparing the last two points of measurements (t2 and t3), the persistence group still showed an increase in the average FSE level, while the dropout group showed on average a decrease. Welch two sample *t*-tests (used because of unequal variances, Derrick & White, 2016) reveal significant group differences for all three points of measurement (see Table 13.3).

Looking at all three points of measurement in one analysis, a repeated measurement ANOVA (within subject: three points of measurement; between subject: group) revealed statistical significance too: $F\ (1,\ 399) = 48.24$, $p < 0.001$. In sum, our findings support the notion of group mean differences in the FSE levels.

Predicting Intentions to Drop Out with One Versus Multiple Predictors

The second research question is, whether the combination of repeated assessments of FSE serve as a better predictor for intentions to drop out than one single-shot assessment (at any point in time during the first year of study). To answer this question, we analyzed four different linear regression models, all of them with the intentions to drop out as criterion. In the first three models (model 1 to 3), we used one FSE assessment as single predictor each. Model 4 was a multiple linear regression with all three predictors (FSE at t1, t2, t3).

As linear regression has prerequisites, we first looked at these. In particular, three requirements should be fulfilled: (i) linearity (linear relation between predictor(s) and criterion), (ii) normality and (iii) homoskedasticity of the residuals (Bortz & Schuster, 2010). We see the first one as fulfilled because higher levels of FSE should on the one hand (theoretically) be associated with less intentions to drop out. This not only appears to be a reasonable hypothesis based on the definition of these constructs but also can be seen as proved to some extent, as even the above-mentioned meta-analyses (Richardson et al., 2012; Robbins et al., 2004; Schneider & Preckel, 2017) show substantial associations. On the other hand, a visual inspections of Fig. 13.2 (standardized predictor on the *x*-axis and criterion (dropout intentions) on the *y*-axis) underpin this for our data presented here. The fact that FSE at t3 reveals the strongest bivariate relation with the intention to drop out is not surprising for that in this case, as the predictor and criterion were assessed at the same point in time. In other words, the smaller the delay between assessing the predictor and assessing the criterion, the higher the bivariate correlation. Note that Fig. 13.2d) displays the bivariate correlation between the standardized predictor variable of model 4 with the criterion. The second assumption was not fulfilled for all four models (see Table 13.4).

In Fig. 13.3, we present plots showing the residual distributions for model 4 (to keep it concise, we do not show the plots for model 1 to 3, but note that these plots

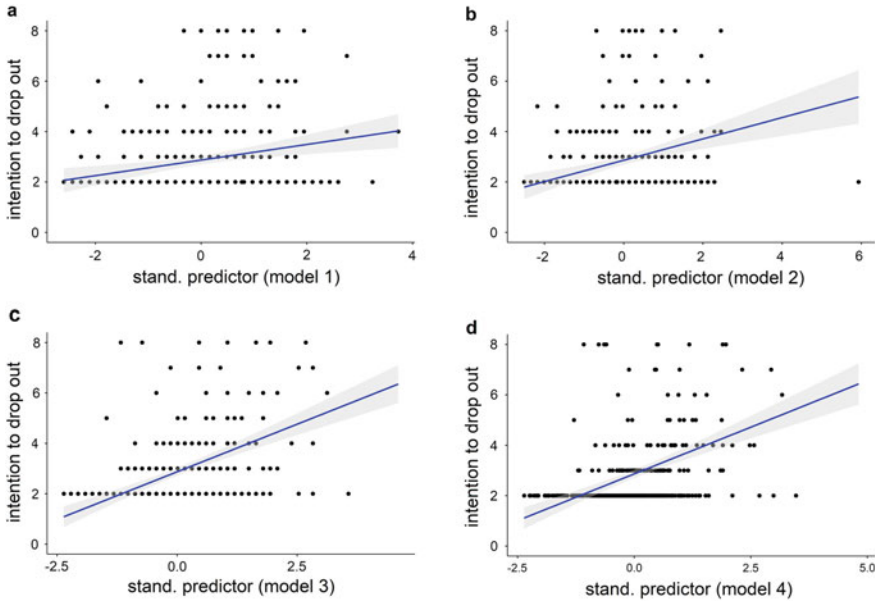

Fig. 13.2 Model 1 to 4: Diagnostic plots for visual inspection of the assumption of a linear relationship

Table 13.4 Test on normality for studentized residuals for all four models

Model (N)	Kolmogorov–Smirnov-Z	p
1 ($N = 424$)	5.06	<0.001
2 ($N = 401$)	4.90	<0.001
3 ($N = 424$)	4.25	<0.001
4 ($N = 424$)	4.16	<0.001

equally show that the prerequisite of homoscedasticity is not fulfilled). Especially informative is the scale location plot in Fig. 13.3b, causing doubts about homoscedasticity because residuals do not appear to be equally distributed along the ranges of the predictor. This implies that the third prerequisite (homoscedasticity) was not observed either.

In sum, the prerequisites are not entirely met. Following the recommendations made by Baltes-Götz (2019) and Hayes and Cai (2007), we estimated the regression coefficients using ordinary least squares and heteroskedasticity-consistent standard errors (HC 4) to account for the violations of the prerequisites.

As can be seen in Table 13.5, model 3 and model 4 yielded by far the largest proportion of explained variance: 16% respective 17%. Comparing model 3 and 4, the change in the F-statistic is not significant: $\Delta F\ (2, 397) = 0.587$, $p = 0.556$. In other words: Model 3 and model 4 explain a comparable amount of the criterion

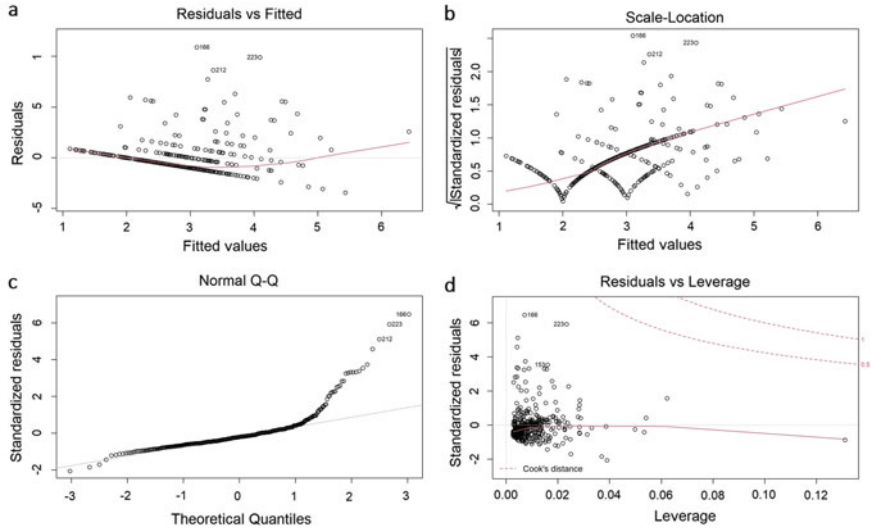

Fig. 13.3 Model 4: Diagnostic plots for visual inspection of residual distributions (questioning normality and homoskedasticity)

Table 13.5 Results of the (multiple) linear regression of intentions to drop out on academic self-efficacy (standardized coefficients)

	Model 1	Model 2	Model 3	Model 4
Intercept	2.87 [2.69; 3.04]	2.86 [2.68; 3.04]	2.87 [2.71; 3.03]	2.86 [2.69; 3.03]
FSE (*t*1)	−0.31 [−0.49; −0.13]			−0.00 [−0.20; 0.20]
FSE (*t*2)		−0.42 [−0.66; −0.19]		−0.10 [−0.30; 0.10]
FSE (*t*3)			−0.76*** [−0.96; −0.55]	−0.69*** [−0.92; −0.45]
F	$F(1, 422) =$ 12.36***	$F(1, 399) =$ 22.25***	$F(1, 422) =$ 86.50***	$F(3, 397) =$ 25.58***
R_{corr}^2	0.03	0.05	0.17	0.16

Note All continuous predictors are mean-centered and scaled by 1 standard deviation. Standard errors are heteroskedasticity robust
***$p < 0.001$

variance. For visual comparison purposes, Fig. 13.4 displays the size of the beta coefficients for all four models.

To answer research question two, we can sum it up: The combination of repeated assessments of FSE is not always a better predictor for dropout intentions as a single-shot assessment of self-efficacy when it comes to linear regression models. In fact, our

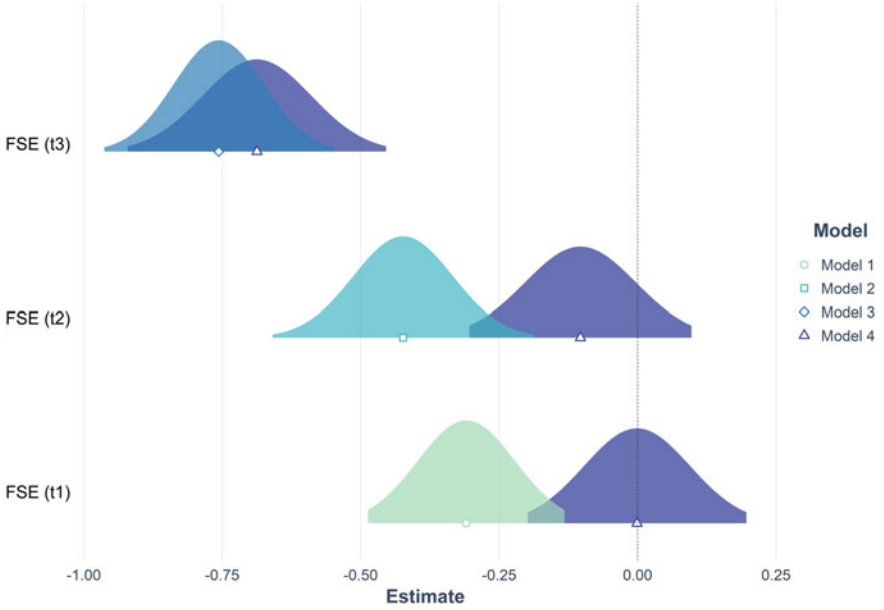

Fig. 13.4 Visual comparison of beta weight estimations for all three predictors (FSE t1, t2, t3) across model 1 to 4

data reveal the not surprising fact that the smaller the delay between the assessments of predictor and criterion, the stronger their relation.

While one could therefore argue that the inclusion of all three predictors is not better than using only the FSE level at t3, looking back at Fig. 13.1 gives nevertheless raise to the question if group-specific trajectories might nonetheless reveal some additional information that could go beyond linear predictor–criterion relations. Specifically, a visual comparison of the groups' average FSE level across the three points of measurement shows different trajectories (see Fig. 13.1).

Therefore, in the third research question, we broach the issue of these trajectories. To answer the research question, whether students prone to dropout show a differently shaped FSE development than those not prone to dropout, we decided to apply a more holistic view by focusing on the FSE trajectories rather than looking at the one-shot assessments. In this way, the third research question goes beyond the first two, because while these are concerned with the manifest levels of FSE, we now wanted to estimate the latent levels that lay behind.

For that purpose, latent growth modeling appears to be the appropriate method in general (Muthén & Curran, 1997). The idea behind is that two (or more) groups may not only differ in the manifest and observable attributes (here: the level of FSE we assessed) but also in the latent factors behind. More specifically, they potentially differ in the trajectories of the latent construct under consideration.

With a focus on the educational context, Isiordia and Ferrer (2018), however, advocate analyzing *curve of factors models (CUFF)* instead of *first-order latent*

growth models (1LGM). The reason for this is that, within the CUFF approach, every single item can be included in the analysis in contrast to 'only' including the mean or sum scores for a scale. Hence, CUFF combine a measurement model and a growth model (ibd., p. 207).

Transferring this idea to our empirical example, this implies: The 13 items (for each point of measurement) of the FSE scale are at the first level, and the second level is made up of the latent factor behind. Finally, this is combined with latent intercepts, and slopes specifying time-specific variance. According to Isiordia and Ferrer (2018), this enables researchers to differentiate between reliable construct variance, reliable time-specific variance and residual variance in contrast to the confoundation of the latter two when using a first-order latent growth models. Therefore, CUFF should result in an overall more accurate estimation. For our empirical example, we used the approach provided by Isiordia and Ferrer (2018)and extended it by specifying additional group-specific estimates for the second-order factors (group-specific intercept and slope).

According to Isiordia and Ferrer (2018), a prerequisite for analyzing CUFF is that the scale used to assess the construct under consideration reveals scalar measurement invariance across the repeated measures. For space limitation reasons, we skip a detailed explanation of measurement invariance testing at this point and refer to the pertinent literature (Chen, 2007; Eid, 2017; Vandenberg & Lance, 2000). To put it in a nutshell, measurement invariance testing for continuous data can be described as a step-wise process using SEM. Hereby, it is examined if it is the same latent construct that is repeatedly tested over time—in our empirical example—across the three points of measurement. In the first, basic step, configural invariance (same items are associated with the same factors which can, however, have different loadings; Chen, 2007) is tested. In the second step, metric invariance is tested which requires additionally same factor loadings. In the third step (scalar invariance), intercept invariance is required additionally. If this 'is achieved, it indicates that scores from different groups have the same unit of measurement (factor loading) as well as the same origin (intercept)' (Chen, 2007, p. 466). Lately, the fourth step (strict invariance) requires additionally residual equivalence. Practically, the analysis is a model fit analysis with an increasing number of invariance constraints (Isiordia & Ferrer, 2018). Step by step, constraints are added and as long as the model still fits well, the respective level of invariance is achieved.

We report the results of the invariance testing in Table 13.6. Following the recommendations made by Chen (2007), the change in model fit observed when proceeding from the first to the second level of invariance is acceptable. In contrast, the change

Table 13.6 Levels of measurement invariance and model fit

Level of invariance	χ^2	df	CFI	RMSEA	SRMR
Configural	769.14	196	0.868	0.085	0.054
Metric	814.92	219	0.863	0.082	0.065
Scalar	1056.74	243	0.813	0.091	0.091

Table 13.7 CUFF and group comparison: Model fit indices and parameter estimates (complete standardized solution)

		Groups	
		PG	DG
Latent intercepts			
		0.936	0.936
		1.574	1.099
		1.719	1.384
Latent slopes			
		0	0
		0.916***	−0.256
		1.198***	– 1.017***
Model fit	Total		
$\chi 2$/df	2843/1473		
Robust RMSEA [CI 90%]	0.086 [0.081; 0.090]		
Robust CFI	0.618		
Robust TLI	0.616		
SRMR	0.418		

Note Robust CFI = comparative fit index; df = degrees of freedom; robust RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; robust TLI = Tucker–Lewis index; DG = dropout group, PG = persistence group; ***$p \leq 0.001$

of fit from the second to the third level is no longer acceptable (e.g., change of ≥ -0.010 in CFI). Therefore, based on our data, merely metric invariance can be attested to the FSE scale. Obversely, at least this necessary requirement for group comparisons (Dimitrov, 2010; Horn & McArdle, 1992; Meredith & Teresi, 2006) is fulfilled. However, it is important to keep that limitation in mind for interpreting the results (Isiordia & Ferrer, 2018).

For model specification, we built on Isiordia and Ferrer (2018) and set all first-order factor means to 0 and constrained all first-order factor variances to equality. In addition, we did not set constraints to the second-order factor means and variances. For the second-order growth factors, we fixed the first slope (t1) to 0. The slope for the second and the third point of measurement was estimated separately per group. Results, calculated applying the full information maximum likelihood method, are shown in Table 13.7. Note that if possible, robust instead of uncorrected model fit indices are reported to apply nonnormality correction (Savalei, 2018).

While—according to widely accepted model fit cut-offs (Hu & Bentler, 1999)—the overall fit was rarely adequate with regards to the $\chi 2$/df and RMSEA, the estimates of the CFI, TLI and SRMR were far beyond anything that could be called acceptable. Nonetheless, the pattern of the latent coefficients was as expected: As Table 13.7 displays, CUFF analysis indeed revealed group differences at the latent level. Insofar,

results from the CUFF analysis are in line with the (descriptive) results concerning the manifest means displayed in Table 13.3.

The slopes were significantly positive for the persistence group both for t2 ($\beta_{\text{PGt2}} = 0.916$, $p < 0.001$) and t3 ($\beta_{\text{PG}t3} = 1.198$, $p < 0.001$). For the dropout group, however, the slope for t2 did not reveal significance, but the slope for t3: This slope was significantly negative ($\beta_{\text{DGt3}} = -1.017$, $p = 0.001$).

While the fact that the insufficient total model fit prevents us from proceeding by statistically testing if the coefficients reveal significant differences between the groups, we can at least note that there was significant FSE growth (e.g., increase) for t2 and t3 in the persistence group, while we found a significant FSE decline (e.g., decrease) for t3 in the dropout group.

Discussion

Summary

With this chapter, we pursued two goals: First, we wanted to give an empirical example on why repeated measurements of academic self-efficacy can be informative. Second, we wanted to add to the discussion about how to reduce higher education dropout rates based on what we know about *Freshmen Self-Efficacy* (FSE) as a predictor of it.

In the following, we will accordingly summarize and critically reflect the empirical results of our study before we come to discuss the practical implications.

With the first research question, we addressed the difference in the average FSE level between students prone to dropout versus those not prone to dropout over the course of the first year of study. Based on our longitudinal dataset, the average FSE level differed significantly between the dropout group and the persistence group at the manifest level at every single of the three points of measurement over the course of the first two semesters.

Furthermore, (multiple) linear regression (research question two) revealed as expected that the smaller the delay between the assessment of the predictor (FSE at t1 versus t2 versus t3), the larger the bivariate predictor–criterion correlation. The comparable largest proportion of explained variance (16 resp. 17%) was observed when using the FSE level at t3 as a predictor (with or without including the FSE level at t1 and t2).

So far, the added value of repeated assessment was only supported by the answer to research question one. However, group differences at the latent level became apparent in the third analysis: While the persistence group showed a significant latent FSE increase, the dropout group revealed a significant latent FSE decrease. In sum, this underpins the importance of FSE trajectories as indicators of potentially unfavorable outcomes like dropout intentions.

Limitations

Certainly, the results concerning research question three presented here have to be interpreted with caution. This is mainly due to the fact that the FSE scale did not fulfill all prerequisites which can lead to biased estimates (Isiordia & Ferrer, 2018). Although we generally tried to use estimation procedures more or less robust against several prerequisite violations, not fulfilling the prerequisite of scalar invariance is the proper reason for the insufficient overall model fit. Moreover, a larger sample size and more power could also help to generate more robust and trustable insights into latent FSE trajectories (Isiordia & Ferrer, 2018).

In addition, we have to admit that we utilized the common proxy 'intention to drop out' instead of actual dropout for several reasons (Neugebauer et al., 2019). For sure, there are good reasons for assuming that findings yield with 'intention to drop out' as criterion are transferrable to the criterion 'actual dropout' at least to a large degree (e.g. empirically: high correlation between these two criteria and theoretically e.g., the theory of planned behavior, Ajzen, 1991) but that should be tested empirically ultimately. Finally, one could criticize that we assigned participants to the dropout group versus persistence group by splitting the sample based on the responses given to two items concerning dropout instead of, for example, sampling a larger group and comparing only the lower and upper quartile (in terms of intentions to drop out).

Outlook

Therefore, we recommend to conceptually replicate our study, for example, with a larger freshmen sample and perhaps using another instrument to assess the academic self-efficacy of freshmen, ideally a scale showing scalar invariance across the different groups and points of measurement.

Practical Implications

Our second goal was to reflect on the practical implications for student counseling. Based on our results, we question the prevalent perception of academic self-efficacy as a (relatively) fixed predictor and suggest to apply a developmental perspective as a basis for supporting freshmen. Tracking students over the course of the first year of study might provide informative insights for offering support specifically to those who show a potentially critical FSE trajectory.

A hands-on practical implication of our finding could be to provide online self-assessments on the institutional level (Gikandi et al., 2011; Ibabe & Jauregizar, 2010). It is out of the question that this has to be in line with data privacy concerns but it could be established on a voluntary basis. Students could regularly be automatically invited

to fill in self-report questionnaires assessing their momentary FSE level. Based on an empirically grounded algorithm (that is: based on a sufficiently large and representative norming sample), feedback could be provided automatically depending on the comparison of the individual momentary FSE level and normed cut-offs. For those reporting critical below average scores, advices and, for example, appointments at the student counseling could be offered (voluntary).

Further, if students create a personal (but anonymous) account within the online self-assessment tool, repeated measures of their FSE level could be matched intraindividually so that the individual trajectory (growth or decline) could be tracked so that feedbacks could be based on empirical finding about latent growth of the FSE.

As we depicted such an online self-assessment approach focused on FSE, we imagine this kind of low-cost high-gains approach to be easily extended to other relevant predictors of student's success.

Finally, to go beyond the assessment/ diagnostics, we would like to say some words on potential subsequent interventions that can be offered to identified students 'at risk'.

For educational settings in general, Regehr et al.(2013) point out that comparably short interventions with different approaches (cognitive, behavioral, focused on mindfulness, …) proved to be effective. Previous research shows that self-efficacy in general can be positively influenced by interventions. Van Dinther et al.(2011) substantiate these findings, reporting that 80 percent of the 39 studies they meta-analyzed showed significant effects. They conclude that institutions should pay attention to student's self-efficacy development.

We hope our results made a contribution to explore the trajectories of academic self-efficacy in the first year of study and raise the understanding of development of academic self-efficacy.

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Chapter 14
Academic Self-efficacy and Its Influence on Teachers' Postgraduate Study Experiences: Voices from the Field

Helen Dixon and Gillian Ward

Abstract Evidence suggests that teachers value postgraduate study as a means to augment their knowledge bases and professional practices (Dixon and Ward in Aust J Teach Educ (Online) 40(2), 2015; Ion and Iucu in Eur J Teach Educ 39(5):1–14, 2016; Ward and Dixon in J Further High Educ 38:163–181, 2014). However, the expectations of postgraduate study are considerable and markedly different from those experienced as either an undergraduate student (Coneyworth et al. in Innov Educ Teach Int 57:1–12, 2019) or, as a practising teacher. Therefore, a high degree of academic self-efficacy (ASE) is critical to cope with the demands of postgraduate study given it is the strongest and most reliable predictor of academic success, affecting cognition, emotion, motivation and satisfaction. In this chapter, we utilise data generated from 27 students who were in the main practising teachers who had completed a master's qualification at a New Zealand university. Through the use of teachers' voices, we provide insights into how teachers' ASE beliefs impacted on their enrolment and completion of a postgraduate qualification. Further, we offer some suggestions as to how postgraduate student ASE may be enhanced through the use of what are seen as the most potent sources of efficacy information: mastery and vicarious experience (Bandura in Psychol Rev 84:191–215, 1977). We also draw attention to how the learning environment might be constructed to mitigate against the potential effects of negative emotional states on students' learning.

Keyword Self-efficacy · Academic self-efficacy · Postgraduate study · Teachers

Setting the Scene

Teaching in New Zealand is a degreed profession with an undergraduate degree being the minimum academic requirement needed to become a teacher. Once registered, as part of their ongoing contractual obligations, New Zealand teachers are expected to engage in career-long professional learning and development (New

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Zealand Teachers' Council, 2017). One way in which this obligation can be fulfilled is through the upgrading of academic qualifications. Typically, many teachers seek to upgrade their qualifications through enrolment in either a taught or research-based master's degree. For the majority of teachers, postgraduate study is undertaken on a part-time basis as they continue to work full time. The provision of a limited number of study awards (Teach NZ, 2020) enables a small number of practising teachers to complete their qualification on a full-time basis as they are released from their regular full-time teaching responsibilities for a set period of time.

While teachers' willingness to pursue further study is laudable, the transition from undergraduate to postgraduate study can be challenging and potentially stress inducing (Coneyworth et al., 2019; Evans et al., 2018). The reasons for this are twofold. Firstly, there are more rigorous academic demands placed on postgraduate students. The expectation expressed at undergraduate level is that students will become self-regulated learners who monitor and adjust their performance in order to achieve desired outcomes (Nicol & Macfarlane-Dick, 2006) is further exacerbated at postgraduate level as students are required to work with greater degrees of independence and autonomy as they move through a programme of study. Moreover, there is a greater requirement for students to think critically and apply a critical stance to their work than that expected at undergraduate level (Watson & Reissner, 2010). Secondly, given these more challenging expectations, there is a strong probability that many students will enter a programme of study without a clear notion of what is ahead of them. Consequently, on entry, many students may be unable to make an accurate appraisal of the knowledge, skills and dispositions needed to become a successful postgraduate student. Further there will be some students who hold a distorted perception of their personal level of competence which is an additional hurdle to success (Bamber et al., 2019).

To date, the work on student transition from undergraduate to postgraduate study has been limited. Yet this field of investigation warrants further attention given that retention and completion rates, as well as levels of achievement and degrees of satisfaction, are dependent on students' ability to transition successfully into postgraduate study (Evans et al., 2018). Published studies indicate that good time management skills, familiarity with the learning environment (Menzies & Baron, 2014) and being resilient (Brewer et al., 2019) each plays a part in supporting effective transition. Absent from the literature, however, is explicit reference to the role that academic self-efficacy (ASE) beliefs play in either helping or hindering students make this transition. In this chapter through the examination of teachers' experiences of postgraduate study, we draw attention to the influence of their ASE beliefs in relation to their completion of a postgraduate qualification. In doing so, we make a contribution to a field that has yet to be fully explored. Through the use of teachers' voices, we provide insights into how the challenges of postgraduate study can be managed. Further, we offer some suggestions as to how postgraduate students' ASE may be enhanced through the use of what are seen as the most potent sources of efficacy information: mastery and vicarious experience (Bandura, 1977). We also draw attention to how the learning environment might be constructed to mitigate against the potential effects of negative emotional states on students' learning.

Academic Self-efficacy and Learning in Higher Education

All individuals hold beliefs about the world in which they live and their place within that world. Specifically, teachers hold a myriad of beliefs about teaching and learning, based on, and reinforced by their personal experiences. In addition, they hold beliefs about their capabilities and capacities to act with personal agency. Commonly referred to as efficacy beliefs, it has been argued that these beliefs are "instrumental in defining one's experience" as they provide an "avenue through which individual's exercise control over their lives" (Pajares, 1996, p. 544).

Published in 1977, Bandura's theory of self-efficacy (SE) conceptualised individuals as proactive beings whose beliefs about their capabilities play a major role in controlling and regulating thinking, behaviour, emotions and levels of motivation. As such, SE is an expectancy belief that is goal, task and situation specific. It pertains to an individual's belief in his/her capability to "… organise and execute courses of action required to deal with prospective situations that contain many ambiguous unpredictable and often stressful elements" (Bandura, 1981, p. 200). It is a future-oriented judgement that has more to do with perception than an actual level of competence. Although general measures of self-efficacy do not have the predictive power to estimate academic success in HE, measures of ASE have shown to have strong predictive ability (Zajacova et al., 2005).

ASE refers to personal judgements about one's ability to achieve at a designated level of achievement or performance on an academic task, or to attain a specific academic or educational goal (Bandura, 1997; Linnenbrink & Pintrich, 2002). It is the strongest and most reliable predictor of academic success (Bartimore-Aufflick et al., 2016; Ritchie, 2016). Moderately high correlations between ASE and academic performance have been consistently demonstrated, with the predictive ability of ASE being the strongest when determined midway, rather than early on, in a semester of study (Honicke & Broadbent, 2016). In addition to its predictive power, the impact of ASE on learning is considerable given that it influences cognition, engagement and motivation (Bartimore-Aufflick, et al., 2016; Ritchie, 2016). The significance of ASE to learning and academic achievement lies in the fact that those with robust efficacy beliefs about their academic capabilities will take on challenges, make persistent and vigorous efforts to achieve goals and display resilience through the adoption of a range of coping behaviours when faced with self-doubt, setbacks or difficulties (Schunk & Pajares, 2010).

ASE operates across the three dimensions of magnitude, strength and generality (Bandura, 1977). The dimensions of magnitude and generality can pose potential threats to postgraduate students' sense of ASE and as a consequence weaken expectations. Magnitude refers to the perceived level of difficulty of a task or performance (Cecil & Pickerton, 2000). Understanding the magnitude of the task is necessary if students are to fully comprehend what is expected of them and then make an accurate appraisal of their capabilities. Yet it has been found that students often enter postgraduate study not knowing what is ahead of them (Bamber et al., 2019). Having an incomplete picture of what is required can lead students to underestimate the

magnitude of the task which in turn can lead to a lack of calibration between their ASE beliefs and actual performance (Bamber et al., 2019; Linnenbrink & Pintrich, 2002). The generality dimension of ASE poses a further threat. Generality refers to the extent to which the knowledge and skills used within one situation can be applied to another. In the light of markedly different expectations at undergraduate and postgraduate levels, there is a danger that students will be lulled into a false sense of security if they believe postgraduate study will be a replication of their undergraduate experience (Heussi, 2012). Given that ASE is not a stable trait, it can strengthen or weaken over time as it is affected by perceptions of task familiarity and similarity and the way in which confirming or disconfirming experiences about personal capability are interpreted and subsequently used. The strength of an expectation is influential in that it will determine persistence of effort, particularly in the face of difficulties. As Bandura (1977, p. 194) explained *"weak expectancies are easily extinguishable by disconfirming experiences, whereas individuals who possess strong expectations of mastery will persevere in their coping efforts despite disconfirming experiences"*.

Known as the four sources of influence, there are four major sources of information that individuals draw upon when forming judgements about their capabilities (Bandura, 1977). These are mastery experience, vicarious experience, social persuasion and physiological and emotional states. Of the four, mastery experiences (also known as enactive mastery or performance mastery) are considered the most powerful source of efficacy beliefs. Built up over time mastery develops from experiences that enable individuals to build requisite knowledge and skills necessary to perform a given task successfully. Repeated performance successes with few intervening experiences of failure build robust ASE levels in individuals, unless it is believed the perceived effort cannot be sustained (Bandura, 1997). Conversely, a succession of performance failures can weaken ASE, undermining belief in one's ability to successfully accomplish a given task, stifling any possibility to attempt similar tasks (Schunk & Pajares, 2010). Vicarious experience, in the form of social models, is generally considered the second most influential source of ASE. It can be strengthened when a demanding task is performed more successfully than by peers, or it can potentially plummet if one is outperformed by similar others (Schunk & Pajares, 2010). Although social persuasion can strengthen ASE, it is easier to weaken beliefs through negative appraisal than to strengthen them through encouragement (Pajares, 1996). However, when coupled with successful mastery experience, social persuasion can be highly effective. Finally, individuals pay attention to their physiological and emotional states when judging their capabilities to complete any given task. Positive physiological and emotional states such as exhilaration or joy experienced by an individual in anticipation of a perceived exciting challenging task can strengthen ASE. Conversely, a difficult task perceived as daunting can weaken ASE by triggering feelings such as anxiety or stress, in turn affecting one's willingness to persevere (Wyatt, 2014).

Research Design

The research outlined in this chapter was situated within the interpretivist paradigm (Neuman, 2003) and sought to inquire into the academic journey of 27 master's graduates through qualitative data collection methods. The participants were drawn from a pool of master's graduates who completed their degrees in education within one faculty at a large urban university in New Zealand.

Context for the Study

The university offers a range of master's degrees in the discipline of education that are either 120 point or 180 point qualifications. "Points" are the value assigned to post-graduate work that denotes its weighting within the university's degrees. Therefore, the number of points indicates the overall time to complete the qualification. A 120 point master's signifies a qualification that is equivalent to one year full-time study and at least two years to complete part time. Student's prior qualifications determine which degree they enrol in. All the master's degrees have academic qualification prerequisites, such as an undergraduate degree or postgraduate diploma, in order for students to be admitted into the degree.

The degrees are regarded as either taught or research with the taught option involving coursework only or coursework and a dissertation of 15,000–20,000 words. The research option involves writing a thesis of approximately 20,000–35,000 words depending on whether a student has enrolled in a 90 point or 120 point thesis. All thesis and dissertation students have to complete a research methods course.

Within the suite of taught masters is the Master of Education Practice (MEdPrac) which is a coursework only degree. Within this degree, one 30 point course, which is compulsory, requires them to work independently on an individual area of interest, culminating in an annotated bibliography. The Master of Professional Studies (MProfStuds) is also a taught master's but requires students to complete a 60 point dissertation as well as coursework. For the Master of Educational Leadership (MEdLd), both taught (dissertation and coursework) and research (thesis) are options that are offered. The Master of Education (MEd) requires students to complete a thesis.

Participants

Participants were selected from one faculty through purposive sampling (Cronin, 2008; Wellington & Szczerbinski, 2007), in which the criteria included successful graduates of master's degrees in the discipline of education. These graduates were to have completed their degree between 2013 and 2018. A data analyst within the faculty

accessed the names of potential participants who met the criteria from the faculty's records. An independent research assistant was employed to email the participants within this pool to invite them to participate in the study. Once the participants agreed to take part, the research assistant organised the focus group interviews and conducted the interviews using a set of questions determined by the researchers. In addition to an interview, each participant completed a baseline data sheet that captured demographic information.

Of the 510 people who met the criteria, 27 graduates agreed to take part in the research. Of the total participants, five were male and 22 were female. Across the participants, a range of master's degrees had been completed, including both taught and research options. As noted earlier, the majority of people enrolled in master's degrees work full time in the education sector. Of the 27 participants, five completed their degree full time and the rest of the participants completed the degree part time. All of the graduates who chose to take part in the study were domestic students, i.e. not international students.

The demographic information for each of the participants is displayed in Table 14.1. Pseudonyms have been used for the names of the participants.

Data Collection

Participants were asked to take part in one focus group interview. The focus group interviews were arranged according to degree programme where possible and/or at a convenient time for the participant. In arranging the interviews, six teachers were unable to attend but were willing to answer the interview questions through written response (see Table 14.1). This enabled the sample to be increased to include as many "voices" as possible. We were also mindful that teachers are busy, and their circumstances are different so we wanted to ensure that their needs were accommodated. Six focus groups were organised initially. However, with Focus Group 1, one of the invited participants failed to attend the interview at the scheduled time. This resulted in the other participant in the focus group, Stephanie, agreeing to be interviewed individually. As a result, a total of five focus group interviews were held (see Table 14.1). Focus group interviews are interactive in nature and enable researchers to understand what individuals believe, feel and why they behave in the way they do (Creswell, 2014; Merriam & Tisdell, 2016). Focus group interviews allow participants to build on each other's ideas by providing viewpoints which may not have been forthcoming if the interview had been conducted individually. However, focus groups are not without their disadvantages. The potential disadvantages of focus group interviews, such as reluctance to disclose or the domination of a focus group member (Denscombe, 2003), were mediated through the appointment of a skilled and knowledgeable research assistant who acted as an independent interviewer. While they had extensive knowledge of postgraduate education, they were not involved in the master's programme. However, because of her prior experience with postgraduate students, she was able to make people feel at ease and willing

Table 14.1 Demographic data for the master's participants

Programme name	Full time/part time	Participant name (Pseudonym)	Data collection method	Admit term	Year complete	Gender
Master of education	FT	Roseanne	Focus group 4	2014	2015	F
Master of education	FT	Christine	Written response	2014	2015	F
Master of education	FT	Julie	Written response	2014	2015	F
Master of education	PT	Meena	Focus group 2	2016	2018	F
Master of education	PT	Ursha	Focus group 2	2015	2016	F
Master of education	PT	Ann	Focus group 4	2011	2013	F
Master of education	PT	Molly	Focus group 4	2015	2018	F
Master of education	PT	Shelley	Focus group 4	2014	2016	F
Master of education	PT	Stefanie	Individual interview	2009	2014	F
Master of education practice	PT	Devora	Focus group 2	2018	2018	F
Master of educational leadership	FT	Ross	Focus group 5	2014	2015	M
Master of educational leadership	FT	Maria	Focus group 6	2014	2015	F
Master of educational leadership	PT	Carla	Focus group 5	2016	2018	F
Master of educational leadership	PT	Derek	Focus group 5	2013	2015	M
Master of educational leadership	PT	Ginny	Focus group 5	2015	2017	F
Master of educational leadership	PT	Roberta	Focus group 5	2015	2017	F

(continued)

Table 14.1 (continued)

Programme name	Full time/part time	Participant name (Pseudonym)	Data collection method	Admit term	Year complete	Gender
Master of educational leadership	PT	Ryan	Focus group 5	2013	2016	M
Master of educational leadership	PT	Selina	Focus group 5	2015	2017	F
Master of educational leadership	PT	Penny	Focus group 6	2012	2014	F
Master of educational leadership	PT	Saffron	Focus group 6	2012	2014	F
Master of educational leadership	PT	Frank	Written response	2014	2016	M
Master of educational leadership	PT	Jocelyn	Written response	2012	2013	F
Master of professional studies	PT	Theresa	Focus Group 5	2014	2016	F
Master of professional studies	PT	Mary	Focus Group 3	2013	2017	F
Master of professional studies	PT	Millie	Focus Group 3	2012	2015	F
Master of professional studies	PT	Chelsea	Written response	2014	2017	F
Master of professional studies	PT	Simon	Written response	2014	2016	M

to give "honest" responses (Belgrave & Smith, 2002; Krueger, 1994). Given the range of responses from the participants, it was evident that all contributed and felt comfortable disclosing experiences that were both positive and negative.

The five focus groups ranged in size from two to eight participants. While research projects often have focus groups of six to ten members, this size range is not to be considered the standard (Morgan, 1997). Apart from Focus Group 5, comprising eight participants, all the groups could be considered "small" (see Table 14.1) but had the advantage of providing space for the participants to talk (Morgan, 2019). A possible

disadvantage of small groups is the potential for less engagement in the topic of discussion and therefore a difficulty maintaining dialogue (Morgan, 2019). However, given the experience of the interviewer in exploring ideas with the participants, the nature of the topic, and the willingness of the participants to take part in the interview, this possible disadvantage of a small group size did not appear to be evident through the transcribed data. With participants' permission, the interview was audio recorded and transcribed by an independent transcriber. Each interview took approximately 90 min to complete and was semi-structured in nature. Semi-structured interviews were employed because while they have a predetermined question order, they also allow for some flexibility. While this meant that the interviewer could be consistent with interview questions across the different focus groups, the protocol also allowed them to respond to participant's viewpoints by following a particular train of thought or ask additional questions related to the discussion at the time (Merriam & Tisdell, 2016).

Data Analysis

Thematic analysis was undertaken utilising the flexibility of the approach to gain a rich, detailed and in-depth account of the data (Punch & Oancea, 2014). The authors used techniques associated with the constant comparison method and open, axial and selective coding (Glaser & Strauss, 1967). First, all sets of interview transcripts and written responses were open coded by examining each participant's transcript or question response against predefined categories drawn from Bandura's (1977) SE framework. Axial codes were then established that uncovered the relationships between the groups of open codes and their interrelating properties (Punch & Oancea, 2014). Finally, selective codes were formed in which interrelationships between themes and sub-themes were identified. When the data were analysed, there were common responses across the participants and key themes emerged. This suggests that the different data collection methods did not have any effect on the results. In this chapter, we report on two key themes as they relate to teachers' ASE beliefs. These are "moving into unknown territory" and "adopting a proactive stance towards study".

Understanding Teachers' Experiences of Undertaking and Completing Postgraduate Study

Moving into Unknown Territory

For many of the teachers in this study, the time frame between completing their undergraduate qualification and enrolling in a postgraduate degree was considerable.

In the cases of Penny, Devora and Millie, it had been nearly 30 years since they had completed a bachelor's degree with virtually no other experience of academic study during the intervening period. For others such as Saffron and Mary, the gap was shorter spanning 10–15 years. However, whatever the temporal interlude is since the last time, they undertook academic study; in all instances, teachers felt that a lack of recent academic study experience was something they took into account when making the decision as to what degree they chose. Devora, for example, enrolled in a recently developed taught master's degree because she had been told it had been created "for people that were in the situation I was in" and hence she saw this "as the safe option". Others such as Derek and Frank, who had more recent study experience by gaining a postgraduate diploma, felt ready to undertake a degree with a research component. For Frank, his experience in undertaking a postgraduate diploma had allowed him to feel successful and "my confidence grew" and as a result felt the master's "was not too far a step for me to take".

When recalling how they felt at the beginning of their study, there was a generalised expectancy that it "wasn't going to be easy, that it would require work" (Stefanie) and "it was going to be tough" (Ginny). It was presumed that "study was going to be really academically challenging and there would be high expectations" (Penny). Despite this generalised sense of what might be expected, looking back at the reality of their postgraduate experience, it was seen at times as "a really difficult journey" (Theresa) leading to some feeling "over-awed when I first started" (Stefanie) or "daunted" (Millie) along the way. Reflecting on her early experiences of postgraduate study, Devora likened the experience to "opening up Pandora's box" as it was like a "whole new world to me". In a similar vein, Penny described her experience as "unlike anything I had ever done".

The unfamiliar nature of study at the postgraduate level led some teachers to doubt their capabilities. As Ursha explained, at first she did not know "whether I am capable" and questioned whether she "could successfully do it [her postgraduate qualification]". In addition, for others it led them to question whether they were even able to make an accurate appraisal of their capabilities at the early stages of their study. Maria for example when reflecting on completing his first assignment felt he "had no idea if I am on the right track". Looking back, Chelsea and Jocelyn, even though successful, wondered if they had made the right decision. Chelsea would have enrolled in a coursework only degree rather than completing a dissertation, and Jocelyn was always "dissatisfied" with her research and said "I don't think I did overcome this challenge".

Adopting a Proactive Stance Towards Study

When considering what had helped them to be successful at the postgraduate level, many teachers emphasised the importance of self-belief. For these teachers, a strong belief in themselves and their capabilities became a motivational force during the

course of their qualification. "A can-do attitude" (Shelley) was seen as foundational to the successful completion of a degree. As Saffron explained:

> I think you have to have a really strong self-efficacy. You have to believe you can do this …. You have to kind of deep down think I can take this on and get through and just have that real belief in yourself that you are going to get there.

Such an attitude sustained many of the teachers, particularly at times when tasks appeared "too hard" leading them to question "why am I doing this?" (Mary). Or when they felt they were in a "trough", and it might be easier to just "give it [study] away" (Millie). Meena used the adage "where there is a will, there is a way" to explain her belief that the challenges and obstacles she faced were overcome because she had the belief and the "self-determination" to succeed. When faced with challenges, Devora was determined to prove "she could do it". Several teachers made mention of "the inner motivation that drives you … to get this thing done" (Roseanne) which helped them to persevere.

Penny drew attention to the fact that it was important not to be too hard on one's self, especially during those first few months of study. In doing so, she emphasised the novice status of those starting their degrees, and hence, they should not expect that task demands would be easily accomplished. From her perspective, as a "beginner it was alright not to know" and "it was okay to learn". Using course readings as an example, she highlighted the demanding nature of the work involved at this level. In her opinion, it was important to acknowledge the demanding nature of the work rather than attributing a personal lack of academic competence as the reason for struggling to meet the task demands. As she explained:

> Maybe with the readings to have faith that if they are so incredibly dense and difficult to understand then it is not necessarily you that is academically incompetent (Penny).

Whilst a strong sense of self-belief was important, this had to be seen within the context of the demands of academic study at this level. Essentially, believing in one's self had to be tempered by making an accurate appraisal of one's personal strengths and weaknesses. And, importantly, if a weakness was identified to take action to avoid potential difficulties in meeting task demands. For example, a number of the teachers were cognisant that the advance of technology over the past two decades had moved academic study from a purely "paper-based" experience to one where the emphasis was on "researching online" (Mary). From these teachers' perspectives, such a move demanded a broader range of academic skill sets than those they had acquired during their undergraduate years. To this end, teachers such as Devora and Meena took advantage of the workshops offered by the library. Devora saw these workshops "beneficial" and "fulfilling" as she became familiar with a range of databases and in doing so felt competent to use them. Ross, Carla and Derek who were completing degrees with either a thesis or dissertation component proactively booked individual appointments with subject librarians. These sessions proved to be "so helpful for me in terms of searching for my literature" (Carla) given this was a key task when undertaking a research master's degree.

Selina likened academic study to "a long game not a short game" where it was important not to "let little things put you off". In addition to "believing in themselves" (Devora), many teachers identified other qualities that were instrumental in their success. The participants talked about the importance of having "grit" and being "thick skinned" (Jocelyn) and the importance of "stickability" (Simon). The two personal qualities of perseverance and resilience were prevalent in teachers' talk. As Meena emphasised, these two qualities along with self-belief "keep you going" and help students face the challenges they encounter during their studies. Perseverance and resilience seemed particularly important qualities for those undertaking research master's degrees where there was a requirement to craft and recraft their thesis work. For many of these teachers, this was the first time they had been expected to recraft their work until it met expectations. According to Ryan, this was the first time he had had to be "academically resilient", as previously he had never had to go back to revise work. Ginny, Theresa, Stefanie, Carla, Simon and Ryan drew attention to the mismatch between their understanding of task demands at this level of study and those of their supervisors. During this time, Stefanie came to realise "just because you think it [a chapter] is good, that it is good". Similarly, Ryan had "crafted stuff that I was really proud of and then it went to my supervisor who was not proud of it". After reading her supervisor's critique of her work, Theresa initially "lost the will to live" but at the same time was buoyed by her supervisor's confidence in her. Ginny who had similar experiences highlighted the need to be "academically resilient". Despite receiving positive feedback from her supervisor, she realised that the praise was not warranted given her work had failed to reach the desired standard:

> Resilience when your supervisor comes back and says you've done a good job and then you open it, and you are like, I haven't done a good job at all!

In the face of receiving feedback about the quality of their work that may have been unexpected and in turn potentially discouraging, Ginny emphasised the need to "keep going once you got the feedback". Likewise, Simon realised "not being too sensitive about critical comments" on drafts of his work was important "to help you develop as a researcher". Reflecting on her experience of writing a masters' dissertation, Stefanie explained she had tried to avoid being disheartened when not achieving at the expected level during her first attempts. She felt she had built her resilience by realising "there is always room to learn and improve", and for this learning and improvement to occur, she had to show a "willingness to take advice, feedback and criticism".

The need to "put in time, put in effort" (Stefanie) was also seen as important if the outcomes of study were to be successful. Both the allocation of time and "good time management" (Shelley) were seen as essential particularly when working full time and studying part time. "Making sure you have got the time in your life" (Penny) prior to enrolling in a qualification was seen as a critical consideration. Once enrolled, "there was no point" (Penny) unless you were putting in the work, the time and the effort. As well as allocating time for study, Carla mentioned the need to make an accurate appraisal of how much time was needed to complete set tasks, whether they

be assigned readings or assessment tasks. Ross also alluded to the importance of not procrastinating when he talked of the necessity of "having discipline" and "stopping doing whatever I am doing and [to] get some work done".

Learning from the Teachers' Voice: Applying Our Learning to Practice

As academics working within the tertiary sector, we have had a long-standing interest in ASE given its impact on learning and achievement. Initially, this interest was at a theoretical level as over time we have deepened our understanding of ASE, through a close examination of Bandura's theory of SE, its component parts and its application to education. More recently, our interest has been at the practice level as we have focused on how we can develop efficacious beliefs in the students we teach. Given its importance to academic success, we are committed to providing a learning environment that fosters strong ASE beliefs in students so they can meet the expectations of learning in HE and cope with and resolve the academic challenges they face (Bartimore-Aufflick et al., 2016; Ritchie, 2016; Van Dinther et al., 2011).

To date, literature suggests that when asked, assessment students express higher levels of dissatisfaction related to their experiences of assessment compared to other aspects of their study. This dissatisfaction highlights both the problematic nature of assessment and the influence assessment can have on students' ASE. For example, more often than not, assessment is seen as a hurdle or a hoop to jump through (Bloxham & Boyd, 2007) with concomitant high levels of anxiety and stress reported (Lynam & Cachia, 2018). Worryingly, students have reported a range of detrimental effects on their learning and well-being as a result of poor assessment practice (Wass et al., 2020). Arguably, it is when students engage with assessment tasks that threats to their ASE occur with the possibility of levels of ASE weakening.

As a rule, students are assessed in HE through the completion of standards-based, summative assessment tasks designed to determine the extent to which learning has been achieved in relation to specified learning outcomes. During a programme of study, students will experience various modes of assessment such as, but not limited to, essays, tests, examinations, practical projects and oral presentations. Based on students' previous experiences of assessment, some of these assessment modes will be more familiar to them than others (Hounsell et al., 2008). Unsurprisingly, modes of assessment that students have greater familiarity with will most probably evoke a range of positive emotions, particularly if students have a history of successful completion. The combination of familiarity and prior success is most likely to foster feelings of academic competence and confidence even when students are faced with mastery of new content. In comparison, modes that students have less experience with, or those which they have struggled with, are more likely to evoke a range of negative emotions. It can therefore be argued that fear of the unknown and/or fear of failure will influence levels of confidence and competence which in turn are major

contributors to student anxiety and stress. In turn, it can be expected that levels of engagement with course content and learning overall will be diminished. With these thoughts in mind, we have been interested to see how these detrimental effects on ASE might be mediated.

For us as we continue to engage in postgraduate course development and delivery, including the framing of assessment tasks, we have taken cognisance of the three dimensions of ASE self-efficacy and the four sources of ASE efficacy belief that contribute to students' judgements about their capabilities. In doing so, we have seen it is important to provide opportunities to build robust efficacy beliefs through the development of academic competence and confidence, persistence and resilience. We define academic competence as having the knowledge, skills, attitudes and behaviours needed for academic success while academic confidence can be defined as a belief about one's ability to perform a task at a particular level to attain a specific academic goal (Sander & Sanders, 2003).

The learning experiences students are exposed to have the potential to either strengthen or weaken their ASE. Dependent on the nature and scope of these experiences, students' feelings of competence and confidence can either thrive or wither. Given that these learning experiences or what Bandura (1995, p. 3) refers to as mastery experiences "provide the most authentic evidence of whether one can muster whatever it takes to succeed", there is a need for sustained and substantial authentic learning experiences that will help students gain a clear understanding of the magnitude of the task at hand and enable them to acquire the necessary knowledge and skills to achieve success (van Dinther et al., 2014). Arguably due to the fact that magnitude is an important dimension of ASE self-efficacy without a complete picture of the task in hand, students will have insufficient information on which to judge their capabilities. This was borne out in the current study to a certain degree where some students, particularly those who were faced with unfamiliar tasks, seemingly underestimated what was expected, and as a consequence overestimated the quality of their work.

Therefore, in the courses we teach, we are endeavouring to provide students with in-class experiences that will assist them to better understand the assessment tasks they are being asked to complete. Specifically, these experiences have been designed to expand their knowledge of: relevant content; the nature and scope of task requirements, including task magnitude and complexity and criteria that will form the basis of decision-making and expected standards of performance. Currently, we are making a sustained effort to provide students with substantive opportunities to develop skills in making judgements about quality work including their own. They are then expected to apply this knowledge in an ongoing manner to their own work in progress in order to produce a piece of work that is deemed of suitable quality. In this way, we hope to afford students with opportunities to develop both their evaluative and productive knowledge and expertise (Sadler, 1989).

Like more expert others, we believe peer review is a necessary precursor to making judgements about the quality of one's own work (Sadler, 1989) and see this practice as an authentic way in which students can develop both evaluative and productive knowledge and expertise. In an attempt to develop students' competence and confidence, we have designed in-class activities that require students to bring works in

progress related to specific assessment tasks to class for peer review. We see requiring students to bring works in progress to class with the intent of sharing, critiquing and revising this work, within a trusting and respectful environment as critical if students are to make accurate appraisals of the quality of work and how it can be improved. We see the benefits of this practice as fivefold. Firstly, as Sadler (1989) has emphasised, the appraisal of work similar to their own enables students to gain insight into and understanding of the wide range of possibilities and outcomes achieved in a given task, thus expanding their knowledge of task magnitude; common problems faced in achieving a particular goal and how these might be overcome; the repertoire of moves and strategies used by others and how specific strategies might be applied to one's own work. Secondly, it affords students with a degree of objectivity, more difficult to achieve when required to make judgements about one's own work (Sadler, 1989). Thirdly, it helps students resist the temptation of academic procrastination (Honicke & Broadbent, 2016). Fourthly, receiving constructive feedback that can be used to improve work in an ongoing manner builds persistence and resilience. Finally, seeing peers similar to themselves working towards successful completion of a task can encourage students to believe they too can succeed (Hawe et al., 2017; Kitsantas et al., 2008). Together such benefits can make a positive contribution to students' levels of ASE.

Further, to capitalise on the role of social models in the enhancement of ASE, we are using authentic student-created exemplars to expand students' knowledge of task requirements and expected quality. However, given the fragility of ASE, the delicate balance between building confidence and overwhelming students has been taken into account. Cognisant that the strength of students' ASE can increase or weaken over time, we are using exemplars in our classes in an ongoing embedded manner rather than as a one-off experience. Our decision to use exemplars in this way helps to mitigate against student's feeling daunted when first faced with student-created artefacts of high quality. As we found that the continued and substantive engagement with exemplars throughout a series of teaching sessions helped students overcome their self-doubt (Hawe & Dixon, 2016).

Further, in our selection of exemplars for student use, we have considered the dimension of generality. Given the task-specific nature of ASE, there has been a strong degree of similarity between the exemplars selected and the specific assignment task. Specifically, exemplars used have contained task properties and requirements similar to those expected in an assignment. We believe such a practice works to ameliorate and mitigate against the negative effects on students' learning of task unfamiliarity or past disconfirming experiences. As Pajares (1996) has argued, confidence is increased when tasks are perceived to be similar in nature and scope.

A Final Note

As teachers reflected on their experiences of postgraduate study, it was clear that strong ASE beliefs played an important role in the successful completion of their

qualifications. At the start of their enrolment, as teachers realised that learning at the postgraduate level was more challenging than expected, they were able to manage their emotions even when they doubted their capabilities. Self-doubt was offset by the insight that typically, initial conceptions of a masterful performance are typically incomplete and moreover are rarely translated into action during first attempts (Bandura, 1977). As they continued with their studies rather than admitting defeat, teachers recognised that there was a need to expend effort if they were to achieve a specific goal or a task. They also understood the need to persevere with the challenges inherent in a task as well as the importance of being resilient when faced with setbacks and self-doubt if they were to be successful (Bandura, 1977). Difficulties encountered were mostly seen as opportunities to learn rather than a reason to abandon the task at hand. Furthermore, it was understood that academic procrastination was considered something to be avoided (Honicke & Broadbent, 2016) and that their success was dependent on internal factors within their control rather than external factors beyond it. Overall, it can be seen that a strong sense of self-belief was critical to their academic success as this belief enabled them to manage their cognitive thinking and emotional states. It also became a source of motivation and led to feelings of satisfaction.

It is heartening to see that despite the challenges of postgraduate study, the teachers' ASE beliefs did not diminish or weaken over time. However as tertiary educators, we cannot take for granted that all students will hold such a strong self-belief or be as persistent or resilient as those in the current study. Cognisant that the dimensions of generality and magnitude can pose real threats to students' ASE, we have outlined some of the practical ways we as lecturers can take to support the development of robust ASE beliefs in the students we teach.

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Part V
Conclusion

Chapter 15
Academic Self-efficacy in Educational Contexts: From Current Research to Future Directions

Tine Nielsen and Myint Swe Khine

Abstract The chapters in this book provided each their perspectives and new knowledge to the field of academic self-efficacy (ASE) in education concerning the assessment and measurement of ASE, what shapes ASE and what the influence of ASE is. This has been done through their new empirical research, new discussions and new overviews or perspectives on existing research. The authors of each chapter have also suggested how the research, within each of their subareas of ASE research, might be extended and gaps in the knowledge of ASE in education be filled by future research. In this chapter, we summarize and expand on the future direction for research in the field of academic self-efficacy, as we see possibilities emerge from the current research.

Keywords Academic self-efficacy · Current research · Future research · Research directions · Assessment · Perspectives · Emerging fields

Future Directions in Assessment and Measurement of Academic Self-efficacy

The book part on assessment and measurement of academic self-efficacy contains four chapters. Chapter 2 describes and discusses the various approaches to assessing self-efficacy, while Chaps. 3, , 4 and 5 employ some of these approaches with a specific focus on the methods employed. In all the chapters, suggestions for future research are provided.

From the broad perspective presented in the overview of methods for the assessment of ASE in Chap. 2, DiBenedetto and Schunk also set three major directions for future research into the assessment and measurement of ASE in education.

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Firstly, DiBenedetto and Schunk suggest research dedicated to providing documentation of the measurement properties of assessment instruments across various academic content areas and grade levels. This might be extended with various school and education contexts and cultures, such as, for example, public and private schools, boarding schools and distance learning, and even in different countries or culturally diverse parts of the same country. It is not sufficient to have a single study or a few studies reporting on the validity, reliability or various detailed psychometric properties of an assessment instrument in a single (or a few) selected target group or educational contexts. Demonstrating that an instrument provides valid measurement for young children does not imply that the same is the case for older children and likewise within different cultures. Nor is reliability a universal property of an instrument, but a sample-specific property, which should be reported with every study. When we use the word "measurement" here, it suggests that we are referring to scales of some sort (survey, observational, behaviour-based and so on). However, the issue of ensuring validity and reliability, in whichever sense is appropriate for the various assessment methods, is equally crucial for all the methods discussed by DiBenedetto and Schunk.

The study by Nielsen, Martínez-García and Alastor, reporting on the psychometric properties of the Spanish translation of the Specific Academic Learning Self-efficacy Scale (SAL-SE) and the Specific Academic Exam Self-efficacy Scale (SAE-SE) in Chap. 5, not only provides a detailed insight on how to conduct and document a psychometric study using IRT models such as the graphical log-linear Rasch model. The chapter is also an example of a study documenting the measurement properties of two ASE scales in a different culture than the original study, while using the same methods and a sample of students from the same academic discipline as in the original study just in a different culture, as to be able to identify differences in measurement properties most likely connected to the differences in the educational cultures in Spain and Denmark. The study shows that there are differences in the measurement properties in the two cultures, and the authors suggest that future research on the two scales is done in more cultures and with students from a variety of academic disciplines. The authors also suggest that additional items are developed for the scales, as now two studies have suggested that this might improve their measurement properties.

Secondly, DiBenedetto and Schunk suggest that more research is conducted in regard to the administration and analysis of the various instruments and assessment methods they discuss as well as how this and the results are communicated. With standardized protocols, it will be possible to replicate research designs in various age groups and contexts and thus not only build on the evidence towards validity and reliability (c.f. the above), but also to compare results to previous research and thus evaluate differences across various populations and/or domains. Chapter 5 (Nielsen, Martínez-García, and Alastor) is an example of such design-wise replication, even if the psychometric results showed that a direct comparison of self-efficacy scores across Spanish and Danish psychology students was not directly possible. To this might be added the suggestion that researchers come together and are willing to share their data from previous studies, in order to facilitate assessment of measurement

invariance between these and new replication data. In this manner, we might be able to discover which populations are truly comparable at the score level and which are in need of more sophisticated methods for the adjusted of biased scores in order to make then comparable and thus reflect true differences or true non-differences. Such analysis might be done both within CFA and IRT measurement models or as add-on analysis of differential item functioning to any type of measurement model. However, only few models allow for the adjustment of scores for such bias. Even so, there is no doubt that such systematic analysis would bring the field of academic self-efficacy in education forward.

Chapter 4 is another example of a study expanding the validity evidence of an instrument for the assessment of ASE, in the case of use in a new culture. In this chapter, Sánchez-Escobedo provides detailed arguments for such studies and exemplifies this with the Mexican Self-Efficacy Grid Scale using a CFA approach. Sánchez-Escobedo also highlights that grid-type instruments such as the MSEGS should be subject to continuous review of their psychometric properties as to ensure they remain satisfactory and the instrument can form the basis of appropriate and adequate interpretation and utilization of assessments. In line with DiBenedetto and Schunk's broader recommendation, we find it appropriate to expand this recommendation to apply to all instruments for the measurement or assessment of ASE. Not only is reliability sample dependent and should be reported in all studies where relevant, validity in one context/culture or for one study population does not ensure validity in other contexts/cultures or study populations. We thus encourage all ASE researchers to continuously include relevant information on reliability and validity of the instruments they use in their particular study population/context. At this point in time, such a practice is facilitated by the increasing number of scientific journals offering to expand articles with online supplemental information. Continuous reporting of validity and reliability information will provide both the research community and practitioners with relevant information when choosing and utilizing an instrument for either purpose.

Third and lastly, DiBenedetto and Schunk suggest that research which utilizes multiple assessment instruments and methods would increase our understanding of the dynamic nature of self-efficacy, whether changes in ASE over time are subtle or significant, and how classroom interventions might impact ASE. This is expanded in Chap. 3, where Hiller and Kitsantas highlight that within STEM education it is yet to be researched how citizen science can support student calibration and ASE, and particularly so for struggling students, students with special needs and student groups that are underrepresented within STEM fields. We look forward to seeing the development within this budding area of ASE research, and how it will grow to connect with other areas of ASE research. An additional and related perspective for future research on the assessment of ASE to consider is presented by Peura and colleagues in Chap. 8. They propose that the specificity level of ACE should be considered and chosen carefully, i.e. from the specific to the intermediate to the general level of ASE. Also, the possibility of including more levels of ASE in the same study should be considered in future research, as they show that in relation to reading, the association between ASE and later achievement differs depending on

the specificity level ASE is assessed at, and this even varies for children at different stages of schooling.

Future Directions in Research on What Shapes Academic Self-efficacy

The third part of the book includes five chapters with a wide selection of perspectives on what shapes academic self-efficacy. Chapter 6 provides a review of the evidence concerning specific factors that influence the association between ASE and academic achievement, while Chap. 7 discusses the complicated relationship between ASE and culture. Chapter 8 discusses the role of calibration in the outcome of interventions focused on improving reading self-efficacy and shines a light on the level of measurement when assessing reading self-efficacy in school children (c.f. the section on assessment of ASE above). Chapter 9 examines the extent to which individual differences in motivation, positivity and resilience can explain children's academic, emotional and social self-efficacy, while Chap. 10 suggests how such knowledge might be used to design strategies for promoting online ASE. Common for the chapters in this part of the book is that they all offer broad perspectives on what shapes ASE and as such lend themselves to broad implications for future ASE research.

From the broad evidence pertaining to how ASE and the association between ACE and academic achievement are influenced by mindset, basic psychological needs, satisfaction, attachment and parental and social support, Mackova and Wood in Chapter 6 also suggest the implications this might have for self-efficacy interventions. Specifically, they suggest that such interventions would benefit from incorporating a peer-support component. Thus, future research should investigate the effects of such peer-support components in self-efficacy interventions at the university level. This can, of course, be investigated in many ways. One suggestion might be a randomized trial design where self-efficacy intervention *without* a peer-support component is considered treatment as usual, while the intervention *with* a peer-support component is the experimental treatment.

In Chap. 7, Liu, Cheng and Chen offer another broad perspective with their discussion of the relationship between ASE and culture. They point out that there are few studies on the relationship between gender, culture and ASE, and how each of these influence students' career choices, and that particularly studies on the influence of culturally determined gender role on ASE are needed. Such relationships may be studied within a power distance framework, as power distance between teachers and students may differ in various cultures and affect students' ASE. Another angle might be culturally determined parenting styles, as these might also affect students ASE. Lastly, they suggest that international students might serve as a target population for such research, as they are typically heterogenous in their cultural background and not as often conceived as a homogeneous group.

A third broad perspective on the future research into ASE is offered by Peura and colleagues in Chap. 8. While the chapter deals with self-efficacy in reading and reading development, the perspectives for future research on ASE are much broader and relate to the level at which we research ASE (c.f. the section on assessment of ASE). In relation to reading, they show that the association between ASE and later achievement depends on the level ASE is assessed at and that it even varies for children at different stages of schooling. Thus, future research into reading self-efficacy should include a clear choice of the level self-efficacy is assessed at (specific, intermediate or general) and preferably include several levels of assessment. This recommendation extends naturally to most areas with the ASE research. In addition, Peura and colleagues call for a more individual approach in designing reading self-efficacy interventions in order for more students to benefit, as it appears that the benefit of such interventions depends on the degree of calibration between self-efficacy and ability. Research into the effect of such more individual intervention designs, which take into account calibration, would advance the knowledge on reading self-efficacy. We suggest that more or less all research into ASE and its relationship to abilities and development of abilities and skills might be enhanced and lead to new perspectives by information on calibration.

In Chap. 9, Wood, Tramontano and Hemsley show how positivity and resilience contribute to 7–11 year-old children's academic, emotional and social self-efficacy, while motivation contributes to either social self-efficacy or emotional and academic self-efficacy dependent on the type of motivation, respectively (extrinsic and intrinsic). However, they call for further longitudinal research with a focus on the development of self-regulation beliefs and capabilities over time, and in particular at the transition to secondary education, as gender differences might then be greater than at the earlier age. Such research might also be extended to the time period of secondary education as well as the transition into tertiary education. We further suggest that such research might be enhanced further by including a cultural perspective such as described in Chap. 7, as well as assessment of ASE at various levels of specificity as suggested in Chap. 8. This line of research could also extend into the research on strategies for promoting online ASE following from Stephen and Rockinson-Szapkiw's suggestion in Chap. 10, as knowledge on the effects of motivation, resilience and positivity on online ASE in both children and adult students is crucial in developing such strategies. Both development and research into online self-efficacy are imperative, as online learning continues to be pervasive in higher education.

Future Directions in Research on the Influence of Academic Self-efficacy

The book part on research on the influence of academic self-efficacy consists of four chapters adding to our knowledge in this field both through statistical modelling and

through in-depth qualitative analyses and suggesting how the research might move forward. Chapters 11 and 12 are concerned with ASE as a mediator between the learning environment and academic achievement and the impact of ASE on academic motivation, respectively, while Chap. 13 provides insight into the effect of freshmen self-efficacy on intent to drop out. Chapter 14 provides in-depth knowledge on the influence of ASE on the study experience of teachers in postgraduate studies.

Afari and Eksail (Chap. 11) adds to the well-established field of research into the relationship between academic self-efficacy and academic achievement, showing that there is a positive relationship between the two so that highly self-efficacious students are more likely to accomplish academic tasks. They further find that ASE is a mediator in the relationship between the learning environment and mathematics achievement. Based on these findings, Afari and Eksail suggest that this mediating role of ASE should be studied further using a strong longitudinal design, in order to ascertain with greater certainty, the causal relationship between learning environment, self-efficacy and achievement. Similarly, Lin, Longobardi and Bozzato, in Chap. 12, suggest that their finding of the relationship between ASE and academic motivation being mediated by students' future orientation should be studied further with a longitudinal and causal design. A longitudinal design including two to four timepoints of assessment of each construct might even uncover the causal relationship of the constructs included in both studies; learning environment, ASE, academic motivation, students' future orientation and academic achievement. Knowledge of such a complex and over time evolving causal relationship would be useful for future research, but even more so for practitioners, as it would inform teachers and educators on possibilities to intervene with supportive measures or other changes at various points in the causal chain. In Chap. 13, Petri and Braun with their longitudinal study on the effect of freshmen self-efficacy on intention to drop out demonstrate the strength of including several timepoints in the measurement of ASE, as this allows causal trajectory analyses. This chapter not only adds to the knowledge on ASE and intention to drop out and invites further research on the topic of development in ASE, the longitudinal design and the trajectory approach of Petri and Braun, but also takes the field of ASE research further at a general level, as this might be applied widely.

An additional suggestion taking the research of Afari and Eksail as well as Lin, Longobardi and Bozzato and Petri and Braun further might also be to combine such a causal design with in-depth qualitative knowledge stemming from the students themselves; what have their experience been of the causes and effects between these constructs as they move through education? An example of such in-depth qualitative knowledge on the influence of ASE and how it can be obtained is provided by Dixon and Ward in Chap. 14. They provide detailed knowledge on the influences of academic self-efficacy on teachers' study experiences in their postgraduate education. Based on this, they suggest how to use this knowledge to improve their educational experiences and discuss the effect they as teachers in the postgraduate education can see of this work. One obvious future direction of this line of research could be to attempt to generalize it by posing a longitudinal causal model based on the qualitative findings and then test this model in a larger study on teachers' postgraduate study experiences. However, the research should, in our opinion, also inspire the statistically inclined

researcher to include such a qualitative approach in their studies, in order to better understand their causal path and trajectory models.

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