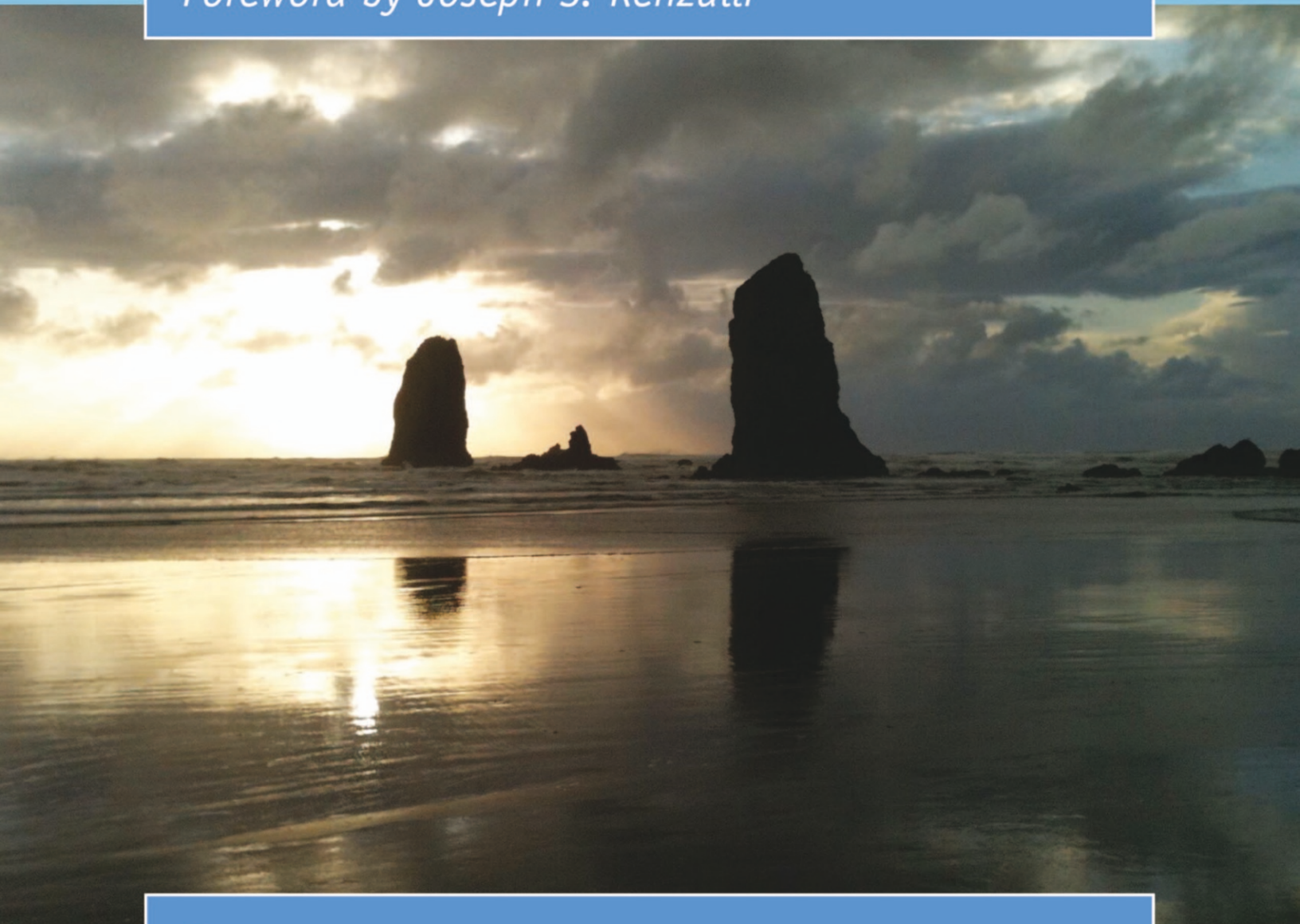# Creative Intelligence in the 21st Century

Grappling with Enormous Problems and Huge Opportunities

Don Ambrose and
Robert J. Sternberg (Eds.)

Foreword by Joseph S. Renzulli

Creative Intelligence in the 21st Century

ADVANCES IN CREATIVITY AND GIFTEDNESS

Volume 11

Advances in Creativity and Gifted Education (ADVA) is the first internationally established book series that focuses exclusively on the constructs of creativity and giftedness as pertaining to the psychology, philosophy, pedagogy and ecology of talent development across the milieus of family, school, institutions and society. ADVA strives to synthesize both domain specific and domain general efforts at developing creativity, giftedness and talent. The books in the series are international in scope and include the efforts of researchers, clinicians and practitioners across the globe.

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Creative Intelligence in the 21st Century

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Foreword by Joseph S. Renzulli

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All chapters in this book have undergone peer review.

Printed on acid-free paper

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FOREWORD

Stream of Consciousness on Creativity, Globalization, Technology, and What Is Happening in a Rapidly Changing World

> *Nothing endures but change.*
> (Heraclitus)

There I sat. Thirty thousand feet above the North Pole looking at the New York Times, watching the moving map on my personal TV screen, checking my email, and munching on a meal that was actually cooked on the plane. Fourteen hours to Hong Kong just crawled across the bottom of my TV. I wondered how long it took Marco Polo to get to China and what Wilber and Orville would have thought about flying from JFK to Hong Kong in 14 hours, inflight TV and Internet, and the meals cooked and served on planes. Their first flight was 59 seconds, went up about 14 feet, and covered 40 yards. I'm glad Orville lived long enough to see big four engine planes fly across the Atlantic.

We're flying the same route flown by Korean Airlines 007 when a Russian missile shot it down in 1983 – Missiles! Creativity? Technology? Thank goodness the Cold War is over but an article in today's Times described some bad news – an alleged H-Bomb and missile test by the North Koreans. More creativity and technology gone astray! I hope my plane is well outside their air space. I wonder what the emperors who built the Great Wall would have thought about their defensive technology.

But another article in today's Times reported some good news – the FDA just approved a new drug developed by a Chinese/American team of researchers for the treatment of melanoma. Good news for me since my annual PET scan is coming up. Nice example of the best use of creativity and international cooperation. Will technology improve what happens on this ever-shrinking globe or help us destroy it? Almost a third of the Earth's population is in China. Imagine if the creative potential of this massive country could be unleashed. Maybe they would figure out the definitive cure for melanoma and all other cancers. One thing is for certain – creativity and innovation and technology and globalization touch everyone's lives every day. Small world! Back to work. I need to finish the chapters that Don and Bob sent me so I can write a preface for their books.

Educational policy makers in China have finally come to the realization that their relentless pressure to produce the highest test scores in the world needs to be balanced

with curricular and instructional strategies that promote creativity. One high ranking official said to me, "We can make anything you Americans invent faster, cheaper, and in many cases better, but we want more inventors and innovators and Nobel Prize winners." I wondered if those fancy UCONN pens I brought as gifts for my hosts were made in China! The persons who invited me said they wanted to "pick my brain" on better ways of promoting and infusing more teaching for creativity and innovation into the Chinese education system. I sometimes wonder if the more I learn about topics like creativity, globalization, and technology the less certain I am about what can be done to infuse good practices into what happens on a day-to-day basis in classrooms around the world. Glad I'm reviewing chapters that take on the interrelationships between and among these multifarious concepts – some ideas are starting to come together.

These random thoughts plowed through my brain as I turned off my in-flight TV and started to read another chapter from the books that Don and Bob asked me to review. This pioneering two-book series wraps its arms around all of the big ideas and issues that define the study of creativity, globalization, and a modern world that is changing at warp speed. As most of the chapter authors in the book point out, creativity, globalization, and technology have brought into perspective the numerous political, social, economic, and human relations issues that define the 21st Century. And undoubtedly, what was most important to me is that educators at all levels, from policy makers, researchers, and school administrators to curriculum developers, counselors, psychologists, and classroom teachers, will find ideas and issues in these books that pertain to the research, theory, and practice that guide educators in making schools more effective places for young people.

The editors of this series have brought together a diverse group of the most prominent contributors to the literature in creativity, giftedness, curriculum development, the arts, talent development, and literacy. The books integrate the complex and diverse elements of these topics with the overriding themes of creativity and globalization. The sheer scope and detail of information about issues in each author's respective area of specialization is almost overwhelming and it made me both think about my own work and things that need to be reexamined in view of the "macroproblems" that we face in a rapidly changing world and the need for interdisciplinary work in fields that have for too long have been studied in isolation. It certainly made the many disparate ideas in my brain, ideas that have appeared, disappeared, and reappeared in the literature over the decades, crash through my mind and I wondered what would be the best things to say in this preface.

No one sits down and reads books like this from cover to cover, but there is something in these two volumes for everyone. I suggest that readers begin with the introductory chapters of both books. These "big picture" focus chapters synthesize insights from over thirty academic disciplines. The overviews will help you understand the impact of globalization on the life prospects of today's young people and will also help you make decisions about which chapters are most relevant to your own work. The interdisciplinary nature of macroproblems such as climate

change, economic inequality, and political turmoil set the stage for addressing macro-opportunities, which are unprecedented circumstances that can lead to significant advances in well-being for billions of people around the world. A focus chapter includes a 3-D model portraying globalization as an enormous wave with macro-opportunities on top and macroproblems on the underside of the wave. If we develop the knowledge, skills, and dispositions required for dealing with the complexities of 21st-century trends and issues, we may be able to leap to the crest of the wave and capitalize on the macro-opportunities. If not, we may be crushed underneath the wave by a combination of macroproblems. A part of the analysis highlights arguments about societal collapse generated by scholars in 15 different disciplines. Each of these prominent scholars argue that current conditions could lead to the collapse of societal institutions some time in the 21st century.

The stream of consciousness prompted by reviewing chapters in these two volumes made me realize that today's world is a much different place than it was when most of the theories that guide today's education system were developed. The only thing that has remained constant is change, and the focus of these two unique volumes will help you, as it has helped me, see that to move forward with new ideas we must consider change within the larger context of creativity, globalization, technology, and the interdisciplinary nature of knowledge. The stream of consciousness also reminded me that creativity, globalization, technology, and what takes place in the larger world affects every one of us every day and that is a good thing. We all live on the same planet and we all have a responsibility to contribute our gifts and talents to making this small planet a better place.

Joseph S. Renzulli
The University of Connecticut

SECTION I

RECOGNIZING POWERFUL CONTEXTUAL INFLUENCES ON CREATIVE INTELLIGENCE

DON AMBROSE AND ROBERT J. STERNBERG

1. PREVIEWING A COLLABORATIVE EXPLORATION OF CREATIVE INTELLIGENCE IN THE 21ST CENTURY

It's possible that the remainder of the 21st century will clarify the extent to which physicist and public intellectual Michio Kaku (2011) was correct when he posited the *caveman principle:*

> Genetic and fossil evidence indicates that modern humans, who looked just like us, emerged from Africa more than 100,000 years ago, but we see no evidence that our brains and personalities have changed much since then. If you took someone from that period, he would be anatomically identical to us: if you gave him a bath and a shave, put him in a three-piece suit, and then placed him on Wall Street, he would be physically indistinguishable from everyone else. So our wants, dreams, personalities, and desires have probably not changed much in 100,000 years. We probably still think like our caveman ancestors. (p. 13)

The caveman principle raises questions about the extent to which violence and dominance have plagued humanity from prehistoric times up to the present. There have been some arguments in archaeological circles about this. The emerging consensus is that, in terms of collective behavior, we've always had mixed inclinations ranging from violent, hierarchical dominance all the way through collaborative, ethical caring (see Knüsel & Smith, 2014). So Kaku's Cro-Magnons likely would have been just as plagued by periodic eruptions of destructive behavior as modern population groups. A crucial difference is that their destructive behaviors would have generated negligible impact on the world whereas the technological power we have amassed in just the last few decades magnifies our harmful impact to the point where we might destroy the biosphere itself.

If we manage to think creatively and critically enough to master the enormous problems we face today (e.g., climate change, the erosion of democracy, resource shortages) while simultaneously capitalizing on today's exciting opportunities (e.g., international scientific networking, the growing power of technology), humanity can claim to have refuted the caveman principle by the dawning of the 22nd century. If instead our globalized[1] socioeconomic and cultural systems deteriorate or even collapse, it will look like the caveman principle was at least a somewhat credible

construct. Or, possibly we will manage to muddle through and end up with some mixture of successes and failures by the time the year 2100 rolls around.

Based on interdisciplinary explorations and collaborations that kept turning up huge socioeconomic and cultural problems and opportunities and their connections with creativity, giftedness, and talent development (see Ambrose, 2009; Ambrose & Cross, 2009; Ambrose & Sternberg, 2012; Ambrose, Sternberg, & Sriraman, 2012; Sternberg, 2014; Sternberg & Jordan, 2005; K. Sternberg & R. Sternberg, 2012; R. Sternberg & K. Sternberg, 2008), we decided it would be wise to explore the ways in which creative intelligence might be interacting with 21st-century globalization, which is the biggest contextual influence of our time. Consequently, we designed this project involving far-reaching, interdisciplinary analyses of globalization and the high-impact trends and issues it is generating. We invited leading thinkers from the fields of creative studies, gifted education, and general education to respond to an interdisciplinary focus chapter on globalization (the next chapter in this volume) from their areas of expertise. Those analyzing globalization through the lenses of creativity research and theory joined us in the formation of this book. Those doing a similar analysis through the lenses of gifted education and talent development clustered together as contributing authors for a sister book on gifted education (Ambrose & Sternberg, 2016). Taken together, these two projects align with recommendations from leading scholars of creativity and giftedness who envision the need for the development of stronger creative capacities and ethical wisdom so bright young people will be more able to grapple with the complex challenges of the 21st century (see Gardner, 2012; Gardner, Csikszentmihalyi, & Damon, 2001; Reis & Renzulli, 2010; Renzulli, 2012; Sternberg, 2013, 2014).

SOME BIG ISSUES TESTING OUR CREATIVE INTELLIGENCE

Why is interest growing in topics like these? We are in unprecedented times featuring a daunting array of issues. For example, accelerating human impact on the biosphere over the last couple of centuries has encouraged a growing number of scholars to claim that we are living in a new era known as the *anthropocene* (Brown & Timmerman, 2015; Dirzo et al., 2014; Rockström et al., 2014). Instead of simply crawling around on the surface of the planet, we are now manipulating its biospheric controls and shaping the prospects for life on Earth over the long term. Moreover, this shaping is extremely powerful, complex, and worrisome. In the words of environmental economists, Brown and Timmerman (2015); "Climate change is unlike any other environmental problem, really unlike any other public policy problem. It's almost uniquely *global*, uniquely *long-term*, uniquely *irreversible*, and uniquely *uncertain*—certainly unique in the combination of all four" (p. 7). But not to worry. A prominent politician brought a snowball into the U.S. Senate and threw it to a colleague to prove that it was cold outside so global warming isn't an issue. Caveman principle, anyone?

While climate change is an enormous 21st-century problem, some other issues have been calling out for our attention. Growing socioeconomic inequality within and between nations is one of them. Political scientist Marie Gottschalk (2015) provided a detailed description of "a new war on the poor" and the accompanying criminalization of poverty. "The US incarceration rate of 730 per 100,000 is still the highest in the world and rivals the estimated rate [at which] citizens of the Soviet Union were being sent to the gulags during the final years of Stalin's rule in the early 1950s" (p. 8). Almost all of the 2.2 million serving prison sentences are poor and a large portion of them are serving very long sentences for minor crimes. An additional 8 million are under some other forms of state control, such as probation or parole. While the problem of severe inequality is most pronounced in the United States, in comparison with other developed nations, it is a growing phenomenon around the world (Wilkinson & Pickett, 2009).

In stark contrast with the war on the poor, economist Joseph Stiglitz (2010, 2012) detailed how a much smaller number of clever but selfish, shortsighted, privileged key players in the financial system manipulated our political regulatory apparatus and gambled with the assets of millions of trusting investors to the point where they precipitated the 2008 economic collapse, which did enormous damage to the well-being of billions around the world. Instead of being incarcerated for these actions, which were far more harmful than those carried out by the vast majority of those languishing in the massive prison system, these corrupt financial gamblers walked away with enormous bonuses largely paid for by taxpayer funded bailouts.

TWO-SIDED ATTRIBUTES FOR CREATIVELY DEALING WITH 21ST-CENTURY GLOBALIZATION

The issues brought forth by 21st-century globalization are so numerous we can't deal with all of them here. At this point in our analysis, suffice it to say that globalization has created unprecedented economic and technological opportunities along with massive, complex problems with enormous destructive power. A more comprehensive treatment of these opportunities and problems appears in the next chapter of this book. For now we foreshadow some of the contents of the volume by taking a brief look at a few human attributes that can help us deal with complex, widespread socioeconomic and cultural issues. Table 1 includes a number of these attributes in the left-hand column. The second column briefly mentions how each attribute can help us solve today's enormous problems and capitalize on big opportunities. The third column of the table suggests some ways in which each of these attributes has a flip side that can do significant damage, undermining our efforts or even causing far more harm than good. The brief analyses that follow the table describe the potentially beneficial and harmful effects in a little more detail. These are just a few examples. Many more could have been included and others will show up in the remaining chapters of this volume.

Table 1. Human attributes that can help or hurt our chances of surviving and thriving in the 21st century and beyond

Attribute	Beneficial side	Harmful side
Optimism	Magnifying and capitalizing on big opportunities	The dangers of utopianism
Individualism	Recognizing individual aspirations and abilities	Egoistic individualism run amok
Diversity	Solving big problems through unpredictable creative associations	Identity group divisions divide and conquer us
Confidence, certainty, striving for precision	Incisive, analytic precision of the scientific method produces new tools for problem solving	Methodological overconfidence and the lure of completeness traps us in unified, insular, dogmatic idea frameworks

Optimism

Beneficial side.   We have to be optimistic if we are to make our way through the complexities of 21st-century globalization. Some of the issues are so complex and daunting that we will need to be extremely resilient, individually and collectively. Positive psychology is an area of scholarship that could be helpful in this regard (see Csikszentmihalyi, 2014; Seligman, 2012).

Harmful side.   Optimism taken too far can mutate into a form of utopian thinking that can generate much more harm than good. For example, through studies of despotic regimes such as those led by Hitler, Pol Pot, Milosevic, and Stalin, historian Eric Weitz (2003) found that a utopian doctrine tends to form the ideological core of a strong state. The utopian ideology enables dogmatic, unscrupulous leaders to demonize and persecute minority populations in the name of ideological purity. Hitler's invocation of the master race is a classic example. Dogmatic, utopian thinking is widespread and has persisted throughout human history so the harmful side of optimism is particularly nettlesome (see Ambrose, 2008; Gerard, Geuy Akers, Shen-Miller, Knežević, & Stankov, 2009; Johnson, 2004).

Recommendation.   We never could afford to allow misguided utopian thinking to prevail but we can afford utopian demonization and manipulation even less in the context of 21st-century globalization. The pressing issues we face allow us far less room for these kinds of large-scale mistakes because utopian societies simply will not be able to deal with today's complex global issues. So we must promote optimism, purpose, and resilience without allowing these positive attributes to crystallize into dogmatic, utopian ideological frameworks. Coming up with ways to accomplish

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this will tax our creative intelligence to the maximum. Paying more attention to the ways in which dogmatism distorts creativity, giftedness, and talent development is a good starting point because dogmatic thought and action, especially among societal leaders, is at the root of harmful, utopian thinking (see Ambrose, 2008; Ambrose & Sternberg, 2012; Ambrose, Sternberg, & Sriraman, 2012; Gerard, Geuy Akers, Shen-Miller, Knežević, & Stankov, 2009; Johnson, 2004).

Individualism

Beneficial side. The discovery and pursuit of individual aspirations and the subsequent talent development aligned with those aspirations provides strong support for purposeful creativity over the long term (Gruber, 1999). Such purposeful development carried out by many collaborating individuals in many societies can generate a large number of innovations, some of which might help those societies solve the enormous problems of the 21st century and capitalize on unprecedented opportunities. Promising, emerging examples come from the online networking of purposeful individuals, each contributing unique pieces of "microexpertise" to solve complex technical, architectural, mathematical, and scientific problems that are resistant to solution by individuals or localized groups (see Nielsen, 2011). More detail about such networking is available in the next chapter of this volume.

Harmful side. Magnification of individualism has distorted our economic system, making it serve the frivolous wants of those born into privilege and the nefarious schemes of successful psychopaths who engage in harmful economic and other activity (e.g., dirty energy, creative distortions of the financial system…) in service of individualistic vainglory and riches. At the root of the problem is the *homo economicus* model from the neoclassical economic paradigm that dominates the field of economics and the globalized economic system to the point where a few powerful plutocrats benefit at the expense of the vast majority and short-term gain trumps long-term economic interests and the sustainability of the ecosystem (Chang, 2002; Madrick, 2014; Piketty, 2014; Stiglitz, 2010, 2012, 2015; Zucman, 2015). In the words of leading economist, Joseph Stiglitz (2010): "most of us would not like to think that we conform to the view of man that underlies prevailing economic models, which is of a calculating, rational, self-serving, and self-interested individual. There is no room for human empathy, public spiritedness, or altruism" (p. 249).

Recommendation. Paying too much attention to individualism can cause a society to allow a few powerful, unscrupulous individuals to distort the socioeconomic system, making it work in service of their own short-term goals while hurting the long-term interests of all. This is especially problematic because many of those in positions of power and privilege are inclined to be narcissistic, attributing their advantage to their own abilities while blaming those less fortunate for their desperate

circumstances (see Piff, 2013; Piff, Stancato, Côté, Mendoza-Denton, & Keltner, 2012). Conversely, excessive distorted forms of collectivism can suppress the aspirations and talents of individuals, as in Stalin's Soviet system of the early to mid 20th century We must develop and nurture the ability to recognize and support individualistic aspiration discovery and talent development while ensuring that such development doesn't spin out of control and run roughshod over common interests. The emergence of a new kind of collective intelligence (see Malone & Bernstein, 2015) could be a sign that we are readying ourselves for this. In addition, more attention to ethical reasoning and the wisdom needed to attain a common good can strengthen the chances that the beneficial side of individualism will prevail over the harmful side (see Ambrose & Cross, 2009; Gardner, 2012, 2013; Gardner, Csikszentmihalyi, & Damon, 2001; Sternberg, 2009, 2013, 2014).

Diversity

Beneficial side.   Diverse ideas and initiatives swimming together can generate the cognitive diversity necessary for collaborative solution of highly complex problems (see Page, 2007, 2010). If we can encourage and facilitate the intermixing of diverse economic, scientific, and cultural ideas, we might have a chance to build a stronger, more just socioeconomic system.

Harmful side.   Various forms of diversity represent some of the biggest barriers to our survival and success in the 21st century. When our thinking is superficial, cultural, ethnic, and religious diversity give us powerful reasons to cluster into angry, fearful identity groups that are unwilling to cooperate and are quite willing to engage in devastating conflicts (Stark, 2003). Even those who are better informed and more considerate still may be prone to the denigration of various identity groups due to implicit biases against outsiders (Banaji & Greenwald, 2013). Class-based diversity in highly unequal populations provides reasons for de facto segregation and the creation of *empathy gulfs* (Shapiro, 2003) that relieve the privileged from caring about the fate of their "inferiors." Our tendency to divide into diverse, conflicting groups, both culturally and economically, generates much of the dogmatism that plagues humanity.

Recommendation.   The world is integrating rapidly as electronic networking and increasing international travel bring diverse people together far more than in decades and centuries past. Meanwhile, our problems require global collaboration with input from diverse groups in various geographic locales. For these reasons, we must find ways to recognize the human propensity for marginalizing and even demonizing outsiders while putting that propensity in its place – on the backstage of the human drama. If we can establish respect for differing cultural, ethnic, and religious traditions, we might be able to draw from diverse idea frameworks and integrate those contributions into solutions for our most pressing problems. In order

to establish this respect it will be essential to root out our implicit biases so we become aware of the ethnocentrism, racism, classism, sexism, and other forms of discrimination that have been constructed through experiences over long periods of time. Developing such deeper understanding can help us overcome this widespread, troublesome form of dogmatism (see Banaji & Greenwald, 2013).

Confidence, Certainty, and Striving for Precision

Beneficial side.   Based on approximations of the scientific method, many academic disciplines within and beyond the natural sciences have generated productive positivist (quantitative-empirical) investigative paradigms that have led to helpful discoveries about the human condition. Working to generate, employ, and test falsifiable hypotheses (see Atkins, 1995; Popper, 1959) has led to advances in theory and research in most fields, thus giving us some valuable, precise tools for grappling with the big issues of the 21st century.

Harmful side.   Excessive certainty sometimes turns into a form of dogmatism, such as the entrenchment within scientific paradigms described by Kuhn (1962) and the *lure of completeness* articulated by physicist Hermann Bondi (1977). Both Kuhn and Bondi argued that we should not remain complacent about current knowledge structures and recognized the likelihood that new discoveries and theories usually emerge and modify or overturn the old. Some disciplines, notably economics and analytic philosophy, are prone to capture by the lure of completeness because they are (a) unified around a dominant theory, (b) insular because they resist interaction with ideas from outside their epistemological borders, and (c) firmly policed because the gatekeepers of the field automatically reject new work that does not fit the orthodoxy (see Ambrose, VanTassel-Baska, Coleman, & Cross, 2010; Bender & Schorske, 1997). If important academic disciplines mire themselves in the lure of completeness, we likely will be unable to generate new solutions to complex 21st-century problems.

  Of course, overconfidence and excessive intellectual certainty are not confined to academia. Leaders in the professions often trap themselves within these forms of dogmatism as evidenced by the corporate infatuation with deregulated free markets. Leading economist Joseph Stiglitz (2010) called this infatuation *market fundamentalism* because radical free-market beliefs, especially in the financial industry, seem to be as impervious to evidence as is radical religious fundamentalism.

Recommendation.   Dogmatism might be our biggest enemy in the 21st century because it confines us to narrow-minded, shortsighted, superficial thinking. In the case of disciplines trapped by the lure of completeness, the problem might not include superficiality because those disciplines go very deeply into the phenomena under study, at least by current standards of investigation. Nevertheless, unified, insular, firmly policed disciplines certainly can produce narrow-minded, shortsighted

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thinking about complex problems, especially when those problems spread across the borders of academic disciplines, making interdisciplinary borrowing necessary. We have to find ways to resist premature closure in our own thinking while helping the more confident, certain, closed disciplines recognize the value in ideas that differ from the orthodoxy within their own borders.

Based on this brief analysis of just a few human attributes, it appears that finding a balance between extremes might be an important guiding principle for success in grappling with 21st-century globalization. Something like Aristotle's (1908) golden mean might be useful to consider because it encourages navigation between extremes of conduct. Sternberg's (1998) balance theory of wisdom provides more specific guidance along these lines because it emphasizes the need for recognizing the interests of various stakeholders, the influences of various contexts, and the importance of adaptation to complex conditions. The element of wisdom is particularly important because the problems generated by globalization are severely testing our ethical capacities. Additional discussions of the need for balance and wisdom in today's world show up later in this chapter and in the next chapter of this volume.

Now that we have taken a brief look at a few 21st-century issues and some human attributes that might be helpful for dealing with them, we can consider what's to come in the rest of this book. The next section of this chapter provides a brief overview of each contribution from our thoughtful, highly accomplished collaborators.

AN OVERVIEW OF THE CONTENTS OF THE VOLUME

This book includes five sections that connect much of what we know about creativity with the challenges of 21st-century globalization. The first section introduces the project and provides an interdisciplinary framework for analyses of globalization. The second section addresses conceptions of creativity within the context of globalization. Authors in the third section analyze the large-scale contextual constraints on creative teaching and learning. Section four includes authors who make more direct suggestions about ways in which educators and students can work creatively to address the demands posed by the enormous challenges of the 21st century socioeconomic and cultural contexts. Finally, section five represents a synthesis of the contributions in the volume.

Our introductory section titled *Recognizing Powerful Contextual Influences on Creative Intelligence,* is comprised of this introductory chapter and a focus chapter titled, *Twenty-First Century Contextual Influences on the Life Trajectories of Creative Young People.* In the focus chapter, Don Ambrose provides a conceptual model based on the integration of perspectives from multiple disciplines. The model illustrates the threat of enormous macroproblems and the potential benefits of unprecedented macro-opportunities that arise from socioeconomic, technological, cultural, and political-ideological conditions in the 21st century. The macroproblems threaten to crush individuals and societies that find themselves mired in a miserable

trap underneath an enormous globalization wave. Fortunately, the macro-opportunities promise to lift individuals and societies toward unprecedented success, if the education system can enable today's young people to leap to the crest of the globalization wave. After the analysis of 21st-century demands, suggestions are made about the blend of knowledge, skills, and dispositions required for dealing with the macroproblems and capitalizing on the macro-opportunities. This focus chapter serves as a launching pad for the other contributing authors' analyses. They use it to examine ways in which their expertise fits together with trends and issues in the 21st century.

Section two of the book is titled *Creativity in the Turbulent 21st Century*. In this section our authors fit creativity research and theory into the macro-context of globalization.

Dean Keith Simonton initiates this section with his chapter titled, *The Decline of the West? A Comparative Civilizations Perspective*. He engages in an impressive, broad scope, interdisciplinary exploration of creativity on the large-scale looking at the ways in which creative work evolves in societies past and present, East and West, over the long term. His analysis addresses various rise-and-decline theories in an effort to assess whether or not the decline of Western civilization is imminent, inevitable, or avoidable. Considering two lengthy time periods, ancient-medieval and post-Renaissance-modern, he ponders questions pertaining to the nature of creative work that emerges, evolves, and sometimes declines in various civilizations, as well as the reasons for those changes in creativity. Through his analysis we gain appreciation of the nature and dynamics of golden ages, dark ages, and societal transition points that influence creative work in the sciences, arts, and technologies. Consistent with the purpose of this book, Dean's panoramic analysis takes us on a long-range, broad-scope excursion through creativity and then concludes with a hopeful discussion of the ways in which current societal evolution might be providing opportunities for healthy, creative work just when we need it most in a turbulent globalized era.

Mark Runco extends the notion that 21st-century macroproblems and macro-opportunities might not be as they seem at first in his chapter titled, *We Must Prepare for the Unforeseeable Future*. He shows how shifting perspectives facilitated by creative problem solving processes can turn a problem into an opportunity. Employing relevant creativity research, Mark illustrates some ways in which problem-finding processes, intrinsic motivation, persistence, adaptation, and other methods might be able to help us grapple with unprecedented 21st-century problems. He also discusses the importance of incorporating these ideas into education to make curriculum and instruction align better with current conditions.

In their chapter titled, *Asking the Wrong Question: Why Shouldn't People Dislike Creativity?* Laura Yahn and James Kaufman explore the pros, cons, costs, and benefits of creativity in the classroom, the workplace, and the world. In recognition that creative people and creative work can generate both profound benefits and significant harm they focus their analysis on some ways in which the harmful side

of creativity can have a magnified impact in complex, 21st-century conditions. They also explore social dynamics pertaining to creativity such as the tendency for creative outsiders to be ostracized or bullied, that many profess to value creativity but shy away from it, and that we can have inaccurate perceptions of creativity. Finally, they conclude with the promising notion that creativity likely will continue to enable us to survive and thrive, even in complex conditions and even though we tend to hold it at arms length due to its novelty, complexity, and uncertainty.

Mary Jacobsen and Lorna Goulden directly address some of the driving forces of 21st-century globalization in their chapter titled, *A Whole New Way of Working with Creativity, Innovation and Innovators.* These forces include the exponential growth of the power of technology and the importance of innovation in a changing world. Mary and Lorna argue that the nature and interaction of these forces, along with other developments, exert powerful influences on the structure and dynamics of economic and cultural systems. These disruptive influences have both beneficial and harmful implications for the effectiveness of the organizations that enable individuals and groups to develop and apply their creative abilities, and on the nature of creative work itself. They also consider ways to support innovation and make it more productive. Their analysis portrays some promising applications of creativity in the evolving workplaces of the 21st century.

In her chapter titled *Facilitating Creative Thinking: When Constraints Help,* Catrinel (Cathy) Haught-Tromp applies insights from the intriguing research on creative constraints to phenomena generated by 21st-century globalization. Contrary to popular belief, constraints that arise from the contexts surrounding our thoughts, actions, and work processes can be useful when it comes to the production and employment of creative insights. Cathy proposes a "green eggs and ham" hypothesis for explaining how constraints that seem prohibitively confining actually can facilitate the flourishing of creative ideas. This could be extremely helpful given the very broad, complex, ill-defined nature of 21st-century problems. She explores the relevance of the hypothesis to various domains and then concludes with the optimistic recommendation that we embrace the opportunities embedded in constraints when dealing with complex issues.

The third section of the book is titled *Unshackling Students, Teachers, and Schools: Recognizing Contextual Constraints.* It includes two chapters on large-scale contextual influences that are shaping the structure and dynamics of school systems. The authors address some disturbing pressures for standardization of education at a time when embracing diverse pedagogical approaches might be more productive.

Yong Zhao and Brian Gearin employ our theme of globalization to develop a panoramic analysis of some disconcerting trends in education around the world. In their chapter, *Squeezed Out: The Threat of Global Homogenization of Education to Creativity*, they describe an overemphasis on measurement-driven education based on shortsighted concerns about international competitiveness. The outcome of this form of dogmatism on a global scale is a narrowing of the cognitive abilities addressed by educational systems. Curriculum, instruction, learning, and assessment

all suffer from this narrowing, which makes education excessively mechanistic, less enjoyable, and less purposeful. In essence, the homogenization of education around the world suppresses and distorts creativity just when the forces of globalization are demanding that young people become more creative.

Jane Piirto analyzes the damage the corporatization of education has done to teaching and learning in her chapter titled, *The Creative Intelligence of Teachers Resisting the Pearsonizing of Global Education.* Jane grapples with enormous questions about what educators can do in view of the daunting challenges posed by the macroproblems and macro-opportunities of 21st century globalization. She uses exemplars of creative teaching from a recent inquiry project to illustrate creative teaching and learning approaches that can invigorate gifted education and general education while enabling young people to overcome the "creative intelligence gap" that separates where we currently are from where we need to be in terms of our capacities. She frames the analysis with descriptions of the ways in which major publishers and testing companies are exerting dominance over educational purposes and processes. The hegemony of these corporations and the ideologues and policymakers who collaborate with them is leeching the education system of creativity and purpose just when purposeful creativity is needed the most. She also proposes that the creative teaching approaches described in the chapter can serve as methods of resistance against the dominance of misguided reform initiatives.

Section four, titled *Invigorating Creativity in Education,* includes authors who explore particular strategies and approaches to education that can preserve and strengthen creative teaching and learning. Consistent with the theme of cognitive diversity that emerges periodically throughout this project they propose a very diverse set of ideas that address various dimensions of the educational system.

Ron Beghetto begins this section by delineating some ways that classroom creativity might address today's big socio-contextual issues in his chapter, *Leveraging Micro-Opportunities to Address Macroproblems: Toward an Unshakable Sense of Possibility Thinking.* Ron suggests that the enormous macroproblems of the 21st century might not require enormous solutions. Instead, they might be addressed productively through the employment of rather small but widespread shifts in teaching approaches. He recommends that teachers back away from striving for certainty in curriculum and instruction to make room for the growth of students' creative imagination, thus putting them in the habit of generating new possibilities. This requires overcoming the "uncertain future paradox," which refers to the pedagogical problem of using established, concretized, stultifying curricula. While making this argument he provides some rather remarkable examples of high-level achievements based on imaginative approaches to teaching and learning. Overall, his argument presents a doable initiative that has the potential to remove some of the dogmatism that prevents us from recognizing and grappling with the big problems of the 21st century.

John Baer makes us think creatively about creative education with his chapter, *Creativity and the Common Core Need Each Other.* While sets of standards can harm creativity and education, as discussed by Yong Zhao and Jane Piirto in this volume, there can be a very positive flip side. John shows us how the Common Core standards that are influencing teaching and learning in the USA can help teachers and students think creatively about the content and processes of learning. The deep mastery of domain-specific content promoted by the standards can provide the fuel for more creative thinking because it aligns with insights generated by research on domain-specific creativity. Appropriately designed standards working within the context of 21st-century globalization can paradoxically provide creative opportunities for offsetting and going far beyond the problems that ill-conceived standards might perpetuate.

In their chapter, *Creative Approaches to Literacy Learning: A Transformative Vision for Education in the 21st Century,* Karen Magro and Kathleen Pierce use the turbulent conditions of today's globalization as background for a discussion of the evolution and growing importance of literacy in our changing world. They identify and describe a wide variety of student-centered literacy learning strategies that can help young people develop the intrinsic motivation and skills necessary for success in today's complex cultural and socioeconomic conditions. Throughout their analysis they point out ways in which literacy enables individuals and groups to perceive and work against oppressive societal barriers that suppress aspirations. For example, storytelling, arts integration, and multicultural literacy approaches can clarify international perspectives on social justice while enabling individuals from diverse backgrounds to understand one another. Karen and Kathleen also highlight the importance of emotional intelligence and transformative learning experiences as crucial elements in the development of 21st-century literacy.

Surviving and thriving in the 21st century will require some inventiveness on the part of individuals and societies. Fortunately, Leigh Zeitz and Sharon "Sam" Sakai Miller show us how we might promote that ability in their chapter titled *Cultivating Innovation Through Invention: How Rube Goldberg Inventions Can Ignite Creativity.* For decades, Rube Goldberg inventions captured the imagination of many; however, they seemed impractical, even frivolous. If we think of them as end products those impressions likely are correct. But Leigh and Sam go deeper into the invention process, highlighting the ways in which it promotes imagination, intrinsic motivation, and creative problem solving. Students who learn through this process could be more likely to perceive opportunities in gigantic problems. This could give them a significant advantage in the turbulence of 21st century conditions.

Dorothy Sisk completes this section by illustrating the important leadership dimension of education with her chapter titled, *Creativity and Leadership Development: Can They Coexist for Transformational Change in Education?* Recognizing that the daunting problems and unprecedented opportunities presented by 21st-century globalization will require unusual creative action on our part, she analyzes a variety of ways in which creative leadership can come into play in

complex situations. While generating this ambitious, multidimensional portrayal of creative leadership she invokes two exemplars, Sid Parnes and Annemarie Roeper, who showed us how these lofty abilities and strategies actually can come into play. Dorothy also synthesizes a wide variety of sources from the leadership and creativity literature to build her 21st-century leadership framework. Overall, the analysis expands our thinking beyond cognitive frameworks to include diverse aspects of human awareness and ability. This expansion generates possibilities for recognizing and dealing with today's very large, complex issues. These possibilities come through in her descriptions of some recent, highly innovative collaborations aimed at solving global problems.

Finally in section 5 Robert Sternberg integrates the complex, diverse elements of creativity, education, and globalization in his chapter titled *What's Wrong and How to Fix It: Balance of Abilities Matters More Than Levels*. He contemplates the prospects for human survival over the long term and then proposes that the difficulties we cause for ourselves arise from an imbalance of important abilities. For example, when suffering from imbalance, otherwise intelligent individuals can rely excessively on analytical ability leaving them seriously short on creativity, practicality, and wisdom. Sternberg also highlights the ways in which societal favoritism of "forward incrementation" locks creativity into small steps forward within existing paradigms thus making it unlikely that we will be able to deal with the enormous problems of the 21st century because those problems will require large-scale creativity guided by wise leadership. In essence, if we are to survive and thrive in the 21st century and beyond we will need to balance our abilities while maximizing them. If we are unable to do this our prospects are grim.

CONCLUDING THOUGHTS

In the end, the question is how we can reorient ourselves to think globally but at the same time wisely. The two kinds of thinking do not necessarily go together. At times, they even make strange bedfellows. Much of what passes as globalization is an attempt by parties in one nation to use global marketplaces—whether products or ideas—to benefit them in particular, not to benefit the world.

In our view, the problem, at least in the West, starts with schooling. More and more, schooling is being oriented toward passing tests. Oddly, this orientation derives from the East, where schooling has long been based largely on the passing of tests. This practice has helped cram-school operators, but few others. The test-driven approach to schooling, at least as it is being implemented in this country, tends to encourage students to try to drill facts into their heads, often at the expense of understanding the relations among, and meaning of, the facts that are learned.

In the augmented theory of successful intelligence (Sternberg, 2003), four sets of cognitive skills are viewed as being essential to becoming an educated person: creative, analytical, practical, and wisdom-based. As this chapter has made clear, what is most missing from thinking in today's world—and the education of students

in preparation for their adult thinking in a globalized world—is balance. For us, part of that balance is among these sets of cognitive skills. Students need to develop creative thinking skills to generate novel and compelling ideas for dealing with complex global problems; analytical skills to ascertain whether their new ideas are good ones; practical skills to implement their ideas and to persuade others of their usefulness; and wisdom-based skills to ensure that individuals use their knowledge and abilities to help promote a common good, by balancing their own, with others' and larger interests, over the long- as well as the short-term, through the infusion of positive ethical values.

Our societies often bemoan the lack of wisdom in our adults—in the United States, we see it in every presidential campaign—but we then have to ask ourselves how much our schools do teach for wisdom. The answer, unfortunately, is practically nothing, even though wisdom is the key to a better world. Many if not most of the problems we have in the world today, if they are to be solved, will be solved only through wisdom. But the more important fact is that if we and our leaders were wise, we would not have the problems in the first place—global warming, extreme inequality of incomes, and terrorism—to name a few.

At the very least, we need creative thinking to attack global problems, but then we have to ask how much our schools do to teach in ways that develop creative thinking, and the answer again is practically nothing. Yet means exist to teach students how to think both creatively and wisely (Sternberg & Grigorenko, 2007; Sternberg, Jarvin, & Grigorenko, 2009). Instead, schools concentrate on memory and analytical skills, which are primarily what standardized tests test.

Standardized tests are being used in the name of accountability, but the accountability these tests produce is very narrow. And in a complex and, in many respects, dangerous world, we can't afford to be developing thinkers who lack the creativity, wisdom, and quite frankly, common sense (practical skills) to solve important global problems. Instead of asking students on what date or in what place a treaty was signed, why not ask instead how the terms of the treaty could have been improved? Instead of asking students to list symptoms of diabetes, why not ask them what schools could to do improve their menus to minimize the chances of children developing diabetes either in childhood or later on? Instead of asking students merely to analyze the ending to a story, why not ask them as well to provide an alternative ending to the story?

Why don't we teach for wisdom and for creativity, when they are essential to solving global problems? There are lots of reasons.

First, in education, entrenchment is an extremely powerful factor. It's not the way we have been teaching for the last several hundred years; it's not the way teachers were trained to teach; so it's not the way they do teach or principals expect them to teach.

Second, teaching for wisdom and creativity requires substantial measures of each in the teacher, and teachers are not necessarily selected for those attributes. Indeed,

teachers who are too creative may find that they fit only poorly into today's schools, with their orientation on preparing students for mind-numbing tests.

Third, teachers teach to standardized tests and those tests do not assess wisdom and creativity, for the most part. They could, but they don't. So school systems probably would devalue teachers who teach in ways that are orthogonal to what the tests measure.

Fourth, it simply is harder to teach for wisdom and creativity, or even for common sense, than for memory and analytical skills. So teachers do what comes more easily to them.

Fifth, it is harder to test for wisdom, creative, and practical skills, and tests of such skills need to be human-scored. In a world that wants to do as much as possible by machine, reflective hand scoring may seem anachronistic but, more importantly, too expensive. There is always a boondoggle to spend the money on.

Finally, teaching for wisdom and creativity is threatening to many elements of society. They view it as "soft." They want students to learn hard facts. One person even wrote a book, *The Know-It-All: One Man's Humble Quest to Become the Smartest Person in the World* (Jacobs, 2004). Given that the chances are you have never heard of the author, A. J. Jacobs, the quest either failed or being smart does not count for much in this world. His plan for becoming the smartest person in the world: to read all 44 million words of the 2002 *Encyclopedia Britannica.* What's worse than the idiotic idea that reading an encyclopedia would make you the smartest person in the world is that the book has a 4-star rating on Amazon.com with 358 customer reviews. So people fell for it, much like they fall for the idea that winning a spelling bee shows a child is very smart. Of course, it may be that Amazon book readers are idiosyncratic, but the book also has a 4-star rating on Barnes and Noble's website, with 129 reviews. We as a society believe that absorbing a lot of facts will make us smart. It may, in a limited sense, but we won't solve problems of globalization by memorizing thousands or even millions of facts.

Although some of our concluding comments are based on one particular theory, the theory is not really what is important. There are lots of theories in this book; there are lots of different points of view. What is important is that we develop global citizens able to face the challenges of a complex, quickly changing world. Right now, we are failing in this challenge, glued as we are to standardized tests and the misguided accountability systems they serve. We can do better. Will we?

NOTE

[1] The term globalization signifies the massive socioeconomic, technological, and cultural integration of populations around the world (see Beneria, 2003; Goldin & Mariathasan, 2014; Rodrik, 2007; Sen, 2010; Stiglitz, 2003; Tsing, 2004). More details about the nature of globalization and the problems and opportunities it creates appear in the next chapter of this book.

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DON AMBROSE

2. TWENTY-FIRST CENTURY CONTEXTUAL INFLUENCES ON THE LIFE TRAJECTORIES OF CREATIVE YOUNG PEOPLE

This chapter represents an attempt to shed more light on the long-term development of the gifted, talented, and creative by placing that development in a large-scale context of 21st-century trends, which include *macroproblems* and *macro-opportunities*. Macroproblems are high-impact, global, long-term, transdisciplinary difficulties that threaten to harm or even devastate the lives of billions around the world (Ambrose, 2009a; Ambrose & Sternberg, 2012; also see Hunter, 1991). They are global because they span international boundaries and cannot be solved from within the borders of a single nation. They are long term because they derive from dogmatic thinking, neglect, and often corruption over years, decades, or even centuries and, consequently, will take long periods of time to solve. They are transdisciplinary because no single discipline encompasses sufficient expertise to address them fully so their solution will require collaboration across disciplines. Examples of macroproblems include climate change; looming resource shortages; the erosion of democracy; and severe inequality in a globalized socioeconomic system increasingly driven by dogmatic, market-fundamentalist ideology. In contrast, macro-opportunities are unprecedented circumstances that can lead to significant advances in well-being for billions of individuals and to ethically guided progress for societies. Examples include powerful new forms of scientific networking, innovative technologies, and the strengths of diverse minds when grouped together for complex problem solving.

This analysis emerges from an extensive, interdisciplinary search for theory and research pertaining to the discovery and development of aspirations and talents within influential socioeconomic, political, ideological, and cultural contexts. I draw from significant work in economics, political science, sociology, social epidemiology, ethical philosophy, history, complexity theory, the environmental sciences, psychology, creative studies, gifted education, and other disciplines to develop a metaphorical model representing the impact of 21st-century globalization on the development of societies, the evolution of education systems, and the life chances of individuals. After illustrating the structure and dynamics of two different versions of the model, I describe some of the most impactful 21st-century macroproblems and macro-opportunities and the demands they are making on our knowledge, skills, and dispositions.

CATCH A WAVE: A METAPHORICAL LANDSCAPE FOR THE
DEVELOPMENTAL TRAJECTORIES OF CIVILIZATIONS, EDUCATION
SYSTEMS, AND CREATIVELY INTELLIGENT INDIVIDUALS

The "catch a wave" model, which takes different forms in Figures 1 and 2, provides a metaphorical landscape illustrating the importance of rethinking education – especially gifted education – in rapidly evolving and challenging 21st-century socioeconomic, political, and cultural contexts. The two versions of the wave model represent two different levels of analysis – the societal level shown in Figure 1 and the level of the education system shown in Figure 2. The models provide frameworks for understanding large-scale contextual threats and opportunities, which are revealed by scholarship in a variety of disciplines. The structure and dynamics of each model portray the profound changes that have been taking place since the mid-20th century. Implications for gifted education, general education, and creative studies can be derived from the models because the knowledge, skills, and dispositions required decades ago no longer are sufficient for success in the 21st century.

Societal Context: Will Our Civilization Thrive or Collapse?

Figure 1 shows the societal level of analysis, portraying the success or failure of the globalized, Westernized, market-driven socioeconomic and cultural system that dominates most of the world in the 21st century. The depth dimension on the left side of the model signifies the passage of time from the early to mid-20th century on into the 21st century. The top surface of the model, moving from left to right, signifies a metaphorical landscape along which a society or civilization can advance through more or less effective economic, sociopolitical, and cultural policies and initiatives. The vertical dimension represents the achievement of societal success, conceived of here as the ability of a society to remain viable over the long term while lifting the vast majority of its citizens toward ethically guided self-fulfillment.

On the surface at the back of the model a straight arrow moving from left to right represents the trajectory of Western society in the early-mid 20th century. Despite a few intermittent stall outs (e.g., the Great Depression, WW II), our civilization at that time moved forward predictably on a linear path toward success; however, that success was somewhat limited, signified by moderate elevation as the culture progressed toward the right-rear sector of the model. In a century dominated by modernist ideology throughout most of the developed world (see Inglehart, 1997) success as a society primarily meant enabling entrepreneurial capitalists to build a level of prosperity (broadly shared in some nations, not in others) based on the extraction and refinement of natural resources. While resource shortages and environmental problems were emerging in that era they did not dominate and societal collapse was on the seemingly distant horizon. The noticeable but somewhat limited level of success in the back, right-hand sector of the model represents the way in which the dominant conceptions of societal and individual fulfillment were
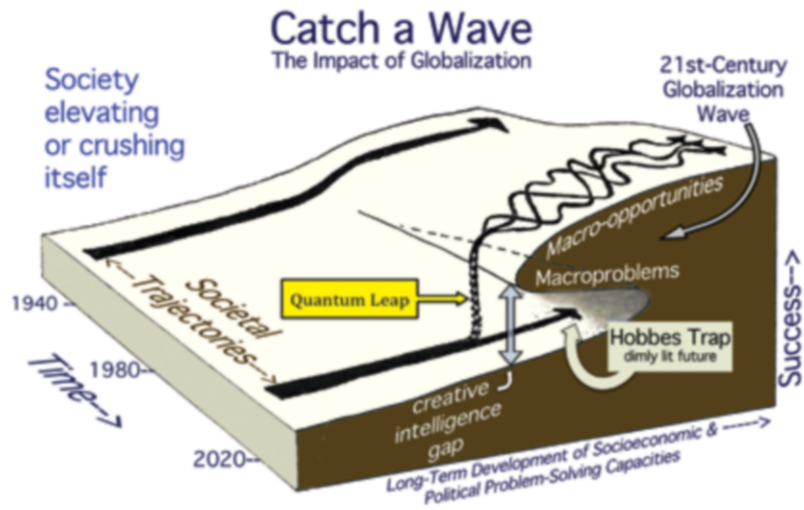
Figure 1. 21st-century model showing the impact of globalization on societies

confined to notions of materialistic gain. But success in 20th-century societies could have been more pronounced (higher on the model). According to the prominent ethical philosopher Alan Gewirth (1998), high-level human fulfillment requires the discovery of altruism-flavored aspirations and the concomitant discovery and refinement of capacities (i.e., talents) for development that goes far beyond materialistic-individualistic vainglory.

The wave on the right, front of the model represents the effects of globalization, which entails massive economic, technological, and cultural integration of populations around the world (see Beneria, 2003; Goldin & Mariathasan, 2014; Rodrik, 2007; Sen, 2010; Stiglitz, 2003; Tsing, 2004). Globalization brings with it large-scale problems and opportunities, which are deemed macroproblems and macro-opportunities because of their enormous impact (Ambrose, 2009a; Ambrose & Sternberg, 2012).

Macroproblems show up on the underside of the globalization wave signifying their colossal impact when they come crashing down on populations that are mired in a devastating, miserable place shown here as the *Hobbes trap* (a dimly lit future). Those unfortunate enough to find themselves stuck in that trap will endure lives that are *poor, nasty, brutish,* and *short,* to borrow words from the pessimistic, 17th-century philosopher Thomas Hobbes (1985/1651). This trap denotes a wretched, disaster-plagued collective existence featuring severe resource shortages, environmental destruction, economic collapse, widespread eruptions of warfare and genocide, and other disasters caused by the inability or unwillingness of a society's leaders to deal with pressing macroproblems and to capitalize on macro-opportunities. Societies

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can move blindly forward into the trap if they are too dogmatic and ill prepared to recognize and grapple with the demands of the 21st century.

Here is more detail about the dimly lit future in the Hobbes trap. Decades ago, a volume written by environmental scientists – *The Limits to Growth* (Meadows, Randers, Meadows, & Behrens, 1972) warned about the need for more attention to resource shortages and environmental stewardship. The authors outlined some possible future scenarios, some involving societal collapse. Later they published a follow-up report showing how considerable sustainability problems still persisted on the large scale (Meadows, Randers, & Meadows, 2004). More recently, investigators from various fields, most of them employing interdisciplinary analyses, have pointed toward the strong possibility of a major collapse of modern civilization in the 21st century, similar to the collapses that took place in prior civilizations such as those of the Romans, the Mayans of Central America, the Mauryan and Gupta Empires of ancient India, and the Khmer of Southeast Asia.

There is, however, a difference between today's situation and the conditions that provoked most of the earlier collapses. The worldwide socioeconomic integration brought about by globalization could make a societal collapse spread around the globe instead of staying localized as they did in the cases of most ancient civilizations. An early example of rapid, widespread collapse occurred when the well-integrated, thriving civilizations of the late Bronze Age rapidly broke down precisely because that integration provided a network for the spread of systemic problems (see Cline, 2014). But a 21st-century collapse could be much more widespread and occur much more rapidly due to the far more substantial economic and technological integration of today's globalization.

A word of caution is in order here. Societal critiques often come with warnings that the sky is falling. A prominent example was the Y2K frenzy that preceded the coming of the 21st century. Such warnings tend to come and go leaving us skeptical about future expressions of concern pertaining to macro-sociopolitical and economic phenomena. We should be wary of chicken-little warnings that emerge from within the borders of single disciplines, or from nebulous, intuitive impressions about macrophenomena. Nevertheless, this skepticism should not make us immune to warnings that emerge from triangulation of findings from credible researchers in multiple disciplines. The warnings about macroproblems and the possibility of widespread, societal collapse in the Hobbes trap discussed in this chapter emerge from some of this transdisciplinary triangulation.

For example, prominent thinkers making arguments about the possibility of massive, widespread, societal collapse include political scientists Thomas Homer-Dixon (2000, 2001, 2006) and Leslie Paul Thiele (2013); historians of science Naomi Oreskes and Erik Conway (2013); geographer Jared Diamond (1992, 2004); sociologist William Robinson (2014); physicist Michael Nielsen (2011); geo-ecologist Wolfgang Lucht (2010); anthropologist Joseph Tainter (1988); environmental scientist Vaclav Smil (2008); environmental studies scholar David Orr (2012); archaeologist Harvey Weiss and geoscientist Raymond Bradley

(Weiss & Bradley, 2014); philosopher Bruce Edmonds (2015); business-management scholar Jorgen Randers (2012); systems scientist Safa Motesharrei, political scientist Jorge Rivas, and environmental scientist Eugenia Kalnay (Motesharrei, Rivas, & Kalnay, 2014); and biologists Paul and Ann Ehrlich (2013). While holding out some hope that we might avoid large-scale collapse through unprecedented, collaborative creative problem-solving they point out the likelihood that we will not be able to overcome the gap between our current cognitive abilities, in a collective sense, and the enormous problems we face. Homer-Dixon (2000) termed this the *ingenuity gap,* arguing that a civilization like ours facing huge resource shortages and environmental devastation will need unprecedented levels and forms of ingenuity to avoid *synchronous failure* – the simultaneous disintegration and implosion of life-sustaining systems on a very large scale. Synchronous failure in collapsing societies usually leads to widespread, violence-saturated anarchy. Nielsen and Diamond made similar arguments about the mismatch between collapsing societies' cognitive abilities and the enormous problems they confront.

In order to connect this analysis with research in creative studies and gifted education I use the term *creative intelligence gap* to stand for Homer-Dixon's notion of the ingenuity gap. The creative intelligence gap shows up on the model as the daunting space between the lower surface, where a society is poised to wander ahead blindly and dogmatically into the dimly lit future of the Hobbes trap, and the much higher, optimism-generating surface on top of the globalization wave.

In stark contrast, and fortunately for us, the macro-opportunities show up on the top of the wave because they promise to lift populations that are well prepared for the 21st century to a very high level of success. A society that is well aware of 21st-century problems and opportunities and generates the ethically guided creative and critical thought capacities necessary for addressing those problems and opportunities will be able to make the quantum leap to the crest of the wave and follow an exciting, unpredictable developmental path. The unpredictability is signified on the model by the multiple, interweaving arrows on the top of the wave.

The quantum leap on the model plays a gatekeeping role for a society aspiring to success in the 21st century. It represents a society's discontinuous jump from the lower level to the top of the wave. This jump is based on an analogous phenomenon in theoretical physics in which a subatomic particle instantaneously moves from one energy level to another with no apparent "in between" transition status (see d'Espagnat, 2006; Omnès, 1999). Similarly but on a much larger scale, a society aspiring to reach the top of the globalization wave must make a discontinuous leap in terms of its collective creative and critical thought processes and problem-solving actions. The analogy of *discontinuity* applies here because *continuing* past practices, for example, following established thought paradigms and socioeconomic and cultural procedures, which often are habit bound and saturated with dogmatism (see Ambrose, 2012a, 2012b), will be insufficient at best and devastatingly counterproductive at worst.

In order to understand the need for the quantum leap to the crest of the globalization wave we must analyze some examples of the macroproblems and macro-opportunities that make up the underside and topside of the wave. The examples listed in the subsections below are potentially high-impact, or already so; however, different or additional examples could have been included. I encourage readers to suggest others.

Examples of Macro-Opportunities

Exponential knowledge growth. Advancements in information technology and scientific networking are spurring knowledge growth in many academic disciplines and professional fields, some of which feature enormous additions to their knowledge bases (see Arbesman, 2012; Motta, 2013; Zander & Mosterman, 2014). It will tax our collective minds to master and use all of this knowledge; however, rapidly expanding knowledge bases in many fields present us with a macro-opportunity–arming us with unprecedented volumes of scientific and technical knowledge as well as better understanding of the human condition. This expanded knowledge provides raw material that gives us the potential for strengthening our creative intelligence. In turn, if we are sufficiently wise we can apply the enhanced cognitive skills to the solution of our most pressing macroproblems.

Cognitive diversity. Subra Suresh (2013, October), former director of the National Science Foundation and chair of the Global Research Council, argues that international, transdisciplinary collaboration among scientists is becoming the new norm in scientific work, largely because innovation accelerates when research teams include diverse ideas and perspectives. Along similar lines, in a large-scale analysis of group problem-solving outcomes in a wide variety of organizational contexts, economist and complexity theorist Scott Page (2007, 2010) revealed that cognitive diversity provides significant advantages when it comes to grappling with complex problems (also see West & Dellana, 2009). A cognitively diverse problem-solving team encompasses diverse theories, and/or problem-solving heuristics, and/or belief systems.

For example, such a team might include individuals trained in counseling psychology, economics, biology, engineering, philosophy, and the visual arts. One individual on this team might have expertise in quantitative-empirical research methods while another might be a natural ethnographer. Yet another individual might be a strong group facilitator. Some members of the team might adhere to liberal-progressive ideology while others might be more conservative. In contrast, another team might consist of intelligent, highly skilled individuals but all of them are economists who adhere to the rational-actor theory of the individual, possess the same highly refined quantitative model building skills, and strongly believe in laissez-faire, neoliberal ideology.

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Now assume that both teams are trying to solve the same problem. Even if the cognitively diverse group possesses less intelligence, collectively speaking, than the homogenous group of economists its cognitive diversity makes it likely to outperform those economists as long as the problem is complex and not solely about economics. Of course, a cognitively diverse, highly intelligent team will perform even better. Interestingly, cognitive diversity turns into a disadvantage when it comes to simple, algorithmic problems.

Given the increasing complexity of problems in the 21st century, cognitive diversity is important now and will become even more essential in the years to come. In addition, it is becoming more feasible because 21st-century networking technology enables clusters of diverse minds to come together much more easily than they could in the past. As Page (2007, 2010) noted, we can think of cognitive diversity as a key attribute for group effectiveness. In addition, we can think of it as an important attribute of *individual* minds. An individual who is able to build a personal problem-solving toolbox, which includes diverse theories, disciplinary perspectives, methodological tools, and belief systems, will benefit from cognitive eclecticism in a world that demands the intellectual flexibility of cognitive diversity.

Unprecedented scientific and artistic networking. Nielsen (2011) described the inception of highly effective, unpredictably emergent online collaborative projects that have led to solutions for previously unsolvable mathematical and scientific problems. For example, in the polymath project an eminent mathematician was making little headway in an attempt to solve a very difficult mathematical problem that always had stymied great mathematical minds. After posting what he had done online and inviting suggestions for next steps, ideas began to flow in from very diverse mathematical thinkers from around the globe. Some who contributed useful pieces to this complex puzzle were other leading mathematicians but many of the contributors were much less distinguished. In a short period of time the problem was solved.

While the solution to the problem was inaccessible to a single mathematical genius or even to a collaborative team of genius mathematicians, the unpredictable, organic-emergent intermixing of many pieces of *microexpertise* turned out to be the key. The term microexpertise signifies bits of knowledge and skill that are distributed throughout a population. While an eminent expert in a domain has mastered an impressive array of knowledge and skill, that expert simply cannot possess all of the relevant puzzle pieces when it comes to today's increasingly complex problems, even when those problems are domain specific. Consequently, she/he cannot match the collective mass of microexpertise bits possessed by hundreds or thousands of individuals around the globe even though none of those individuals could match the eminent expert in a one-on-one intellectual contest in that domain. The notion that "none of us is as smart as all of us" actually is true when it comes to this kind of networked problem solving.

Some other examples of the phenomenon come from the galaxy zoo project; a competition between the world's greatest chess player and the unpredictably emergent teamwork of many lesser players around the world; the spontaneous global networking of contributors to an open architecture project for the design of innovative buildings in the third world; and an open-source, game-based process that enables skillful visual thinkers to invent new proteins for attacking diseases. In the galaxy zoo project, for instance, astronomers realized that they couldn't possibly analyze all of the data coming in from powerful new telescopes so they decided to build a website and invite outsiders to look for patterns in space. The results have included highly productive discoveries of new types of galaxies and other space-based phenomena. Nielsen went so far as to suggest that these emergent, online collaborations very well could represent the beginning of the next scientific revolution.

Similar, unpredictably emergent, online collaborations are coming forth in other dimensions of human experience. For example, in the arts, composer-conductor Eric Whitacre has been pulling together emergent, highly proficient and creative virtual choirs from around the world (see Webb, 2010).

Example of a Macroproblem/Macro-Opportunity Hybrid

Runaway technology.   While electronic networking is advancing, so are other forms of technology. Rapid advances in digital technologies are promoting unprecedented levels of economic productivity and creating seemingly boundless opportunities for innovations in a variety of industries (Brynjolfsson & McAffee, 2014). Developments in materials science, including nanotechnology, the science of engineering matter at very small molecular and atomic levels (Interrante & Chandross, 2014; Khan, 2012), and biotechnology, the science of re-engineering life itself (Carlson, 2010; Harris, 2007; Rose, 2006), are accelerating rapidly. Technological systems for generating and exploiting green energy are improving and have the potential to replace dirty energy sources such as coal and oil (Prentiss, 2015). They also could provide strong opportunities for job creation while reining in environmental destruction and climate change (Gallagher, 2014). Among other purposes, advances in materials science such as nanotechnology innovations could revolutionize our development and use of materials for construction and engineering, giving us opportunities to make stronger, lighter vehicles, machines, and buildings with smaller carbon emission costs. Biotechnology could solve some of our most difficult medical and food-shortage problems. The emerging science of synthetic biology is especially promising because it provides the potential for transforming our material world (see Bonnet & Subsoontorn, 2012; Bonnet, Yin, Ortiz, Subsoontorn, & Endy, 2013; Kahl & Endy, 2013). Just one example of many possible applications is the production of new, exceptionally strong and biodegradable building materials.

Nevertheless, unpredictable events occur in complex systems (Jervis, 1997; Miller & Page, 2007; Page, 2010; Thompson, 2007) and unexpected, harmful effects

from runaway technology always loom on the horizon (Ravetz, 2010; Tonn & Stiefel, 2012). For example, the unprecedented prosperity generated by the digital revolution, termed the *second machine age* by Brynjolfsson and McAffee (2014), is flowing into the hands of a few while the wages of the many are stagnating and unemployment is growing. These harmful effects can derive from accidental misuse of new technology, unanticipated implications of the application of new technology, or unethical, exploitative applications by bright but unscrupulous individuals and groups.

Farther out on the time horizon a more devastating problem might arise from unpredictable developments in artificial intelligence. According to Bostrom (2014), humanity lacks sufficient long-range vision to guide the development of potentially powerful artificial intelligence innovations toward the betterment of future lives. Instead, short-range profit seeking drives artificial intelligence developments and future advances in this area could spin out of control as increasingly clever artificial minds, unguided by ethics, outpace the development of our own cognition. Consequently, rapid advances in new technologies potentially represent both macro-opportunities and macroproblems.

Examples of Macroproblems

Resource depletion.   The BP oil disaster in the Gulf of Mexico foreshadowed another pressing macroproblem – a looming shortage of resources such as hydrocarbons, minerals, fresh water, and arable land (see Daly & Farley, 2010; Friedrichs, 2013; Klare, 2012; Prior, Giurco, Mudd, Mason, & Behrisch, 2012; Rockström et al., 2014). Klare (2012) illustrated ways in which these shortages are encouraging extraction industries to take ever-bigger risks such as deep-water drilling and mining in dangerous regions because easily accessible resources are disappearing quickly. In the case of oil and gas extraction, the shortages are encouraging a frenzied chase for "unconventional hydrocarbons" such as those found in the tar sands of Western Canada and the difficult-to-release natural gas deposits that are being accessed through hydraulic fracturing. These extractive processes are far more damaging to the environment than conventional oil and natural gas extraction, and those processes were dirty enough. Consequently, the energy industry is causing far more devastating environmental damage than ever before, and this damage includes the rapid acceleration of climate change (see the next macroproblem).

The potential for dangerous international conflicts over territory and resources also is rising due to the shortages. For example, nations are saber rattling and building up their military capacities in anticipation of conflicts over oil and gas resources in Southeast Asian waters and in the Arctic Ocean, which is being made more accessible to drilling due to climate change. In addition, wealthy nations such as Saudi Arabia and the United Arab Emirates are buying up enormous tracts of arable land in third-world countries in order to ensure their own food supplies at the expense of the impoverished populations in those nations. International tensions are

rising over this practice. In the long run, we must either use our ingenuity to come up with replacements for some of these resources or pay gargantuan ethical and economic prices for them in the future. Klare (2012) terms this macroproblem the *race for what's left.*

Environmental devastation and climate change. Insufficiently regulated, globalized capitalism coupled with population growth has been aggravating one of our longest running macroproblems – environmental pollution. Climate change likely is the worst manifestation of this problem and, in and of itself, possibly represents our second-most-dangerous macroproblem because it threatens the viability of life on earth as we know it (see Archer, 2009; Duménil & Lévy, 2013; Flannery, 2006; Friedrichs, 2013; Nordhaus, 2013; Pellow, 2002; Sherwood & Huber, 2010; Verchick, 2010). Even now, climate change is magnifying the power and frequency of high-impact storms worldwide, causing severe heat waves and desertification of large tracts of land, precipitating mass extinctions in the biosphere, establishing conditions favorable to widespread epidemics, and setting the stage for huge, disastrous mass movements of environmental refugees around the world.

Distortions of globally networked capitalism, and severe inequality. The trend toward economic globalization over the last several decades has freed up entrepreneurial enterprises while tying the hands of regulators who are charged with protecting the interests of national and regional populations from exploitative economic practices. The exploitation includes rapacious raiding of natural resources and race-to-the-bottom outsourcing of previously secure first-world jobs to deplorable third-world sweatshops. The result has been a morphing of somewhat beneficial capitalism into a distorted system of exploitative global economic domination (see Ambrose, 2011, 2012; Applebaum, 2005; Arvidsson & Peitersen, 2013; Block & Somers, 2014; Brown & Jacobs, 2008; Blyth, 2013; Chang, 2007; Christensen, 2011; Daly & Farley, 2010; Garrett, 2014; Gilman, 2015; Harvey, 2006, 2007, 2010; Kotz, 2015; Kasser, Cohn, Kanner, & Ryan, 2007; Kuttner, 2013; Pasquale, 2015; Piketty, 2014; Posner, 2009; Robinson, 2014; Sachs, 2011; Santoro & Strauss, 2012; Sassen, 2014; Stiglitz, 2010, 2012, 2015; Zucman, 2015). This domination has led to a pervasive form of *slow violence* – a form of long-term attrition destroying the life support systems of billions throughout the world (see Nixon, 2013).

The exacerbation of already serious economic inequality within and between nations (Piketty, 2014; Stiglitz, 2012, 2015; Wilkinson & Picket, 2009) is an enormous, spinoff macroproblem deriving from these distortions of capitalism, which ironically emerged as a system for freeing the masses from exploitation under the thumb of European aristocracies in centuries past and was not intended to serve unfettered greed, individualistic vainglory, and the feathering of privileged nests (see Fleischacker, 2004; Muller, 1995; Sen, 2010). If the trend toward even more severe inequality continues, humanity faces a highly unethical divide between a small number of immensely powerful, selfish plutocrats and the vast majority of

miserable, exploited, and denigrated citizens whose insecure, impoverished lives are poor, nasty, brutish, and short, to borrow descriptors again from the 17th-century philosopher Thomas Hobbes (1985/1651). The division of populations into exploitative elites and exploited commoners has been a primary reason for societal collapses throughout history (Motesharrei, Rivas, & Kalnay, 2014) so the severe inequality macroproblem is particularly worrisome.

Democratic growth and erosion.   Democracy is not an either-or political condition. Instead, it is a complex political system characterized by shades of gray ranging anywhere from vibrant, participatory governance systems to near totalitarianism (see Ackerman, 2010; Ambrose, 2005; Gutmann, 2003; Hacker & Pierson, 2005, 2010; Harvey, 2006; Hasen, 2015; Roberts, 2010; Ringen, 2007; Wolin, 2008; Yamin & Ambrose, 2012). Some nations are more democratic than others and no perfect democracy has existed yet on earth, at least not on a national scale. Interestingly, democracy has been expanding around the world (United Nations, 2002), spreading into third-world nations at the same time that it has been eroding in many developed nations (see Gilman, 2015; Kurlantzick, 2013).

A democratic government tends to erode when the population of a nation polarizes ideologically and then one side comes to dominate the system (Bermeo, 2003; Gutmann & Thompson, 1996). Most often, this manifests in the form of extreme left-wing ideology (e.g., the Pol Pot regime of Cambodia, the Stalinist Soviet Union) or extreme right-wing ideology (e.g., the Pinochet regime in Chile, Nazi Germany).

In a particularly worrisome example of democratic erosion, leading political scientists have shown that the United States has been going through this polarization process and has been shifting toward right-wing extremism over the last several decades (see Hacker & Pierson, 2005, 2010; Wolin, 2004, 2008). Disturbing consequences include mass deception of the citizenry and the erosion of civil liberties. When a democracy erodes, the political and economic levers of the nation are commandeered by unscrupulous, dogmatic elites, and the media is manipulated to spread propaganda in order to keep the populace ignorant and compliant. Evidence of democratic erosion in the United States comes from the dominant influence of plutocratic money in the political system through the power of lobbying and the ways in which the shortsighted, ideologically tainted Supreme Court *Citizens United* and *McCutcheon v. Federal Election Commission* decisions enormously magnified the influence of money in politics (see Gilman, 2015; Hacker & Pierson, 2010; Teachout, 2014).

Additional evidence comes from the replacement of objective, investigative journalism, which is designed to seek out and shed light on corruption, with industrial journalism, which tends to ignore or hide corruption. When the media is dominated by industrial journalism, arguments between entertaining but vacuous talking heads provide superficial, distorted, biased messages about what's going on in the world and the public lacks the knowledge necessary for participation in the democratic process (Belsey, 1998; also see Starkman, 2014). In view of its recent

acceleration, democratic erosion in developed nations, especially in the United States, is becoming another serious macroproblem because the short-term wants of a few plutocrats (e.g., oil barons, inheritors of immense fortunes, financial industry insiders) trump the needs and rights of the vast majority. Note that the effects of this macroproblem correspond with the effects of the severe inequality macroproblem because the political and economic systems in the developed world are so closely intertwined. Consequently, these two macroproblems mutually reinforce.

Dangerous dogmatism. Shortsighted, narrow-minded, superficial, dogmatic thinking might be our most serious macroproblem because it is pervasive and causes most of our other macroproblems. Dogmatism is a major contributor to everything from creativity killing school-reform initiatives; to misconceptions about creativity and giftedness; to reckless, enormously damaging economic policy; to foolhardy military aggression; to ethnic conflict; even to the extremes of genocide (see Ambrose, 2009a; Ambrose & Cross, 2009; Ambrose & Sternberg, 2012; Ambrose, Sternberg, & Sriraman, 2012; Granik, 2013). Interestingly, gifted and creative individuals are not immune to dogmatism (Elder & Paul, 2012). Understanding and successfully grappling with the human penchant for dogmatic thought and action is a necessary step toward solving most of our other unrelenting macroproblems.

Taken together, the enormity and pressing nature of these macro-opportunities and macroproblems will demand more creative intelligence than humanity has ever been able to muster. An education that can help young people overcome the creative intelligence gap and make the quantum leap to the crest of the wave in the 21st-century model in Figure 1 will aim at the development of a very different, more complex set of abilities than those provided by the 3R's education of the not so distant past.

<div align="center">

EDUCATION SYSTEMS: A BIG-PICTURE ANALYSIS THROUGH THE
LENS OF THE CATCH A WAVE MODEL

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As mentioned earlier, the catch a wave model applies at multiple levels of analysis. Now that I have used Figure 1 to consider 21st-century trends and issues at the panoramic, societal level I narrow the scope somewhat to analyze ways in which education systems are evolving within the context of 21st-century globalization.

In Figure 2, the dark, left-to-right trajectory arrows on the surface represent the attempts educators and educational leaders make over the long term to create educational philosophy, curriculum, and instruction that will enable students to aspire, achieve, and ultimately succeed in their adult lives. The vertical dimension represents the extent to which this work actually does lead to authentic, long-term student success as opposed to superficial, short-term success signified by shaking out inauthentic grades.

On the surface at the back of the model the straight arrow moving from left to right now represents the trajectory of an education system in the early to
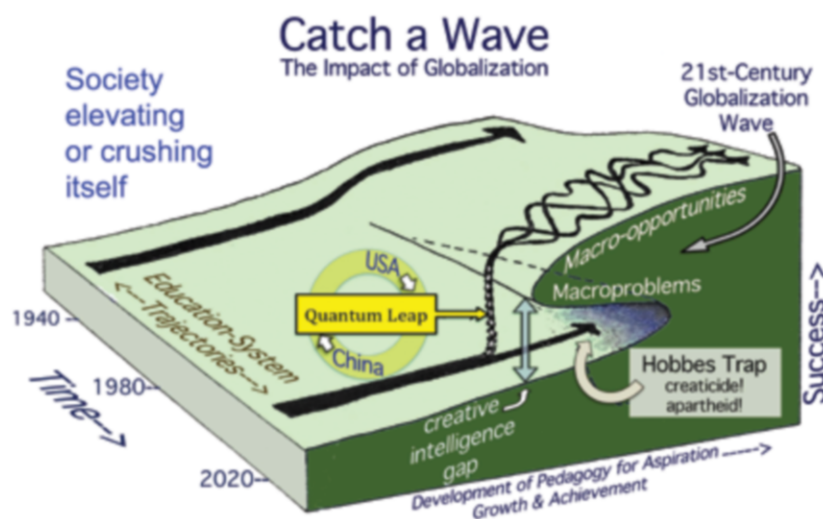
Figure 2. 21st-century model showing the impact of globalization on education systems

mid-20th century. In that era, educational success was considered to be the result of pedagogy that could provide basic, domain-specific knowledge and skills; consequently, success represented by the elevation in the back corner of the model was moderate, if it was achieved. It was moderate because it was missing some important elements, which will become clear later in this analysis.

The dark, left-to-right trajectory arrow on the near-side surface of the model represents the trajectory of an education system in the 21st century. If the philosophy, curriculum, and instruction of the education system does not match 21st-century demands it will push millions of students into the Hobbes trap where they ultimately will be crushed by the macroproblems on the underside of the globalization wave. If instead the education system matches 21st-century demands it could provide millions of students with the discontinuous, quantum leap to the crest of the globalization wave where they will be able to capitalize on the unprecedented macro-opportunities.

Using the American education system as an example, the Hobbes trap generates *creaticide* and *apartheid* that derive from current pressures to push American education back toward alignment with the worst forms of 19th-century pedagogy. For example, David Berliner (2012) coined the term *creaticide* to stand for the systematic killing of creativity in the American education system. The murder of creativity comes from dogmatic adherence to accountability initiatives driven by widespread, high-stakes measurement of superficial, narrow abilities through standardized testing. The term "apartheid" appears on the model because it signifies the pressure that influential but dogmatic, ignorant, and unscrupulous profit-seeking educational reformers are putting on school systems to impose more high-stakes

testing, quasi-militaristic discipline, and barren, robotic instructional methods throughout the schools while cleansing them of higher-order thinking (see Berliner, 2009, 2011, 2012; Berliner & Glass, 2014; Fabricant & Fine, 2013; Horn & Wilburn, 2013; Kozol, 2005; Lubienski & Lubienski, 2014; Nussbaum, 2010; Ravitch, 2010, 2013). This situation magnifies educational apartheid because school systems run along these lines suppress the life chances of the deprived while the privileged enjoy elite school experiences unencumbered by accountability mania (for more on the magnification of privilege through exclusive educational opportunities for elites see Khan, 2010). Young people forced into this trap will have little to no chance of overcoming the enormous creative intelligence gap (represented by the vertical double arrow) and making the quantum leap to the crest of the globalization wave.

Notice that the quantum leap on this version of the model has some symbolism indicating an ironic race between the world's two most powerful nations. A circle on the model shows the USA near the top but moving downward and China near the bottom but moving upward. Recently, several leading thinkers in general education, gifted education, and creative studies have discussed, independently, the problem of the USA dropping in terms of emphasis on creativity and some of them have portrayed China, which is notoriously noncreative in its education system, as desperately trying to become more creative. For example, Yong Zhao (2009, 2013, 2014) argued that China is trying to revamp its excessively mechanistic, noncreative, accountability driven model and align it more with the creative, constructivist, student-centered approach found in many American classrooms. Similarly, Kyung Hee Kim (2011) suggested that American infatuation with standardized testing is de-emphasizing creative thinking while Asian school systems are attempting to replicate the American system due to its past success with creative learning. David Dai (personal communication, November 15, 2012) has taken on a project to translate scholarly books on creativity into Chinese because leaders in the Chinese system want it to become more creative. Further illustrating the irony of the circle on the model in Figure 2, Jonathan Plucker was cited in "The creativity crisis" (2010), a *Newsweek* article in which he relayed the bemusement of Chinese colleagues who said "you're racing toward our model. But we are racing toward your model, as fast as we can" after he told them about American reform initiatives and accountability systems.

In essence, the societal catch a wave model in Figure 1 and the model in Figure 2 showing the challenges of the 21st century for education systems reveal some extremely high-stakes concerns for citizens, policymakers, educators, and the children they serve and mentor. The perilous Hobbes trap, featuring a dimly lit future in the societal model and creaticide/apartheid in the educational model, becomes something even more pernicious when it is applied to the future lives of today's children. If our societal leaders are unwise, dogmatic, and unscrupulous they will deny educational leaders and teachers opportunities to create an education system capable of lifting millions of children up toward to the macro-opportunities on the top of the globalization wave. Instead, it will force educators to operate fearfully in barren, hyper-mechanistic, quasi-militaristic, 19th-century ways and millions of

children will be pushed forward into the dingy, dangerous, oppressive region under the macroproblems on the underside of the globalization wave. Here, their lives will be poor, nasty, brutish, and short while they are being crushed inexorably by those macroproblems.

In the Hobbes trap they will suffer from unrelenting insecurity and severe economic deprivation deriving from reliance on increasingly rare and far more expensive natural resources as well as the destitution that comes from exploitation of the vast majority by a few extremely powerful, selfish, unethical plutocrats who monopolize the levers of an increasingly distorted form of hegemonic, globalized capitalism. They will suffer from human-rights abuses that ensue from the erosion of democracy, the aforementioned economic exploitation, and the escalations of mass conflict that occur when populations face severe, unprecedented environmental stressors. In addition, they likely will face as yet unimagined difficulties that will come from the unpredictable negative effects of runaway technology.

Should they escape the Hobbes trap and make the quantum leap, today's children, tomorrow's adults, will have opportunities to sample a profusion of enormously appealing prospects heretofore undreamt. This especially will be the case for the gifted and creative. They will be able to contribute to, and benefit from, numerous, rapid leaps forward in scientific innovation and knowledge, which will emerge from the meshing of micro-expertise through networked, interdisciplinary science. They will find creative, ethical new ways to make the powerful, innovative capacities of globalized capitalism work for the good of the vast majority instead of for the benefit of a selfish, vainglorious, hyper-materialistic, well-positioned few. They will come up with ways to solve our current resource shortages while creating a new era of environmentally friendly abundance. Most importantly, they will diminish violence and greed by capitalizing on cognitive diversity, developing their creative intelligence, and dismantling the dogmatism that plagues so many in so many ways.

TWENTY-FIRST CENTURY KNOWLEDGE, SKILLS, AND DISPOSITIONS

The high-impact globalization wave shown in the catch a wave model in Figure 2 requires more than rote learning of easily measured knowledge and skills. Such an education may have sufficed in the early to mid-20th century, as shown by the linear life trajectory arrow in that region of the model. But the quantum leap to the crest of the wave will require an extensive range of other abilities, which are outlined in the list to follow. We could argue that only the gifted few with leadership potential need to master the daunting list of proficiencies in this list. Moreover, we could claim that these gifted individuals need not address the entire range of proficiencies. Instead, they could specialize and count on widespread collaboration among specialists to solve macroproblems and capitalize on macro-opportunities. Such an argument makes some sense because it would be extremely difficult for anyone to master all of the proficiencies. However, the majority of citizens, designated gifted or not, will

need to develop some understanding of 21st-century challenges and opportunities while developing some level of expertise with these proficiencies because today's enormous challenges require at least some participation of citizens en masse and the generation of the political will necessary for tackling unprecedented macroproblems and capitalizing on unprecedented macro-opportunities. We need widespread citizen awareness and support for the work of experts in the various domains relevant to each macroproblem and macro-opportunity.

The following is an extensive, and likely incomplete, list of knowledge, skills, and dispositions that might give us a chance to make the quantum leap to the crest of the globalization wave while avoiding the Hobbes trap. Elements in the list were inspired by a helpful analysis of 21st-century skills provided by Dede (2010) while some other elements came directly from prior interdisciplinary explorations of contextual pressures in today's world (e.g., Ambrose, 2009). In the descriptions below, the selected aspects of knowledge, skills, and dispositions were connected with and adapted to the macroproblems and macro-opportunities described earlier in this chapter.

Broad and Deep Proficiency in the Subject Areas

Due to the complex, transdisciplinary nature of today's macroproblems and macro-opportunities education must be comprehensive, addressing diverse concepts in multiple disciplines. Contrary to the direction imposed by major school-reform initiatives; which narrow and fragment the curriculum, forcing it to address easily measured, superficial knowledge and skill in literacy and mathematics (see Berliner, 2006, 2009, 2011, 2012; Berliner & Glass, 2014; Nichols & Berliner, 2007; Ravitch, 2010, 2013; Zhao, 2009, 2012); today's students need deep-level cognitive and affective immersion in a variety of subject areas including literacy, the arts, mathematics, the sciences, world languages, history and governance, and geography. "Deep level" means grappling with interesting problems in the subjects and mastering key concepts instead of just learning superficial facts and basic mechanics for standardized testing.

Creative Thinking Skills and Inquiry-Based Dispositions

Given the unpredictable, evolving conditions of the 21st-century globalized context, today's students must learn to generate insightful ideas, adapt, innovate, and problem solve when confronted with uncertain, nebulous, threatening technical, socioeconomic, and cultural circumstances (see Sternberg, 2009a, 2012). "Inquiry-based" dispositions entail the development of keen interest in digging into the core of puzzling situations and interesting phenomena. These skills and dispositions may be particularly important when it comes to the development of gifted young people (see Renzulli, 2012).

Critical Thinking Skills and Dispositions

The most effective thinkers find ways to generate both creative and critical thought. The latter requires nuanced judgment (see Elder & Paul, 2012; Paul & Elder, 2002; Resnick, 1987), which allows an individual to perceive shades of gray in complex 21st-century issues instead of falling prey to dogmatic, polarized, either-or thinking. The ability to critically pick out important patterns in complex, messy data is another crucial element of critical thinking in today's world. These abilities will enable citizens and leaders to (a) select and refine the most promising creative ideas while problem solving and adapting, and (b) recognize and deal with macroproblems, ethical dilemmas, and dogmatism.

Interdisciplinary Thinking

As mentioned earlier, the ever-more-complex macroproblems of the 21st century cannot be solved from within the confines of insular disciplines (Ambrose, 2009a). For example, one of our largest and most pressing macroproblems – climate change – will require natural scientists, social scientists, policymakers, and a *strong critical mass of citizens* to understand ways in which theory and research from climate science, economics, political science, ethical philosophy, and other disciplines must interweave to create a coherent strategy for grappling with this enormous issue, which threatens our very survival as a species.

   More specifically, ideas from economics alone can tell us how to operate more efficiently as economic actors but the dominant conceptual frameworks of that field obscure the cost of externalities, which are hidden production and environmental costs shifted from corporations onto the shoulders of innocent bystanders (Ambrose, 2011, 2012; Green, 2009; Stiglitz, 2010). Confining our thinking to economics allows a few big players in the energy extraction industry to exploit petrochemical resources while ignoring and externalizing the cost of environmental damage, thereby pushing that severe cost onto the rest of humanity. Insights from political science can reveal ways in which exploitative, anti-democratic forces deceive the general public into supporting policies antithetical to their personal interests and the long-term interests of humanity. Ethical philosophers can reveal additional nuances and implications of this deception.

Visual-Spatial Literacy

Those with strong visual-spatial thinking ability are capable of creating and interpreting conceptual models representing complex systems and issues. They can generate and understand intricate, graphic models incorporating large amounts of data from multiple sources. Visual-spatial ability always has been important for work in the STEM (science, technology, engineering, and mathematics) arenas

(see O'Boyle, 2008; Rocke, 2010; Root-Bernstein et al., 2008; Root-Bernstein & Root-Bernstein, 2013; West, 2009). The 21st century is demanding more STEM expertise (see Subotnik, Olszewski-Kubilius, & Worrell, 2012). Moreover, the STEM professions are requiring more visual-spatial talent than ever before because they rely more heavily on computer technology with ever more sophisticated analytic and synthesizing graphics.

Imagine yourself propelled back in a time machine to the late 1970s or early 1980s to view the operation of computer systems of that era. You would see small, black monitors with horizontal rows of amber or green symbols – and absolutely no graphics. Such an environment favored logical, linear-sequential, symbolic thinking and made little room for visual-spatial talent. Now travel forward into today's high-tech organizations where you come across high-powered computer systems with enormous, high-resolution monitors showing highly complex, periodically morphing 2-D and 3-D visual models that synthesize enormous amounts of complex symbolic data. Highly skilled visual-spatial thinkers are at a premium in these STEM environments.

Visual models also can be used to synthesize theory and research from multiple disciplines to shed light on complex issues that require transdisciplinary syntheses. An example is a two-dimensional graphic synthesizing scholarship from political science, economics, journalism, history, ethical philosophy, creative studies and gifted education to clarify the dynamics and effects of democratic erosion in various national contexts (Ambrose, 2005; Yamin & Ambrose, 2012). Another example is a three-dimensional graphic-metaphorical earthen landscape within an imaginary glass cube several thousand miles on a side (see Ambrose, 2009b). The model synthesizes scholarship from ethical philosophy, political science, economics, primatology, history, creative studies and gifted education to clarify the ethical dimensions of high ability.

Without the development of visual-spatial talent we will be wandering blind, at least to some extent, in the midst of highly complex macroproblems and macro-opportunities that demand graphic conceptual syntheses. Those with considerable visual-spatial talent will find themselves well suited to these complex, cognitive demands. Moreover, those lacking visual-spatial talent also will be well served if they experience an education that enables them to appreciate and understand visual-spatial conceptual models and syntheses to the extent possible.

Information-Technology Skills

The aforementioned high-powered computer systems in STEM labs are only the tip of the technology iceberg in the 21st century. Computerized technology is ubiquitous in virtually all dimensions of our lives from the business world, to education, to healthcare, to environmental stewardship, and beyond (Kaku, 2011; Levy, 2010; Zhao, 2012). Today's students and citizens must be able to function in a complex, technological environment and to keep abreast of rapid changes in technological

systems and infrastructures. If successful, some of them will function as highly innovative technologists and virtually all of them will function as knowledgeable consumers of information technology. Ideally, most also will function as citizens who influence policy decisions about the ways in which new technologies are used in our societies.

Financial, Business, Economic, and Entrepreneurial Acumen

While the early to mid 20th century provided a relatively stable, predictable work environment, the 21st century is anything but stable. Corporate globalization has created a rapidly shifting, unpredictable economic system in which money and information instantaneously pass through porous international borders, regional business regulations are weak and transitory, work is outsourced to third-world sweatshops, and entrepreneurial opportunities appear and disappear at breakneck speed (Turner, 2011; Xiang, 2007). In such an environment, today's young people must become financially savvy and entrepreneurial about their own long-term career trajectories.

For example, according to Xiang the globalized information technology industry engages in the practice of "body shopping," which entails hiring information technology workers from anywhere in the world and farming them out to do piecework projects, also anywhere in the world. When a project is completed these workers are "benched" without significant income or benefits until the next project comes along. In such conditions of insecurity and unpredictability the only way to survive and possibly thrive is to develop one's talents to the maximum and then market those talents as one would an entrepreneurial startup firm.

Intrapersonal Self-Discovery and a Sense of Purpose

Closely related to the need for viewing one's own talent development in entrepreneurial terms is the wisdom of magnifying one's own intrapersonal insight and a sense of direction. Gardner (1983, 2006) highlighted the importance of intrapersonal intelligence, which entails the ability to recognize and assess our strengths, weaknesses, talents, and interests, and to use these discoveries to develop adaptive but purposeful self-direction. Gruber (1989) also emphasized the ways in which highly creative people establish purposeful self-direction throughout the lifetime. Renzulli (2012) described a set of co-cognitive factors that enable individuals to develop commitment and purpose. Among other elements, these factors include sensitivity to human concerns, optimism, courage, a sense of destiny and the notion that one has the power to initiate needed changes. The Roeper School in Bloomfield Hills Michigan provides a particularly successful example of an institution that enables gifted young people to develop Gardner's intrapersonal intelligence; to engender Gruber's purposeful, lifelong, creative self-direction; and to generate Renzulli's co-cognitive factors (see Ambrose, Sriraman, & Cross, 2013).

In view of the highly complex, ever-shifting conditions of the globalized 21st-century, intrapersonal self-discovery and long-term purposeful self-direction appear to be more important than ever before. Those who can discover their passions and maximally develop strong, innate talents related to those passions, and then look for opportunities to apply these abilities to promising niches in a turbulent world will maximize their chances of surviving and thriving.

Cognitive Diversity

Cognitive diversity (Page, 2007, 2010), one of the macro-opportunities discussed in an earlier section of this chapter, represents a dimension of creative intelligence that can give individuals and groups a better chance of making the quantum leap to the crest of the globalization wave. The intermixing of diverse theories, problem-solving heuristics, and belief systems gives individuals and groups better chances to solve complex problems. Given the increasing complexity of problems in the 21st century, developing cognitive diversity in individual minds and in collaborative groups is important now and will become even more essential in the years to come.

Interpersonal Ability, Collaborative Skill, and Leadership

Returning to the issue of group problem solving, it can be difficult for people of diverse belief systems to work together so interpersonal, collaborative skills also are becoming more important in an integrated, globalized world. The days of the lone genius are disappearing (Gribbin, 2007; Suresh, 2013, October) and, as mentioned earlier, today's complex problems and opportunities demand the efficient intertwining of diverse minds (Page, 2007, 2010). Interpersonal acumen and collaboration always have been important but they are becoming more essential in view of today's macroproblems. Strengthening our collaborative abilities will enable us to lead, follow, and contribute to innovative team projects that employ diverse minds. Artfully sensing *when* to lead, follow, or collaborate is an important dimension of this ability. Overall, the need for creative, intelligent, wise, non-egocentric leadership is pressing (see Gardner & Csikszentmihalyi, 2011; Jacobsen, 2009; Sternberg, 2005, 2009a, 2009b).

Ethical Insight, Global and Multicultural Awareness, and Personal and Social Responsibility

Ethics always represent the most important dimensions of human experience. This is especially the case when it comes to the actions of the gifted, talented, and creative because their work often has more profound impact on the world (for detailed discussions about this impact see Ambrose & Cross, 2009; Sternberg, 2013). The emergence and expansion of macroproblems and macro-opportunities

in the 21st century magnifies the importance of ethics even more. If we don't include ethical elements in our attempts to solve macroproblems or to capitalize on macro-opportunities we are likely to make those problems worse and to turn macro-opportunities into even more macroproblems. For example, it looks like the energy industry's use of hydraulic fracturing to solve the energy shortage macroproblem has the potential to seriously aggravate another macroproblem – environmental devastation (Hagström & Adams, 2012).

International conflict and the maltreatment of deprived populations within nations and around the globe is another macroproblem threatening the wellbeing of billions. In large part, conflicts and exploitation tend to arise from superficial misunderstandings between cultures. For example, scholars of ethical philosophy and political science have revealed distinctions between universalist and particularist morality (Gewirth, 1998). Individuals and groups with moral compasses guided by universalist identity formation make no strong distinctions between their own identity groups and populations of "outsiders." In contrast, particularists can be kind and generous toward those within their own identity group but draw strong distinctions between those of their own kind and outsiders. They find it easy to demonize those from other cultural, ethnic, religious, racial, gender, or class backgrounds and such demonization can lead to ethical abuses up to and including the horrors of genocide (Chirot, 2012; Chirot & McCauley, 2006). Building global awareness and cultural competence can shed light on the dogmatism of insular identity formation and enable identity groups to break down the racist and ethnocentric barriers that justify conflict and exploitation (see Banks, 2012; Ford, 2012; Noddings, 2005; von Károlyi & Ambrose, 2008). In short, an education that doesn't include strong attention to ethical awareness will be inadequate and possibly dangerous in the complex, globalized 21st-century (see Gardner, 2008, 2012).

CONCLUDING THOUGHTS

Overall, this analysis is based on an incomplete selection of 21st-century macroproblems and macro-opportunities. This chapter was just a starting point. A more extensive exploration of the highly complex, transdisciplinary conceptual terrain addressed here likely would turn up even more problems and opportunities that might refine our thinking about the knowledge, skills, and dispositions required for success in the 21st century. Consequently, the list of requirements for development of the creative intelligence necessary for the quantum leap to the crest of the globalization wave in the catch-a-wave models also may be incomplete. Even so, the list of 21st-century proficiencies provided here is daunting and those proficiencies are difficult to attain. Those who can aspire to the acquisition of these capacities and then develop the requisite aspirations and talents will be able to maximize their own chances for self-fulfillment while simultaneously helping to heal a problem-fraught world. They might even help us prevent the most massive, devastating collapse of

civilization in human history. Those who lack opportunities for developing these abilities, or for even perceiving the possibility of developing them, are at a distinct disadvantage in the 21st century.

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SECTION II

CREATIVITY IN THE TURBULENT
21ST CENTURY

DEAN KEITH SIMONTON

3. THE DECLINE OF THE WEST? A COMPARATIVE CIVILIZATIONS PERSPECTIVE

Most of us writing chapters for this volume as well as those who read these chapters are likely deeply immersed in modern Western civilization. And one of the hallmarks of that civilization, at least since the Renaissance, is the belief in progress. Everything will get better and better. Scientists will know increasingly more about the nature of our world, artists will increase their capacity to represent that world (or offer alternative worlds), and inventors will enhance our capacity to exploit and dominate that world—through varied machines and gadgets. Indeed, technology progresses so fast that we cannot purchase a smart phone without knowing that it will probably become obsolete in no time. No wonder, then, that many modern philosophers of history have promulgated theories of how progress becomes a central feature of civilization. For example, Auguste Comte proposed his "law of three stages," in which civilization advances through the theological, metaphysical, and positive stages, the latter representing our modern age of science (Martineau, 1853/1893). Once we reach the last stage, continued progress becomes ensured by the scientific method, which will eventually solve all social problems.

To be sure, some thinkers speculated that progress will not go on forever. Instead, history will progress to the point where humanity attains the culmination of history. For instance, both Georg Wilhelm Friedrich Hegel and Karl Marx argued, albeit in totally different ways, that some dialectic process would lead to the end of the internal conflict driving historical change (Hegel, 1832/1952; Marx & Engels, 1848/1952). In the case of Marx, the end result would be the classless society. That economic and political utopia then goes on forever.

The story gets worse. Some theorists advocate that what goes up must come down: Progress attains a peak after which civilization or culture regresses. In the particular case of creative activity, we might see a decline in science, art, and technology. It might even be possible to speak of the "end of art" (Martindale, 2009) or the "end of science" (Horgan, 1996; cf. Simonton, 2013). At that point, scientific and artistic creativity might cease in Western civilization. And notwithstanding the technological wizardry of Silicon Valley, a point may be reached when people just keep their smart phones until they break or burn out, as in the old days of those clunky landline telephones seen in old movies.

My task in this chapter is to provide an overview of these rise-and-decline theories as well as the empirical research relevant to these theories. A key question is whether a hypothesized creative "decline of the West" is evitable or reversible.

THEORETICAL SPECULATIONS

Because cyclical theories of history have a long (and cyclic) history, I will group the speculations into two inclusive periods: (a) ancient and medieval and (b) post-Renaissance and modern. Needless to say, I can here offer no more than a simple (even simplistic) overview. Many of the theories would deserve a whole chapter to treat adequately (cf. Sorokin, 1950).

Ancient and Medieval Theories

The earliest theories of rise and decline were proposed by ancient historians. In China, for example, Ban Biao (3–54 C.E.) advanced a thesis regarding the destiny of kings (Pan Piao, n.d./1967). The cycle began with the arrival of a highly virtuous ruler who would establish a new dynasty. But with each successive monarch, the dynasty would eventually lose the "mandate of heaven" as virtue was replaced by evil and corruption. Ban Biao was remarkably prescient, for Chinese history is chronicled with the rise and fall of dynasties that can be largely cast in the same terms. Even the current People's Republic of China can be viewed in this way.

Of course, the above scheme concerns leadership rather than creativity, but only slightly earlier the Roman historian Marcus Velleius Paterculus (c.19 B.C.E. – c. C.E. 31) had applied a cyclical theory to the rise and decline of literature and philosophy in Greece and Rome. He even speculated on the underlying cause:

> Genius is fostered by emulation, and it is now envy, now admiration, which enkindles imitation, and, in the nature of things, that which is cultivated with the highest zeal advances to the highest perfection; but it is difficult to continue at the point of perfection, and naturally that which cannot advance must recede. And as in the beginning we are fired with the ambition to overtake those whom we regard as leaders, so when we have despaired of being able either to surpass or even to equal them, our zeal wanes with our hope; it ceases to follow what it cannot overtake, and abandoning the old field as though pre-empted, it seeks a new one. Passing over that in which we cannot be pre-eminent, we seek for some new object of our effort. (http://penelope.uchicago.edu/Thayer/E/Roman/Texts/Velleius_Paterculus/1*.html)

Behind the rhetorical flourishes resides the basic idea that once creativity in a given domain reaches the peak of excellence, subsequent generations will pale by comparison, and eventually exceptional talent will be channeled into other domains that have yet to attain their creative climax. As noted earlier, some recent scholars

have suggested that this decline has already taken place in the arts and sciences within Western civilization.

Although the above two cyclic theories apply to two separate phenomena—political leadership and cultural creativity—their rise and fall may be to a certain extent synchronized. The first hint of this possibility is perhaps found in Ibn Khaldūn's famous *Muqaddimah* (c 1377/1967), or "An Introduction to History." To begin with, he talks about the rise and fall of dynasties, which in his case concentrated on the rise and fall of monarchies in Islamic civilization. In a typical cycle, a highly cohesive and abstemious group comes out of the desert to conqueror the adjacent urbanized civilization. After establishing a new dynasty, the new rulers slowly succumb to the corrupting influences of urban luxuries, eventually becoming so lax that they become more committed to maintaining their acquired lifestyle than to preserving the virtues that enabled their past conquests. Eventually, a new group emerges out of the periphery, defeats the now morally compromised dynasty, and the cycle begins anew. Corresponding to this cycle in political regime is a parallel cycle in arts and crafts. The founders of a new dynasty will not only be poor consumers of such luxury products but perhaps even reject and destroy them as indicative of the immorality of their predecessors (cf. the vandalism of the Vandals). But as one leader replaces another within the same dynasty, appreciation for the finer things of life increases. Besides enhanced luxury, the rulers will often become active patrons of the arts and sciences—and by so entertaining themselves eventually seal their doom!

Taken together, Ban Biao, Marcus Velleius Paterculus, and Ibn Khaldūn provide the beginnings of a rise and decline theory of creativity applicable to all world civilizations. However, certain pieces of the puzzle are certainly missing. For example, how does creative activity get resuscitated in a given civilization after it has already passed into decline? After all, a number of civilizations have displayed multiple "golden ages" separated by "silver" and even "dark" ages. Ancient Egypt, Mesopotamia, Persia, India, China, and Japan provide numerous examples. Accordingly, even if the Western world sees a decline in creativity in the near future, the more far-future may yet offer a revival, a true renaissance.

Post-Renaissance and Modern

Giambattista Vico (1668–1744) was probably the most prominent thinker since Ibn Khaldūn to advocate a rise and fall theory. This theory was presented in his *Scienza Nuova* (Vico, 1725/1959). Here he argued that all societies advance through three stages: the divine, the heroic, and the human. Corresponding to each of these stages are distinct modes of both creativity and leadership. For example, every nation will begin with theological poetry, followed by heroic poetry, and concluding with "human" poetry. Although this might seem similar to Comte's three stages mentioned at the beginning of this chapter, Vico's stages strikingly differ in that after reaching the final stage, the society can descend back to the beginning, yielding an

ever recurring cycle. Although Vico's treatment was purely philosophical, the three stages and their cyclic recurrence will have echoes in empirical research.

Rise and decline theories underwent something of a decline themselves in the late 18th and 19th centuries when the doctrine of progress got a major boost from the Industrial Revolution and other dramatic changes that completely transformed the world in which we live. Nonetheless, some fin de siècle thinkers began to wonder whether Western civilization was entering a phase of decadence. For example, after all of the tremendous progress in representational art since the Renaissance, modern artists seemed more disposed to repudiate realism rather than render their work ever more realistic: Impressionism, Analytical Cubism, and especially Abstract Expressionism provide obvious examples. These doubts about the supposed inevitability of the Western world going ever upward and onward were accentuated all the more by World War I, the Great Depression, and World War II, when civilization often appeared to regress into barbarism. Pessimism began to replace optimism.

The first major thinker in the 20th century to advocate the beginning of the end was Oswald Spengler (1926–1928/1945) in his controversial *The Decline of the West*, the first volume of which was published toward the end of the First World War. Here he argued that all world cultures develop over time just like organisms. Just as organisms have a life expectancy, so do these cultures—a period of about a millennium. In maturity, these cultures evolve into major civilizations, such as the Babylonian, Egyptian, Indic, Sinic, Mexican (Mayan/Aztec), Classical (Greco-Roman), and Arabic (Islamic). Just as any organism, the age of greatest vigor is followed by a period of inevitable decline until the culture finally dies. Just as ancient Babylonian and Egyptian cultures have ceased to exist, so will Western ("Faustian") culture. As in Vico, Spengler saw the rise and decline as permeating all aspects of the culture, including creativity.

Spengler's thesis received considerable attention, particularly criticism. His ideas were founded far too intimately on an organic metaphor that many critics thought oversimplified a complex phenomenon. His classification of high cultures was also controversial. Nevertheless, his basic position was not so much destroyed as superseded by the far more scholarly, sophisticated, and elaborated rise and decline thesis presented in Arnold Toynbee's (1946) *A Study of History*. Besides discussing more civilizations—19 in all (not counting "abortative" and "arrested" civilizations)—Toynbee proposed a model that was not tightly connected to an organic analogy. All civilizations move through the stages of genesis, growth, time of troubles, universal state, and disintegration. The genesis of civilization results from a culture's encounter with significant *challenges* and then, significantly, the growth stage is driven by "creative minorities" who provide solutions to those challenges. Unfortunately, these creative minorities eventually degenerate into "dominant minorities" that eventually form the universal state that imposes its will on the civilization, destroying its creativity. Toynbee's thesis stimulated so much

intellectual debate that he ended up on the front cover of the March 17, 1947 issue of *Time* magazine, a rare accomplishment for an academic historian.

Toynbee's rise and decline theory was by no means the last such theory (see, e.g., Blaha, 2002; Quigley, 1979). However, I believe it more useful at this point to move from theoretical speculations to empirical investigations. Some of the latter provide a factual confirmation of the former.

EMPIRICAL INVESTIGATIONS

Francis Galton (1869) may be said to have initiated scientific research on rise and decline of civilizations, albeit in a somewhat negative manner. In his classic *Hereditary Genius* he argued for a genetic explanation that presumes the existence of superior and inferior "races." After first arguing that the ancient Greeks, and especially those of Attica, constituted that greatest single race in human history, Galton then went on to explain the decline of Greek civilization in terms of various dysgenic practices that undermined Greek genetic superiority—such as interbreeding with lesser races. He lamented what great achievements never saw the light of day once pure-blooded Athenians vanished from the earth.

Happily, Galton's extreme genetic determinism inspired an immediate response from Alphonse de Candolle, an eminent scientist. Although Galton specifically cited Candolle as evidence for hereditary genius, his father also being an eminent scientist, the son still did not buy Galton's inference. Candolle knew full well that he had the advantage of coming from a highly supportive environment. Hence, to counter Galton's claims, Candolle (1873) conducted an impressive empirical study to tease out the political, cultural, economic, religious, and educational factors that contribute to the presence of scientific creativity in various European nations. His examination of the comparative national contributions was not just cross-sectional but also transhistorical. That is, he assessed how scientific creativity changed across time, allowing some upstarts to eclipse their predecessors (cf. Yuasa, 1974). In Candolle's own day the French hegemony in science was already yielding to the German.

Although Candolle (1873) was not explicitly interested in the causes of decline, many of his findings shed light on that question. After all, any factor that enhances creativity will very likely decrease creativity if that same factor is reduced or removed. For example, nations that produce numerous first-rate scientists tend to value the pursuit of scientific knowledge. So when science is no longer culturally valued, the decline in scientific creativity is a necessary consequence. This repercussion is apparent in the history of Islamic civilization (cf. Simonton, in press; Sorokin & Merton, 1935). At one time the greatest scientists in the world were active in that very civilization (whether they were Muslims, Christians, or Jews), but eventually the "rational sciences" came to be seen as inconsistent with the far more culturally central "religious sciences."

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Unhappily, Candolle's (1873) pioneering empirical study was never translated into English, the language that was even then becoming the lingua franca of scientific communication (ironically, a trend that Candolle himself had pointed out). Accordingly, he was largely ignored for more than a century (cf. Simonton, 2003a). For that reason, too, we had to wait until the 1930s before empirical enquiries begin to appear that are directly relevant to the rise and decline of civilizations. Once restarted, the work continued well into the 21st century.

These empirical investigations may be grouped into three categories: cultural configurations, intellectual history, and aesthetic evolution.

Cultural Configurations: Creative Geniuses

As a cultural anthropologist, Alfred Kroeber (1944) was also strongly opposed to Galton's genetic determinism. However, he adopted a somewhat different approach than did Candolle. Kroeber argued that creative geniuses are merely part of what was termed "configurations of culture growth." That growth would begin with a specific cultural "pattern" that would be developed and expanded until reaching a "climax," after which the pattern would be "exhausted." The resulting configuration would then have a distinctive rise and fall shape over time. The configuration would begin with lesser precursors who provide the shoulders on which the true giants stand—the geniuses who demarcate the peak of the curve—after which the decline would set in, trailing off into an ever diminishing series of epigones. The Golden Age would eventually be followed by a Silver Age and finally a Dark Age. Kroeber's argument has obvious affinities with Marcus Velleius Paterculus, and the latter is actually quoted at length. Significantly, too, the rise and fall could not be explained by Galton's genetic position. What would cause the rise? And why would the decline be so precipitous? Sometimes the whole rise and decline took place within a few generations—hardly enough time for genetic forces to act (Simonton, 1988b).

Unlike the theorists discussed earlier, Kroeber (1944) collected extensive raw data to document configurations for all of the world's major civilizations and for all major domains of creativity, from the arts to the sciences. In particular, he compiled list after list of creators arrayed in chronological order, asterisks indicating those creators who stood head and shoulders above the rest. He also converted these listings into graphic representations so the rise and decline could be better visualized. All that said, Kroeber was not quantitatively inclined, quite unlike Galton (1869), so his treatment may seem too qualitative for comfort from a scientific perspective.

The missing quantitative analysis was introduced and developed by Simonton (1975, 1984, 2003b) in the form of generational time-series analysis. The creative geniuses who define a particular cultural configuration are first assigned to consecutive 20-year periods according to their respective floruits or acmes (usually taken as their 40th year, based on empirical research; Simonton, 1988a). Once so aggregated, the resulting data can be subjected to time-series analytical methods. These methods allow us to assess the extent to which the quantity and quality of

creators at generation g is a positive function of the quantity and quality at generation $g - 1$ and perhaps also generation $g - 2$. The analyses reveal that the time series are in fact *autoregressive*, that is, creativity in one generation is indeed a function of creativity in preceding generations. The specific autoregressive process is usually either first order (i.e., positive function of the previous generation) or second order (i.e., positive function of the previous two generations). This specification may seem abstract, but it can be considered an aggregate implementation of the "emulation" process put forward by Paterculus and endorsed by Kroeber.

In any event, the research clearly shows that this autoregressive process can easily account for the configurations of culture growth discussed in Kroeber's (1944) qualitative treatment. Such a process necessarily causes creative genius to cluster into consecutive generations. Just as importantly, this process has been established for all of the world's major civilizations for which adequate data are available (Murray, 2003; Simonton & Ting, 2010). For example, the same mechanism holds for not just Western civilization (Simonton, 1975) but also Chinese (Simonton, 1988b; Simonton & Ting, 2010) and Japanese (Simonton, 1992, 1997; cf. Simonton, 1996). Only civilizations like Pre-Muslim India, which did not place much cultural value on precise chronology, do not lend themselves to this quantitative treatment (cf. Schaefer, Babu, & Rao, 1977).

The autoregressive status of generational time series does not preclude the intrusion of other variables (Murray, 2003; Simonton, 1981). On the contrary, and in line with Candolle's (1873) pioneering work, the generational fluctuations can be deflected up or down by political, cultural, and other extrinsic factors (cf. Gray, 1958, 1961; Kroeber, 1958; Taagepera & Colby, 1979). Among the negative influences is the "universal state" discussed by Toynbee (1946). Not only is creative genius often fostered by the political fragmentation of the civilization—as seen in the Italian Renaissance and the Golden Age of Greece—but revolts and rebellions against imperial states can often increase creative activity (Naroll et al., 1971; Simonton, 1975, 1976b). Although political anarchy (assassinations, usurpations, etc., involving the power elite) can have a negative effect, civil disturbances involving the masses and repressed minorities can have a positive effect (Simonton, 1975, 1976c, 1976d). Other influential factors are cultural rather than political. For example, creative genius in a civilization is likely to increase after exposure to alien cultures, including new religions, philosophical or scientific ideas, and art forms (Simonton, 1997, 2004). This effect is important in facilitating the revival of creativity in a civilization after it had undergone a decline. Many civilizations in the Far East underwent an impressive renaissance after the arrival of Buddhist art and thought directly or indirectly from India.

Intellectual History: Philosophical Systems

I just mentioned how creative activity in a given civilization might be associated with intellectual movements. This association deserves more attention in this section.

The best place to begin is with the monumental *Social and Cultural Dynamics* by Pitirim Sorokin (1937–1941). Here Sorokin proposes an explicitly cyclical theory, a theory that has a certain initial affinity with Vico's theory (Schneider, 1964). In particular, Sorokin argues that cultures are defined by prevalent "mentalities." Three mentalities are especially prominent, namely, the Ideational, the Idealistic, and the Sensate—which roughly parallel Vico's stages of divine, heroic, and human. Civilizations also pass through these three mentalities in an eternal sequence owing to an intrinsic dialectic process: first Ideational, then Idealistic, and finally Sensate, only to return to Ideational. Indeed, Sorokin argued that modern Western civilization was in the final phases of the Sensate mentality, soon to be replaced by the Ideational. These shifts in the dominant mentality were important because they corresponded with particular types of creativity and leadership. For example, Ideational art was highly spiritual or religious, whereas Sensate art was highly sensual, even sexual. Sorokin's theorizing was sufficiently important to stimulate numerous scholarly evaluations, both contemporary and posthumous (Allen, 1963; Ford, Richard, & Talbutt, 1996).

Unlike Vico, Sorokin collected extensive data sets to empirically test his theory. Most notably, he had a team of professional philosophers rate more than 2,000 Western thinkers on a large number of intellectual positions. The later included empiricism, rationalism, skepticism, materialism, idealism, nominalism, eternalism, determinism, individualism, and hedonism, just to name a handful. By tabulating these thinkers and their beliefs into 20-year generational periods, he was able to produce time series that spanned from ancient Greece to the early 20th century. Although his statistical analyses were not very sophisticated, subsequent researchers have taken advantage of his published data to conduct their own analyses (e.g., Klingemann, Mohler, & Weber, 1982; Martindale, 1975; Simonton, 1978). I should not even try to summarize the findings but rather must concentrate on three results most relevant to the question at hand.

First, scientific creativity is most strongly associated with the Sensate mentality (Simonton, 1976a). This mentality corresponds with such philosophical positions as empiricism, materialism, nominalism, determinism, individualism, and hedonistic ethics. Hence, if Sorokin was correct in forecasting that our Sensate civilization is on the decline, a decline in scientific creativity will follow suit. Interestingly, the Sensate mentality is also positively associated with political fragmentation (Simonton, 1976d).

Second, the specific philosophical positions display fluctuations across the history of Western history that are driven by both internal and external forces. An example of an internal force is the classic Hegelian dialectic of thesis, antithesis, and synthesis (Simonton, 1978). That is, certain positions will stimulate counter-positions that will then stimulate new positions. For example, Kantian epistemology can be seen as a synthesis of the rationalism of Leibniz that emerged as a reaction to the empiricism of John Locke. An instance of an external force is how civil disturbances tend to polarize philosophical discussion so that thinkers emerge to advocate totally contrary positions, such as materialism versus idealism, empiricism

versus rationalism, individualism versus collectivism, determinism versus free will, and hedonistic versus principled ethics (Simonton, 1976d).

Third, and somewhat related to the last point, the quantity and quality of creative activity in a given generation is positively correlated with the level of ideological diversity (Simonton, 1976b). Ideological diversity is simply a measure of the total number of diverse philosophical positions represented in a given generation. Naturally, civil disturbances should tend to increase ideological diversity, given its polarizing effects. Yet that is not the only external factor: Ideological diversity is also encouraged by political fragmentation (Simonton, 1976b). Indeed, a civilization is often fragmented politically when it is riddled with ideological divisions, whether religious or economic.

Aesthetic Evolution: Artistic Styles

Just as the previous section focused on philosophical ideas, the current section concentrates on artistic styles. It is obvious that such styles evolve over historical time. Thus in Western civilization we might roughly suggest such sequences as Romanesque, Gothic, Renaissance, Mannerist, Baroque, Neo-Classical, Romantic, Modern, and Contemporary (cf. Hasenfus, Martindale, & Birnbaum, 1983). Moreover, during these stylistic changes, the previous style is completely replaced by the new style as the leading edge of the art world. Once Leonardo, Michelangelo, and Raphael were in their heyday, an artist wanting to paint in the styles of Cimabue or Giotto wouldn't have a prayer of getting a job anywhere. Cimabue's and Giotto's work might still be admired for their innovations, as indicated by their chapters in Giorgio Vasari's (c. 1550/1968) *Lives of the Artists*, but the styles themselves would be considered passé. Yet what causes these stylistic changes?

Colin Martindale (1975, 1990) has provided by far the most systematic theoretical and empirical treatment of this issue. He notes, first of all, that styles sometimes change because of external circumstances, such as shifts in religious or political systems. Christian or Islamic cultures will have different art styles than the religious cultures that preceded them. According to Marxist reflectionist histories of art, art styles will also reflect the prevailing means of production and distribution of power (see, e.g., Dressler & Robbins, 1975). When the latter changes, so will the former. Nevertheless, Martindale points out that these external influences are not very interesting. Obviously socialist countries are going to favor Socialist Realism! Moreover, external accounts cannot handle the faster stylistic changes normally observed.

Far more interesting, according to Martindale (1990), are the internal forces that drive aesthetic evolution. In the arts, the creator is under constant pressure to surpass what has been done before, to create products that retain their shock value. Doing the same thing over and over is antithetical to art. Because artists start off in a given style, they must constantly stretch the stylistic constraints by introducing various novelties. After a few generations, however, these innovations begin to destroy the

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style altogether. Hence, the only route to continued artistic creativity is to adopt a new style. It is the new style itself that claims the novelty. But as artists begin working in that new style, the progression repeats, and eventually it, too, is destroyed. The eternal cycle returns.

To his credit, Martindale (1975, 1990) was not content to speculate, but actually subjected his speculations to empirical tests. In fact, he devised rather ingenious computer content analytical methods to test his theory. First applying these methods to British and French poetry, he then extended them to other literary forms and even devised new techniques for testing the same theory in the visual arts and music. Others have followed in his path. For instance, computer content analyses have demonstrated how the unpredictability of melodies in the classic repertoire has tended to increase over the centuries (Kozbelt & Meredith, 2010; Simonton, 1980). Yet because the aesthetic success of a musical composition tends to be an inverted-U function of melodic unpredictability (Simonton, 1994), one must wonder whether classic composers have "priced themselves out of the market." Melodies are often so unpredictable that they no longer sound like melodies (e.g., in atonal compositions). Classical music continues to be composed today, but the result is often inaccessible to as a wide public as in days of yore. There were between 10,000 and 30,000 onlookers at the funeral of Ludwig van Beethoven, suggesting the fame of a modern rock star. How many classical composers in the 21st century would attract such a following when laid to rest?

Therefore, we get back to Martindale's (2009) thesis that we have reached the "end of art" in Western civilization. Contemporary artistic movements often tend to be too esoteric, requiring detailed manifestoes to accompany each new work to render it comprehensible. And too frequently the artist increases accessibility by going for immediate shock value, such as putting a crucifix in a bottle of urine or putting dung and pornography on a Madonna. In Kroeber's (1944) terminology, Western artistic culture might have already reached the stage of "pattern exhaustion."

POTENTIAL IMPLICATIONS

Once more, this review only presents the highlights of a very complex literature involving both theoretical speculations and empirical investigations. Because I hope that both types of research will continue well into the future, it is perhaps premature to derive any forthright conclusions. Every inference must be tentative. That admitted, I close by looking at the pros and cons regarding whether creativity will soon decline in Western civilization.

On the positive side, certain considerations would lead us to conclude that the West is far from creative decline. Certainly political fragmentation remains high, the weak unification seen in the European Union easily compensated by the breakup of the Soviet Union and other states. At this point, given the distribution of power, it is difficult to see how this fragmentation can substantially change in the near future. Furthermore, the West remains extremely permeable to influences from

non-Western cultures throughout the world. Carroll Quigley (1966) argued that "inclusive diversity" was a core feature of modern Western civilization. If so, that civilization will remain creative well into the future, at least until it has sufficient time to incorporate and integrate all the rest of humanity has to offer, whether cuisine, recreation, art, or ideas. In addition, while it is possible that certain forms of creativity may reach some terminal point, that event does not necessitate that creativity itself must die. As Paterculus indicated many centuries ago, creative talents can always move to something else. Indeed, Western civilization has shown an incredible capacity to reinvent itself by coming up with new genres for creativity. Since the ancient Greeks, for example, there were only six arts, until cinema emerged as the Seventh Art in the 20th century (Simonton, 2011). Video games may eventually become the Eighth Art of the 21st century, if they haven't already. The bottom line is this: Nearly a century ago Spengler was descrying the decline of the West, and yet it still hasn't happened, not even close.

On the negative side, Western civilization faces some severe challenges that even a supreme "creative minority" may not be able to solve. Environmental change has been a significant factor in the destruction of many previous civilizations, and in the current case our civilization may have to cope with catastrophic change of our own making—global warming accumulating since the Industrial Revolution. Nor is that the only big challenge. Partly as a repercussion of past Western imperialism and colonialism, some peoples of this planet reject Westernization and instead advocate a return to what are believed to represent traditional cultural values. In the Muslim world, for example, the Islamic State of Iraq and Syria and the Boko Haram of Nigeria perhaps provide the most conspicuous manifestation of this trend. Although perhaps not a direct threat to the West (at least not today), such movements can prove an indirect threat should they elicit a reduction in our civilization's signal inclusive diversity, as witnessed in anti-Muslim prejudices in Europe and the United States. Yet another challenge is the growing economic inequalities that may eventually destabilize political systems throughout the Western world. Once the economically disenfranchised no longer buy into the promise of a middle class life, then the radical gap between the "1%" and the rest could only fuel the fire of popular unrest that finally burns down the house. These civil disturbances may polarize more than unify.

Ironically, perhaps the best hope for preventing the decline of creativity in the West may be to permit its trademark inclusive diversity to convert Western civilization into some new global culture that can display its resuscitated creativity for another millennium or more. I have already mentioned that many civilizations have experienced multiple rebirths via the introduction of alien cultural materials. China's Tang Dynasty was not just a continuation of the earlier classic dynasties, given the intrusion of cultural traits beyond its borders—most notably Buddhism— yet it remains a Golden Age of Chinese civilization. By the same token, whether we will still be justified in calling the future civilization Western really doesn't matter so long as the world as a whole maintains its creativity. Rather than the decline

of the West, we will just discuss the transformation of the West into a new world civilization—one that successfully synthesizes all of the best that humanity has to offer.

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MARK A. RUNCO

4. WE MUST PREPARE FOR THE UNFORESEEABLE FUTURE

The featured chapter of this volume makes the highly-tenable claim that a large number of new challenges and problems have arisen in the 21st century. The featured chapter immediately connects these new problems to new opportunities. It describes what is required to solve the problems and take advantage of the opportunities (i.e., knowledge, skills, and dispositions) and explores implications for education in the 21st century. The featured chapter, by Ambrose (chapter 2, this volume), refers to the challenges of the 21st century as *macroproblems*. This is an apt label. Many of the problems he mentions are new and unique to the 21st century, and many are so broadly encompassing that, one way or another, they threaten a broad spectrum of society.

The new problems faced in the 21st century are not just technological, scientific, medical, economic, political, and ecological. They are also moral challenges, some of which are the direct result of the advances within technology, scientific discovery, medical innovation, and so on. The connection between technology, science, medicine, and these other areas with morality has led to a shift within the creativity research. This shift and the particular moral challenges arising in the 21st century were foreshadowed in a special issue of the *Creativity Research Journal*, devoted to "Creativity in the Moral Domain" (edited by Gruber & Wallace, 1993). One conclusion from that work was that creative problem solving will be required to solve the moral dilemmae, many of which are related to various macroproblems.

The present chapter explores the creative problem solving process and extends the thinking proposed by Ambrose in the featured chapter. The creative process described herein will facilitate a *shift of perspectives* that will in turn allow what may first appear to be problems to be interpreted as opportunities. This kind of shift of perspective has been described previously in the research on *problem finding* (see chapters in Runco's 1994 edited volume on the topic). The present effort summarizes the research on problem finding and argues that it depends on a universal creative capacity and in particular on the construction of novel interpretations. The present chapter also connects immersion, engagement, intrinsic motivation, adaptation, persistence, decision making, and perception to the creative process. These should each be targeted in the educational system with a likelihood of beneficial returns for the 21st Century.

THE DISAPPEARANCE OF THE PROBLEM

The title of this chapter was adapted from Bruner's (1962) essay on creativity. In that essay Bruner argued quite convincingly that the primary objective for education was to "prepare students for the unforeseeable future." Those words are even more compelling today than they were when Bruner penned them. That is because the acceleration of cultural evolution is such that change is occurring faster and faster. Sociocultural changes are most accurately viewed as reflecting Lamarckian evolution, which is much faster than Darwinian revolution. Lamarckian evolution applies to changes that, once introduced, remain a part of culture from that point forward. This is especially obvious with technology. Once a computer processor is invented, for example, we have it forever. It immediately becomes a part of culture and need not be rediscovered or reinvented at a later date.

The problems and challenges of the 21st century are also imposed on us at an ever-increasing rate. In this sense, we not only have new 21st-century problems; we have a whole new social and technological context. It is in fact the acceleration of change that makes the future unforeseeable. And because the problems and opportunities are both different from previous experience, educators cannot merely provide students with skills that work in today's society. Many of today's jobs will disappear. Many skills used today will be useless quite soon. One of the few things that will help students in the unforeseeable future is creative skill.

One creative skill with clear relevance to the unforeseeable future is implied by the title of this particular section of the present chapter, "The Disappearance of the Problem." This is also a quotation from an earlier essay, namely that of Wittgenstein (1921/1974, p. 73). It is quoted here because the idea of disappearing problems is enormously useful for pinpointing how creative thinking will allow problems to be transformed into challenges and opportunities. Wittgenstein's idea may sound a bit magical—one, two, three, the problem is gone!—but in actuality there is a rationale for what he describes as disappearance in several lines of psychological research. One line of research is biographical. It contains illustrations of how famous creators became totally immersed in their work or in some problem. In some cases a problem became the focus of their thinking, day in and day out. Such intense engagement is apparent in the lives of Darwin and Einstein (Gruber, 1981; Miller, 1992), just to mention two luminaries.

Then there is the work on gifted children and prodigies who develop expertise because they are, as Howard Gruber once put it, "on fire" to learn about and engage in their chosen field. Gruber (1985) described a chess prodigy who would play his game 6, 8, or more hours each day, if allowed to do so—and he was only 8 years old! Certainly chess is a game and not, say, hard physical labor, but many 8 year old children cannot devote themselves to something that requires sitting in one place and concentrating on one small location (i.e., a chess board) for hours and hours, day in and day out. Yet if the child is "on fire" and so deeply engaged, there is an immersion that is similar to that of the famous adult creators.

Some of the support for the idea of problems disappearing is experimental. The research on intrinsic motivation has, for example, demonstrated that there is often a cost to being dependent on consequences, contingencies, and other extrinsic reward, at least in terms of creative thinking. Intrinsically motivated behavior is more often associated with creative thinking and creative achievement than is extrinsic thinking. And it is easy to see why this would be the case. An intrinsically motivated individual is likely to care more about the task itself and will be less concerned with the consequences of his or her work. The intrinsically-motivated individual is also able to concentrate more easily because outside distractions (e.g., supervisors or contingencies) are diminished. Then there is the likelihood that the intrinsically-motivated person will persist, which in turn increases the probability of finding remote associations and original ideas and solutions. There are many instances where creative performance has resulted from extrinsically motivated behavior—think of commercial art, for example—and to be realistic both intrinsic and extrinsic motivation are relevant to the creative process (Rubenson & Runco, 1992; Runco, 1994). But intrinsically motivated behavior frequently facilitates creative behavior.

The immersion and engagement just described may play a large role in transforming problems to challenges. To understand how this transformation happens, it is useful to have a working definition of *problem*. Problems are defined in terms of objectives, or goals, and obstacles. If someone has an objective, but there is an obstacle in the way, that person has a problem. The creativity research categorizes problems in various ways (Houtz, Jambor, Cifone, & Lewis, 1989; Runco, 1994). Some are open-ended, some closed. Some require algorithmic thinking, and others can be solved heuristically. Problems may be structures such that a restructuring leads quickly to an insightful solution, while some must be approached incrementally. Some problems are presented or imposed on the individual; others are discovered. Regardless of the kind of problem, a problem implies that there is an obstacle to some objective.

What if the person is in what appears to be a problematical situation but is enjoying the process and would not remove the obstacle even if he or she could? What if the end result, a solution, is less important than the process, the work, the journey?

These questions might be best answered by again considering Wittgenstein's (1921/1974) philosophy. And indeed, Wittgenstein is more often quoted by philosophy textbooks than psychology textbooks. This tie to philosophy is relevant because individuals who are immersed in a challenge may very well have found a meaning in life. That certainly sounds like philosophy—the discovery of meaning—but it can be translated to a psychological process as well. Meaning in life can be defined as having a purpose, which in turn implies that one's work is intrinsically interesting. Recall here what was just said above about determination and persistence. "Purpose" may direct a person's work for decades and motivate continued effort (Gruber, 1996). Creative achievement sometimes results. Simonton (1994) reported that creative achievement can be predicted by three things: (a) starting in one's field at an early age, (b) regular, continuous effort within that field, and (c) longevity

within the field. The first of these may be a matter of luck, as is the case when the individual has a crystallizing experience (e.g., as a child Einstein was given a gift of a compass, and the Wright brothers as children received a gift of a toy flying machine), but certainly (b) and (c) reflect effort, decision-making, and motivation.

The effort and motivation follow naturally from the individual's engagement. Many decisions do as well, though these tend to be conscious and intentional. What decisions are made will gravitate towards what is important to the individual, so they too are tied to purpose and meaning. There are numerous decisions that can lead a person to creative behavior, including what ideas to take seriously, what education to pursue, how to allocate resources, and even where to live (Florida, 2004; Runco, Johnson, & Gaynor, 1997). On the topic of resources, recall Ambrose's (chapter 2, this volume) discussion of various macroproblems resulting from limited resources.

In fact it might be instructive to briefly explore a concrete example of creative thinking for the solving of a macroproblem. Ambrose (chapter 2, this volume) provided a good start and can be quoted to get us started:

> The BP oil disaster in the Gulf of Mexico foreshadowed another pressing macroproblem – a looming shortage of resources such as hydrocarbons, minerals, and arable land… Klare (2012) illustrated ways in which these shortages are encouraging extraction industries to take ever-bigger risks such as deep-water drilling and mining in dangerous regions because easily accessible resources are disappearing quickly. …These extractive processes are far more damaging to the environment than conventional oil and natural gas extraction, and those processes were dirty enough. Consequently, the energy industry is causing far more devastating environmental damage than ever before, and this damage includes the rapid acceleration of climate change… The potential for dangerous international conflicts over territory and resources also is rising due to the shortages… In addition, wealthy nations such as Saudi Arabia and the United Arab Emirates are buying up enormous tracts of arable land in third-world countries in order to ensure their own food supplies at the expense of the impoverished populations in those nations. International tensions are rising over this practice. In the long run, we must either use our ingenuity to come up with replacements for some of these resources or pay gargantuan ethical and economic prices for them in the future.

Creative thinking is needed, and quickly. More specifically, those involved need to shift their perspectives and redefine the situation. The solution is not to continue along the present course. What is needed is a shift towards alternative forms of energy and towards an evaluation of how energy is being used. Very likely, corporations and nations will find opportunities, financial and otherwise, if they invest in alternative forms of energy instead of simply trying to move faster in the same direction. Paraphrasing Klare (2012), instead of "racing for what is left," the opportunity to innovate while conserving should be exploited.

TRANSFORMATIONAL CAPACITY

This chapter proposes that the problems of the 21st century can be solved with creative problem solving. So far decision-making, problem definition, and intrinsic motivation have been brought into the creative problem solving process. This process can lead to a shift of perspectives such that problems become opportunities. Problems can also be *transformed* such that they are opportunities. It is indeed quite beneficial to consider the creative problem solving process in terms of cognitive transformation, interpretation and the universal creative capacity.

The problems of the 21st century will not disappear but there is reason to believe that they can be transformed such that solutions are more likely. This process, from problem to engagement to creative solution – requires creative skill. It might be best to use the label *creative capacity*. That is because the process is not something rare or exceptional. It is an inborn and universal capacity, no doubt a result of our evolutionary history. It has given us an enormous evolutionary advantage (Albert, 2012). This capacity is used by each of us, and sometimes several times each day. It is, then, readily available, though it requires support and direction. Fortunately Ambrose (chapter 2, this volume) and others (e.g., Cropley, 1992; Fasko, 2001; Runco, 2003) offer methods that can be integrated into the educational system for exactly this purpose. The *ingenuity gap* highlighted by Ambrose might be circumvented if the creative capacity is fully utilized. Another way of saying this: Creative potentials unfulfilled will lead to a large ingenuity gap, but the fulfillment of creative potentials will minimize or eliminate the gap. Not everyone sees creativity as a universal and daily process. This is a theory of Big C creativity, for example, that focuses on original achievements that change the world or at least have enormous impact (Merrotsy, 2013). The theory of Big C creativity does assume a little c creativity as well, but little c creativity is supposedly entirely personal and mundane. Elsewhere I have suggested that the Big C/ little c dichotomy be avoided precisely because it separates the widely-distributed creative capacity from wide-impact creative achievement. The dichotomy is especially problematic if the intent is to support and encourage creativity such that creative potential be fulfilled and personal creativity be engaged such that it is directed towards macroproblems. This is one way to describe an ideal for education, as the fulfillment of creative potentials such that universally-shared creative capacities are brought to the solution of macroproblems, be they technological, cultural, political, environmental, or economic.

It is easy to see creative capacities as universal if they are tied to the processes mentioned earlier in this chapter, and in particular if they are tied to the possibility of creating meaning. That is a universal need, to find meaning in life (May, 1994; Richards, 2007; Runco, 2007), and it requires particular interpretations. After all, life *will* present problems. There will be challenges, disappointments, struggles. There is no way around them, though their particularities will vary from person to person (other than death and taxes). Thus the only option for meaning is to interpret what

life presents in a creative fashion. Fortunately, we inherited the capacity for doing exactly that—constructing creative interpretations. This capacity can be viewed as that which allows the construction of interpretations, though theories of top-down processing can be cited as well, as can the idea of cognitive transformations.

Consider for a moment the experience of psychological stress. This occurs when there is a failure to adapt. The environment imposes a challenge, and if the individual does not adapt, he or she experiences stress. The psychological experience is not "out there," however. It may be triggered by some objective experience, sometimes called a stressor, but in actuality the stress is a subjective interpretation of the experience. That is why two people can have the same experience and one reacts with stress while the other does not react or reacts very differently. If stress were a function of the objective experience, those two individuals would have the same reaction. Stress is not demanded of us. It is our interpretation of certain experiences.

Interpretation can also be understood by contrasting it with *sensation*. Sensation involves the mere detection of information. One of the five sensory modalities responds to energy or other information in the environment; the nerves in the cochlea respond to particular frequencies of sound, for example, or the rods and cones respond to particular wavelengths of light. This information is conveyed to the nervous system, but the individual is not yet aware. The nervous system is reacting, as it evolved to do, but meaning has yet to be assigned. We could not possibly assign meaning to everything being processed on a sensory level. Instead our cognitive systems select what is important, attention is allocated, and meaning can be found. Using the vernacular, our sensory systems allow information to enter the cognitive system, but perception only occurs some of the time—only when the information is interpreted such that meaning is constructed.

Much of this should sound very familiar. The description of stress, for example, involves the same argument used earlier in this chapter when describing the disappearance of problems. Both stress and the negativity of problems come down to interpretation. This may also sound familiar to students of Jean Piaget's (1976) developmental theory. Piaget described how the cognitive structures that allow understanding are actively constructed as the individual processes new experiences. For Piaget this involved adaptation, and more specifically *assimilation* and *accommodation*. Other processes have been identified and named to explain the construction of understandings, but the key point is simply that understanding is constructed. It is, put most simply, created by the individual. The construction of understanding allows equilibrium whereby the individual is able to cope with an ever-changing environment. The fact that our world is changing at a faster and faster pace makes adaptation that much more important, which in turn means that the creative capacity that is required for the construction of understandings is also increasingly important. The universality of this kind of creativity is indicated by the fact that we are each capable of developing new understandings. Each of us can interpret experience as stressful, or not, as problematic—or as challenging, engaging,

and meaningful. As a matter of fact Piaget (1976) can again be cited because he argued that adaptation is biologically-based and intrinsically motivated.

A handful of theories of the creative process have emphasized transformation as a key component of creative problem solving (Guilford, 1968; Feldman, 1978), and one recent investigation took an initial step towards measuring creative transformation. In it Catalana and Runco (2014) administered several new measures. One was a figural test of divergent thinking that was presented along with directions for examinees to think of as many things as they could for what the figure could represent. Three figures were presented, one at a time. The examinees were then given explicit instructions with figures that asked them to think of things that were represented but to utilize certain tactics, including turning the figure upside down, or imagining it smaller or larger. The idea here was that individuals with strong transformational skills would have a significantly different number of ideas, and perhaps a significantly different number of original ideas, when given the explicit instructions. If so, the conclusion could be drawn that the explicit instructions elicited or facilitated cognitive transformations of the figures. A second measure in this same study also employed divergent thinking tasks, but verbal and not figural ones. It asked the examines to generate problems. This kind of problem generation task has been used before with good reliability, but Catalana and Runco followed it up with a question asking the same examinees to look back on their own problems, selecting one, and reinterpreting it as an opportunity rather than a problem. The logic for this task is no doubt obvious, given what was said earlier in this chapter: problems might be transformed and re-interpreted such that they are not negative difficulties but opportunities instead. Tentative analyses demonstrated that both the figural and the verbal measures were reliable. Additional analyses are underway to determine if the transformation tasks also have predictive power. This set of analyses uses various criteria of creative performance. If the measures prove themselves to be psychometrically sound, future research might employ them such that educational efforts designed to encourage the skills outlined herein are accurately evaluated.

CONCLUSIONS

It would be nice if problems really did disappear. They may never do so, however, but the next best thing is make the best of the situation and reinterpret to take stock of potential opportunities. Educational efforts should prepare students for the unforeseeable future by acknowledging the difficulties of the 21st century and by supporting creative capacities such that macroproblems, though broad and global, are meaningful and engaging. The thesis of the present chapter is that creative capacities involve interpretative and transformational skills, and that these can be targeted in education, and that this is the best way to prepare students for the unforeseeable future. Educators should be pleased with the creative process outlined in this chapter, especially in that it described intrinsic motivation and engagement

as byproducts. A student will be motivated if the educational context challenges in a personally meaningful way. Educators need not target motivation. If they create the right context, natural motives will energize students (Piaget, 1976; Runco, 2003).

The creative capacity outlined here defines creativity in a particular fashion, but very significantly, the definition of creativity assumed here is entirely consistent with creativity as defined more broadly in the social and behavioral sciences. Runco and Jaeger (2012) reviewed definitions of creativity, asking who might have been the first to propose (a) originality and (b) effectiveness as the requirements. This is the "standard definition of creativity." The exact terminology varies slightly, with originality sometimes called *novelty* or *unconventionality* and effectiveness sometimes called *fit*, *appropriateness*, or *usefulness*, but virtually all contemporary research involves originality and effectiveness in some guise. That is not to say that the standard definition is entirely adequate. There are concerns. Simonton (1994) added surprise to the definition, and Kharkhurin (2014) and Tan (in press) questioned the cross-cultural applicability of the standard definition. Khurkhurin felt that *authenticity* should be added in order to understand creativity as it usually appears in Eastern cultures. Tan's view is especially germane to the argument here in that she described the creativity of Confucius as a matter of morality and self-enlightenment. This led her to the same conclusion presented just above, namely that meaning is a result of the creative process and is itself a creative product.

One of the most important ideas presented in this chapter is that of decision making and the related idea of an allocation of resources. This allocation was only mentioned in the discussion of attention, but attention is not the only limited resource that plays a role in creative efforts. Ambrose (chapter 2, this volume) and Rubenson and Runco (1992) identified other critical resources, some interpersonal, some intrapersonal, and Sternberg (1997) went into some detail about the practical intelligence that allows entrepreneurs and other creative individuals to make decisions that lead to creative action and achievement. The need for particular decisions and an appropriate allocation of resources is being underscored here because these are things that can be discussed and explored in education. Students can be encouraged to make decisions that will lead to their investing in creative options and in alternatives that are meaningful, both personally and more broadly, to society as a whole.

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LAURA YAHN AND JAMES C. KAUFMAN

5. ASKING THE WRONG QUESTION

Why Shouldn't People Dislike Creativity?

> You missed a very dull TV show on Auschwitz. More gruesome film clips, and more puzzled intellectuals declaring their mystification over the systematic murder of millions. The reason they can never answer the question 'How could it possibly happen?' is that it's the wrong question. Given what people are, the question is 'Why doesn't it happen more often?'
>
> – *Hannah and Her Sisters* (Allen, 1986)

Creativity is usually portrayed and studied in a positive light. Sometimes this benevolence is explicit. Theoretical models fuse creativity with positive traits such as wisdom (e.g., Craft, Gardner, & Claxton, 2008; Sternberg, 2003) and ethical behavior (Kampylis & Valtanen, 2010), and positive psychology includes creativity as a valued ability (Adams, 2012; Simonton, 2002). More often, studies implicitly assume that creativity is a good thing and emphasize how creativity can be increased in the workplace, classroom, or daily life.

The benefits of creativity are real and well-studied, and the purpose of this chapter is not in any way to dispute them. At a global level, creativity has been tied with success in the overall economy (Florida, 2002) and within large organizations (Agars, Kaufman, & Locke, 2008). In the workplace, creative people are more likely to get promoted, earn high salaries, and be happy with their careers (Seibert, Kraimer, & Crant, 2001). In life, creative people tend to be in better physical health (Stuckey & Nobel, 2010) and good moods (Amabile, Barsade, Mueller, & Staw, 2005; Silvia, Beaty, Nusbaum, Eddington, Levin-Aspenson, & Kwapil, 2014). Creative people are better equipped to cope with trauma (Forgeard, 2013) and stress (Nicol & Long, 1996).

Despite the connection of creativity and positive psychology, there has also been a long association of creativity and less-desired characteristics. Probably the most prevalent association is between creativity and mental illness (see essays in Kaufman, 2014). The "mad genius" stereotype has persisted – and is believed by creative people (Kaufman, Bromley, & Cole, 2006). The connection between mental illness and creative genius is consistent (Simonton, 2014), if flawed and challenged (Schlesinger, 2009). Although extrapolating this work to assume that everyday creative people are more likely to be mentally ill is dangerous (Silvia & Kaufman, 2010), there is also a body of research linking everyday creativity with subclinical

disorders, which range from anxiety (Silvia & Kimbrel, 2010) to hypomania (Furnham, Batey, Anand, & Manfield, 2008) to schizotypy (Abraham & Windmann, 2008).

There has also been a recent movement to study malevolent creativity, or creativity deliberately engaged to hurt others (Cropley, Kaufman, & Cropley, 2008; Cropley, Cropley, Kaufman, & Runco, 2010; Cropley, Kaufman, White, & Chiera, 2014). Some of this research takes a broad perspective by looking at the creativity present in terrorists (Gill, Horgan, Hunter, & Cushenbery, 2013) and criminals (Cropley & Cropley, 2013). Most studies within this realm look at negative traits associated with the creative individual, from aggression (Lee & Dow, 2011) to dishonesty (Beaussart, Andrews, & Kaufman, 2013; Gino & Ariely, 2012) to deception (De Dreu & Nijstad, 2008) to lower emotional intelligence (Harris, Reiter-Palmon, & Kaufman, 2013).

These disparate views can easily coexist. Someone could be more prone to be aggressive and to be in a better mood. A reflection on the last several decades in Wall Street can provide numerous examples of dishonest, deceitful people who have been promoted and earn high salaries (see, e.g., Babiak, Beumann, & Hare, 2010). Creativity itself, like intelligence, is an ability that can be used to try and save the world or destroy it.

Yet which view dominates public perceptions of creative people and creativity itself? Recent studies have indicated that the dark side may be winning. Mueller, Melwani, and Goncalo (2012) found that although people did not show an explicit bias against creativity, their implicit beliefs were more complex. In an initial study, the authors primed some participants to feel uncertain by offering additional payment based on a random lottery system; the control group was not offered anything extra. In a second study, participants were told to write an essay that either praised or criticized the concept of uncertainty. It is important to note that in both studies, not only did neither group of participants show any explicit bias against creativity, but most showed a slight positive association. However, the "uncertainty" group in the first study and the "criticizing uncertainty" group in study two showed an implicit, unconscious bias against creativity.

These hidden attitudes emerge in the workplace and in the schools. Mueller, Goncalo, and Kamdar (2011) found that creative employees were not perceived as showing high leadership potential, even when they parroted prewritten creative responses rather than giving their own spontaneously creative answers. Such negative perceptions can also be found within the classroom. Similarly, although there are certainly studies that demonstrate that teachers feel favorably about creative students (e.g., Runco, Johnson, & Bear, 1993), many others suggest a stronger anti-creativity bias. Most notably, Westby and Dawson (1995) found that teachers claimed to like creative students – but they defined creativity using words like "conforming" and "well-behaved." When they were presented with adjectives that typically describe either creative or less-creative students, they preferred the descriptions of less-creative students and disliked the creative ones.

This potential anti-creativity bias can have specific, real-world implications. For example, most innovative products fail (Heidenreich & Spieth, 2013). One reason is that these creative products can encounter passive and active resistance from consumers (Ram & Sheth, 1989), especially from those who are older (Laukkanen, Sinkkonen, Kivijärvi, & Laukkanen, 2007). Consumers can delay adopting new technology, reject it, or actively resist it. There is greater potential for active opposition when the perceived risk (to self, society, or cultural norms) is higher (Kleijnen, Lee, & Wetzels, 2009). Given the importance of cognitive diversity and approaching problems and opportunities in a "macro" sense (Ambrose, chapter 2, this volume), such setbacks do not just impact the individual, organization, or even the country in question; genuine ripples may impede our progress as a global unit.

It is important, then, to recognize that negative attitudes do not necessarily illustrate a simple dislike of creative people or change. Creativity represents a trade-off. Creativity requires a significant investment of time and resources (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Unsworth & Clegg, 2010). Creative workers can be less thorough, conscientious, and attentive (Miron, Erez, & Naveh, 2004), more devoted to their personal careers than their company (Madjar, Greenberg, & Chen, 2011), and more apt to increase conflict (Miron-Spektor, Erez, & Naveh, 2011).

In the classroom, the biggest issue may be a disconnect between the abstract concept of creativity versus the messier reality. Aljughaiman and Mowrer-Reynolds (2005) found that teachers often do not understand what it means to be creative, even when claiming to like creativity. Many studies have produced related findings in which teachers' beliefs about creativity do not reflect actual research. For example, teachers usually associate creativity with the arts instead of knowledge (Diakidoy & Phtiaka, 2002; Seo, Lee, & Kim, 2005). De Souza Fleith (2000) reported that teachers did not see the relationship between creativity and rewards, intrinsic motivation, or self-evaluation. Schacter, Thum, and Zifkin (2006) found that few of the teachers they observed employed instructional strategies that supported creativity.

Creativity has as many costs in the classroom as it does in the workplace. Creativity is often associated with impulsiveness, nonconformity, and other disruptive behaviors. Teachers dislike these behaviors in the classroom (Aljughaiman & Mowrer-Reynolds, 2005) and prefer bright students over creative ones because they are less impulsive and more conforming (Cropley, 1992; Karwowski, 2010; Torrance, 1963). Bachtold (1974, 1976) found that teachers, parents, and students generally did not consider creativity important. They placed more value on traits such as health, consideration for others, and self-confidence than on creative descriptors. In another study where teachers and undergraduates rated fake profiles of creative and less-creative children, the teachers deemed creative children more likely to engage in disruptive behavior (Scott, 1999).

As much as it may be painful to admit, it needs to be acknowledged that these associations do not emerge from thin air. Creative students can be difficult and

unruly. Brandau et al. (2007) found that students who were rated by teachers as being hyperactive, impulsive, and disruptive scored higher on a test of creative fluency. Creativity has been associated with behavioral problems in underachieving high school students (Kim & VanTassel-Baska, 2010). One possibility is that if teachers like creative students less, then they may be more likely to discipline them; an alternate possibility is that creative students simply demonstrate more poor behavior. Indeed, creativity has been linked with less desirable personality facets such as hostility (Feist, 1998), disagreeableness (King, McKee-Walker, & Broyles, 1996), and arrogance (Silvia, Kaufman, Reiter-Palmon, & Wigert, 2011).

So it is fair to say that some of any underlying anti-creativity biases may be truly rooted in genuine disobedience, unpleasantness, or cost efficiency. But we would argue that resistance to creativity does not simply come from misbehaving brats or inattentive, resource-demanding employees. It comes from our own human nature.

This bias begins in childhood as we begin to assume the roles of who is popular and who is ostracized. These roles are in part, so to speak, determined by creativity – and the creative one is often placed in the role of the outsider. This situation is not new; going back more than half a century, Torrance (1961) warned that a highly creative child would inevitably have difficulty adjusting due to nonconformity and "must either repress his creativity or learn to cope with the tensions which arise from being frequently a minority of one" (p. 31). Children tend to abandon individually acquired behavior and adjust their responses to match their peers after seeing them demonstrate a behavior. These tendencies are even stronger when peers are present (Haun, Rekers, & Tomasello, 2014). Children naturally gravitate towards conformity for the sake of social acceptance. Of course, the need to conform is not limited to children (e.g., Cialdini & Goldstein, 2004).

Whether a child is accepted by their peers (or, in other words, if a child is popular) is related to his or her creativity. Gebart-Eaglemont and Foddy (1994) identified four sociometric groups: popular, academic, rejected, and neglected. The majority of the highly creative children fell in the neglected, or ignored/invisible, group. In addition, there was a strong relationship between teacher assessment of creativity and academic group status, suggesting that peer status is influenced by teacher perception. Lau, Li, and Chu (2004) found that creativity was affected by students' social status. Children classified in the rejected peer group tended to score low on social characteristics and self-concept, but highly on creativity and academic self-concept. Children in the popular group scored highly on social characteristics and self-concept, and low on creativity.

Children's desire for conformity and peer acceptance sometimes drives their behavior beyond mere rejection or neglect of their more creative peers. Research on social anxiety has shown that discrimination against out-group members is one way to achieve acceptance by in-group members (Fenigstein, Scheier, & Buss, 1975). This discrimination may manifest in one of the many forms of bullying. Victims of bullying may be perceived as different and thus excluded from the group (Tanaka, 2001). Children are at a greater risk of becoming victims of bullying if they are

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different from their peers (in a negative way) in either appearance or behavior (Georgiou & Stavrinides, 2008). Students who participate in several extracurricular activities, such as music, theater, student government, yearbook, or literary publications, are more likely to be bullied than those who do not (Peguero, 2008). Victims of bullying tend to have fewer friends, who are usually victims themselves, while bullies have larger social networks that include other bullies as well as friends who support their behavior (Salmivalli, Huttunen, & Lagerspetz, 1997).

This behavior carries over into adulthood. One study of more than 1,000 US college students (Chapell et al., 2004) found that 61% have seen a student get bullied by another student and 44% have seen a teacher bully a student. In another study at a Finnish university, 4.5% of respondents reported having been bullied more than once during the semester, a few times a month, or daily (Sinkkonen et al., 2014). Half of the bullies were other students; half were teachers or university administrators. These examples of adult bullying are not necessarily attributable to creativity. People are victimized for any number of reasons. However, there is evidence to suggest that victims of workplace bullying score higher in openness to experience (Rammsayer, Stahl, & Schmiga, 2006), which is the Big Five personality trait most highly correlated with creativity (Feist, 1998).

Just as creativity has negative connotations (even implicitly), conformity has positive connotations. People prefer what is familiar. We think something must be good simply because it exists (Eidelman et al., 2009). We gravitate towards the mainstream, and we like the status quo (Eidelman & Crandall, 2012). This phenomenon is illustrated by the mere exposure effect, wherein simple repeated exposure to a particular thing will increase one's preference for that thing (Zajonc, 2001). The longer something exists, the more we like it (Eidelman et al., 2010). It could simply be that well-established things tend to be safe bets. Or maybe it's because there are more opportunities for exposure to that thing over time. This effect is why Coke and McDonalds bother advertising – it's not to make people aware of their products, but rather to stay in our thoughts.

Although people prefer certainty, people also experience more pleasure under uncertain conditions than certain ones. For example, people will feel greater immediate pleasure when they know an event will be positive (such as winning a prize) but do not know the specific details (Lee & Qiu, 2009). In fact, we feel better and the good feelings last longer (Wilson, Centerbar, Kermer, & Gilbert, 2005). Van den Bos et al. (2007) tested a model for managing personal uncertainty, or uncertainty about oneself. They proposed that people try to protect themselves from situations that make them feel uncertain. While people sometimes seek out new and uncertain situations, they do so while managing the amount of uncertainty encountered. Van den Bos et al. found that people react negatively to social deviants when they consider uncertainty to be emotionally threatening. The feeling of uncertainty led people with negative attitudes toward social deviants (specifically homeless people) to distance themselves both objectively and psychologically from those individuals and things associated with them.

How people react to uncertainty can be influenced by group membership and perceived social deviance. Hogg et al. (2007) found that people who feel uncertain about themselves identify more strongly with groups that are highly entitative, or clearly defined and structured. Two studies by Adarves-Yorno, Postmes, and Haslam (2007) demonstrated that group norms can influence what people think is creative. They first primed people to either think about group-based identity or their own personal identity, and then formed groups and asked them to produce creative fliers. Those people primed for group-based identity produced creative work that gravitated toward group norms and showed a preference for creative work that was consistent with group norms. People who maintained a focus on their personal identity were both more willing to deviate from group norms in their own creativity and to better appreciate creative work that defied these norms. A second study showed that these effects continued even when people were working alone.

It is generally accepted that diversity within a group can foster creativity (Chatman, Polzer, Barsade, & Neale, 1998). West and Dellana (2009) found that cognitively diverse groups make better decisions when solving complex problems. Karwowski and Lebuda (2013) argue that groups that dynamically interact together and develop energy from collaboration are a key component of an ideal creative climate. Such importance again draws back to Ambrose's (chapter 2, this volume) conception of cognitive diversity as a macro-opportunity and 21st century skill. As the world grows more complex and as technology allows collaborations to become simpler, it will become more important to overcome initial resistance (and even dislike) of creativity.

However, diversity is not simply a pure positive. Deep-rooted diversity can actually result in a less creative final product. Diversity in underlying perspectives can lead groups to generate a greater number of creative ideas, but their final output (the idea on which the group converged) may be no more creative than that of groups without deep diversity (Harvey, 2013). This suggests that when a group must come to a consensus to deliver a single product, deep level diversity within the group may hinder agreement on a final creative output. This is particularly important in the face of the macroproblem of dogmatic thinking that Ambrose (chapter 2, this volume) notes. Even if individuals bring unique perspectives, groupthink can nonetheless quiet these voices.

Nemeth and Ormiston (2007) gave groups two brainstorming tasks. One set of groups remained unchanged for both tasks; the other set was reshuffled into completely new groups for the second task. Groups that changed membership increased both the number and originality of ideas generated. However, groups with stable membership perceived their brainstorming as more creative than did the change groups – but they were wrong.

So not only do we prefer situations that inhibit creativity, we also have difficulty assessing creativity within ourselves. The research literature is not fully consistent; there are studies that show a connection between self-ratings and divergent thinking scores (Batey Furnham, & Safiulina, 2010; Furnham, 1999; Furnham et al., 2006;

Furnham et al., 2008). In addition, self-ratings of creativity can align with supervisor ratings (Ng & Feldman, 2012) and teacher ratings (Beghetto, Kaufman, & Baxter, 2011). However, most studies that have examined actual creative work have shown that self-rated creativity does not usually correspond particularly well with expert-rated creativity (Karwowski, 2011; Kaufman, Evans, & Baer, 2010; Pretz & McCollum, 2014; Priest, 2006; Reiter-Palmon, Robinson-Morral, Kaufman, & Santo, 2012).

This disconnect should not be news to those who regularly watch talent competition shows, which are filled with people who believe they possess rare creative abilities that are not obvious to the viewer (or the judges). Indeed, Kaufman et al. (2010) coined "American Idol Effect" after finding virtually no relationship between creative self-beliefs and creative performance. In many cases, people may simply be unaware of how untalented or inept they actually are (Dunning, Johnson, Ehrlinger, & Kruger, 2003; Kruger & Dunning, 1999).

The ability to recognize one's own creativity is consistent with the broad concept of metacognition, which is the ability to monitor one's own learning, perform self-evaluation, and then make plans accordingly (Everson & Tobias, 1998; Flavell, 1979). A person with high metacognitive ability is able to recognize their own limitations and estimate their likelihood of succeeding at a task with a high degree of accuracy. Creative metacognition involves how accurately a person can assess their own creativity and whether they know when it is appropriate to be creative (Kaufman & Beghetto, 2013).

Creative metacognition is an understudied topic, but it may carry great importance. Turning to the animal kingdom, the awareness of creative and new concepts may be linked to the ultimate positive outcome – survival. Animals can be spontaneously attracted to novel foods, objects, or places (neophilia), or they can be repelled by them (neophobia; Greenberg, 2003). Animals that are able to self-regulate these responses in environments where exploration is both risky and necessary are more likely to survive than species that are unable to maintain this balance (Greenberg & Mettke-Hofman, 2001). This makes logical sense. The zebra that chooses to explore a new stream and avoid the strangely moving tall grass is less likely to become lunch.

Other studies have suggested that creative behavior in food gathering (Heck & Ghosh, 2002) and feeding the young (Sen & Gadagkar, 2006) may improve a species' chances for survival. Kaufman and Kaufman (2004; see also A. Kaufman, Butt, Kaufman, & Colbert-White; 2011, A. Kaufman & Kaufman, 2014) have proposed a framework for creativity in animals that includes recognizing and seeking out novelty, observational learning, and innovative behavior. This framework provides a neurological and physiological basis for creative behavior in animals and links it to creativity in humans.

Creative metacognition is less likely to play a direct role in human survival, although it certainly could (consider an airplane pilot who decides to try a creative maneuver on a routine landing). It is more likely, though, to impact how people end up feeling about their creativity, as well as other people's creativity. If someone is

creative in the wrong situation or misjudges his or her creative abilities and repeatedly fails, that person may be less likely to be creative again or to view creative activities in a favorable way. Similarly, if someone's exposure to creativity in other people is dominated by bad art, poorly-timed creative interludes, and misjudged humor, he or she may have negative opinions subtly reinforced. Many forget that creativity involves taking appropriate risks, not flinging one's self off the edge of the precipice. Indeed, the difference between a sensible risk and a silly risk can be a very fine line. It is easy to forget how conditioned we are to be wary of risks.

CONCLUSION

Ambrose (chapter 2, this volume) highlights a 21st century in which there will be macro-opportunities to solve macroproblems, and we can harness our collective microexpertises and work together, across populations and domains, to solve the great issues dominating our times. This idea is an important one. In this chapter, we highlight a few notes of caution. People claim to value creativity, yet their actions demonstrate an implicit bias against actual creativity. It is easy to highlight this discrepancy and worry about the state of the field, not to mention the state of the world. But the issue goes deeper. People are bad at recognizing creativity within themselves. We often dislike creative behaviors in others. We are hard-wired not to like that which is different, complex, or uncertain. These things are innately repellant to us as a species. As they are associated with creative behavior, it would be logical to conclude that we should not like creativity.

This line of thinking brings us back to our opening epigram, in which we wonder if we are asking the wrong question. Instead of decrying the lack of creativity in schools or bemoaning how it is poorly rewarded in life and work, we find it more remarkable that we have come as far as we have in terms of attempting, appreciating, and revisiting creative activity. How many things take effort, consume resources, and are frequently not externally rewarded or valued – and yet somehow persist throughout generations?

If creative behavior at the individual level has continued throughout the ages despite so many reasons for it to cease, then perhaps it is possible for cultures and domains to work together to solve the key issues of our time. Perhaps it is possible that we can use our educational systems as a tool to build interdisciplinary, critical, and creative thinking. As a species, we may not yet excel at recognizing, rewarding, or developing creative ideas – but we can get better.

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MARY E. JACOBSEN AND LORNA GOULDEN

6. A WHOLE NEW WAY OF WORKING WITH CREATIVITY, INNOVATION AND INNOVATORS

The 21st century is being rocked by distinct yet interrelated paradigm shifts—social, cultural, environmental and economic—triggered by an unprecedented and exponential rate of technological development and innovation convergence. The impact has repositioned the world and its inhabitants on the cusp of pervasive global disruption that demands a radically different way of working with innovators. The apparent growth and prosperity from a century of industrial development has camouflaged a critical obstruction of innovative thinking and creativity evolution.

As we venture farther into the 21st century, we face monumental changes unlike any experienced in the current era. Together, the impact of globalization and rapid technological advances are about to reorder the world so profoundly that its inhabitants may feel like foreigners in their own lives. Moreover, the years of growth and prosperity brought about by a century of industrial revolution cannot serve as a useful guide. Over the past fifty years the "average per capita income almost tripled, and the global economy expanded six fold in GDP terms" (Dobbs, Manyika, & Woetzel, 2015, p. 4). It now seems highly unlikely that future growth will rematerialize as the "rapid upward trajectory of recent decades" (Dobbs, Manyika, & Woetzel, 2015, p. 4) with poverty and inequality set to rise rather than decline in both developed (van Zijl, 2015) and developing areas of the world.

GLOBALIZATION, DISRUPTION, CHALLENGES AND OPPORTUNITIES

Globalization is not, of course, a new concept, though it may mean different things to different people. No matter how it is defined, there is little doubt that globalization will provoke a worldwide makeover of seismic proportion (Hay Group, 2014; World Health Organization, 2015). Yet this will not be the first or only global shift that rocks the world. Peter Druker (1994) puts this into perspective:

> Every few hundred years in Western history there occurs a sharp transformation. Within a few short decades, society rearranges itself; its worldview (paradigm), its basic values, its social and political structures, its arts, its key institutions. Fifty years later there is a new world. (p. 75)

Globalization is a complex matter, giving rise to unprecedented challenges (macro-problems) while also presenting unique possibilities for advancement

(macro-opportunities). Some forecasters predict that by 2100 we will be able to browse the Internet through our contact lenses, eradicate cancer cells by sending nanobots into our bodies, and some of our closest work associates will be intelligent computers (Kaku, 2011).

Paradigm shifts will also shake up our understanding and experience of work. Indeed, our entire perception of work is on the verge of radical change. In the future, "business as usual" will be very different from our understanding of business as we know it today. Computers have already caused a shift in the occupational structure of the labor market (Autor & Dorn, 2013; Goos, Manning, & Salomons, 2009), with further levels of disruption anticipated to go far beyond anything we have experienced. While opinions are divided, some experts argue that unlike previous economic paradigm shifts, the broadening range of technological capabilities, coupled with an exponential rate of change (see Kurtzweil, 2001), will ultimately destroy jobs faster than they can be created (Brynjolfsson & McAfee, 2011; Smith & Anderson, 2014).

Technological advances present both macroproblems and macro-opportunities. The boom-bust business cycles driven by technology innovation have historically been a net creator of jobs, forcing the development of new skills to meet new demands, but not without causing severe hardship for many in the short term. As old jobs are shed and incumbent companies go bankrupt, hardship will continue into the long term for those who cannot acquire the skills and work experience needed to operate in entirely new professional domains. This process is referred to as *creative destruction* (Schumpeter, 1943). Technological progress does indeed grow the economy and create wealth, but there is no economic law that says everyone will benefit. "In other words, in the race against the machine, some are likely to win while many others lose" (Brynjolfsson, 2013, para 36).

Within this context it is important to recognize that advances in technology have not been confined to routine manual and cognitive tasks. A growing convergence of technologies (e.g., the Web, artificial intelligence, big data, improved analytics) is bringing computerization into more complex cognitive and service-driven domains. For the first time, organizations and professions traditionally insulated from automation intrusions are experiencing the effects of computational disruption (Frey & Osborne, 2013).

THE IMPACT OF GLOBALIZATION ON ORGANIZATIONS

The world's organizations will be confronted by a mixture of new problems and opportunities. The rapid growth of digitalization has already given birth to "hyperscale businesses …that are challenging conventional management intuition about scale and complexity" (Chui & Manyika, 2015, para. 1). Emerging from the search, social networking and e-commerce sectors, these hyperscale big data businesses are scaling up and branching out, while requiring relatively few employees to do this compared

to traditional industry measures. These companies have achieved such a scale of operating leverage through algorithm-driven automation and insignificant marginal costs for storing, transporting, and replicating data that they are set to "rise up and disrupt traditional businesses at speeds that will surprise the unprepared" (Chui & Manyika, 2015, para. 5).

The industries already facing disruption are wide-ranging and varied, from finance, transportation, healthcare, education to media and communication. It is therefore curiously paradoxical to chart the path of current disruptions from the narrow perspective of established organizational activities and innovation practices, or by reflecting on the outcomes of previous technology-driven economic paradigm shifts. The very nature of current technological developments—speed, convergences and unprecedented capabilities—indicate that a totally new way of thinking and a radically different way of working with creativity and innovation will be required, including the way we think about the *path, impact,* and *creative strategies* to deal with emerging paradigm shifts—essentially a shift in paradigm shifts

It will no longer be sufficient for organizations to anticipate competitive threats coming from within the confines of their own sectors. Consider recent movements of the Tesla automotive company toward the energy business (Chediak, 2014), and Apple's heavily-rumored interest in the automotive industry (Newcomb, 2015). With the onset of the Internet of Things, billions of connected devices are creating a world of objects and places augmented with sensing and information processing capabilities (van Kranenburg, 2007). In manufacturing, technological advances have resulted in metamaterials being artificially engineered to exhibit properties not yet found in nature (DOE/Ames Laboratory, 2012). Furthermore, additive manufacturing has enabled the 3D printing of objects, including body parts (Johnson, 2015), electronic devices (Borghino, 2015) and backpack-sized jet engines at GE Aviation (2015). The convergence of digitalization with physical manufacturing of innovations is indicative of an emerging competitive landscape that is far more connected, complex and uncertain than ever before.

Creative and innovative forces are breaking free from traditional industrial domains with the rise of open source software and hardware, heralding a democratization of both technology and design that is bringing accessibility to an increasing group of independent developers and creative start-up potentials (Goulden, 2013). They are gaining one more degree of freedom in proactively shaping and modifying technologies, both in terms of design and use (Jesiek, 2003). In some instances, additional freedom may provide a macro-opportunity. Jeremy Rifkin (2014) underscores the growing legion of consumers who are becoming producers due to the impact of near zero marginal cost, triggering an economic shift from markets to collaborative commons. These *prosumers* are producing and sharing knowledge, news and entertainment, as well as renewable energy, 3D-printed products and online college courses. Prosumers "are also sharing cars, clothing and tools, entirely bypassing the conventional capitalist market" (Rifkin, 2014, para. 12).

This unparalleled accessibility could provide a potentially powerful mechanism to enable lower class groups to break free from their fragile reliance on traditional industry-controlled employment, while also creating new opportunities for the middle classes who are being automated out of the regular job market as illustrated by the emerging tech start-up scene "rising from the ashes of the once proud auto-manufacturing City of Detroit" (Relander, 2015, para. 1). But as with all periods of creative destruction, there will inevitably be members of an increasing demographic that lack the access and adequate education to develop the necessary skills and innovative flexibility. And just as organizations face a struggle to survive, less fortunate individuals will struggle to find a means of support for themselves and their families while also facing a potentially irreversible social exclusion.

In this highly charged global climate, organizations are more aware than ever of the critical relationship between innovation and business sustainability. Results of the 2014 PwC CEO Survey spotlight the essential nature of innovation in terms of organizational growth:

> the growth lever that has the greatest impact is innovation… The most innovative companies are set to grow at twice the pace of the global average, and three times the least innovative… CEOs ranked innovation as the #1 approach for growth. Increasing competitive pressures and a need to deliver growth mean that CEOs recognize the need to bring new products and services to market quickly and efficiently. (p. 1)

In nearly every direction familiar boundaries are disappearing. Whereas in the past geography and social boundaries were major impediments for business, now they are merely "secondary circumstances" beckoning to be overcome (Olivero, 2011, para. 1). As the intensity of global competition rises, in order to succeed, perhaps even to survive, organizations must do more than elevate innovation to the top of their priority list. They will need to become proactively involved with innovation, promoting and encouraging creative efforts (Atwater & Carmeli, 2009; Lovelace & Hunter, 2013; Martin, 2009; Mumford & Licuanan, 2004; Mumford, Hunter, Eubanks, Bedell, & Murphy, 2007; Rae, 2014; Tushman, Anderson, & O'Reilly, 1997).

Organizations will need to pay very close attention to the creative process itself, not just the outcome (Byrne, Mumford, Barrett, & Vessey, 2009; Hunter, Cassidy, & Ligon, 2011; Lovelace & Hunter, 2013). For some organizations this will present macro-problems, especially given the intensity and urgency of pressure to change. In particular, to stay apace with the competition, organizations need to develop new ways of thinking about idea generation, better ways to promote creative endeavors, and more effective support of the innovation process from start to finish. Organizations with strong performance on innovation succeed because they are open to new ideas, patient with experimentation, and accepting of innovation's inherent risks (Kirkpatrick & Maroney, 1998). In a 1998 *Fortune* interview Steve Jobs stresses the role of innovative people as the core of innovation:

Innovation has nothing to do with how many R&D dollars you have. When Apple came up with the Mac, IBM was spending at least 100 times more on R&D. It's not about money. It's about the people you have, how you're led [*sic*], and how much you get it. (Kirkpatrick & Maroney, 1998, para. 12)

For future workers to win in the talent race, they will need to develop skills that are inherently difficult to automate, including such abilities as complex perception and manipulation that requires tactile feedback (e.g., surgeon), creative acuity (e.g., biological scientist), and social intelligence (e.g., psychologist) (Dearborn, 2014; Frey & Osborne, 2013). According to Dov Seidman (2014), we are in the process of shifting from a *knowledge economy* to a *human economy*. As such, the most valuable workers will be "hired hearts", bringing essential traits "that can't be and won't be programmed into software, like creativity, passion, character, and collaborative spirit—their humanity, in other words" (p. 1). For organizations to be resilient to the coming wave of creative destruction, they will be called upon to reinvent the ways in which they work with those who possess exceptional creative and social intelligence, and the ability to generate and implement big ideas— individuals who will be the key to innovating with intent.

A NEW WORLD OF WORK AND INNOVATION

How we work, and even the very meaning of work, is already entering a period of upheaval. Organizations that are customarily open to change or have established a genuine climate of innovation will surely fare best. Tomorrow's workforce will be remarkably different. Even now, employees entering the workforce have different goals and higher expectations than their predecessors. They are more globally minded and thoroughly connected, possess incredible technological know-how, and are typically more demanding. Exceptionally creative employees are well aware of the fact that there is a global shortage of critical skills and innovative talent.

Work is being reimagined and redesigned worldwide. According to Deloitte's 2014 Global Human Capital Trends report (Bowman, Geddes, Flynn, & Sumberg), innovation will be seen in nearly every aspect of organizational life, especially in its relationships with the people who work there. The report essentially puts today's organizations on notice, providing a list of "imperative" actions:

• elevate innovation to the top of the list
• redesign and modernize HR practices
• re-energize the learning process by putting employees in charge
• fashion new ways to seek out key talent and capture their interest
• include passion and engagement as a top priority
• intensify diversity and inclusion as drivers of innovation (p. 4).

The last imperative in this list is related to a macro-opportunity to link creativity with cognitive diversity for more effective collaboration:

> Understanding that diversity of thought is a real driver of value is key to organizations' ability to harness the power of collective difference. Different approaches can yield new solutions, uncover new ways of working and inspire new innovations. (Tulsiani, 2013, para. 2)

Moreover, because creative thinking and idea generation are inextricably tied to talented people, a clear understanding of what they need to engender breakthrough ideas and conceive of pioneering innovations is an essential agenda item in any discussion of competitive advantage (Anderson, De Dreu, & Nijstad, 2004; Anderson, Potocnik, & Zhou, 2014; West, 2002a; Zhou & Shalley, 2003). Major shifts of power—from manager to employee—are expected to rapidly change organizational management practices (Deloitte, 2014). For instance, innovators in the job market today are less acquiescent than workers of the previous generation, and quite definite about what they want. One in three young applicants identifies *flexibility* as the top reason for taking a job because they fully intend to integrate work and life (Seaward & Law, 2014). Furthermore, the quality of their work experience will be a primary concern. Three overarching questions will occupy the minds of outstanding innovative applicants: *What is it really like to work here? Is this company genuinely innovative, or do they just talk about it and stay within their comfort zone? Will the work be exciting and challenging, or will I quickly sink into boredom (again)?* Skepticism is very common among highly creative employees, and for good reason. No matter how much they may wish to stay with their current employer, creative high achievers and brilliant problem solvers will reach a point of no return if they feel unduly constrained or their ideas are repeatedly dismissed without consideration (Jacobsen, 2015). At that point, their creative energy will shift to finding a job elsewhere.

In this regard, it is enlightening to examine opinions from innovators themselves. To date, in an ongoing exploratory global survey of high-ability creative adults, 67% of participants have endorsed "feeling held back" as their number one reason for leaving an organization (Jacobsen, 2015). When exceptional employees depart, the organization they leave behind must deal with the fallout: (1) they will take all of their talent, future ideas and creative insights with them, (2) the word will go out that the company does not adequately support innovators, and (3) they often go directly to the competition or become entrepreneurial competitors themselves (Jacobsen & Ward, 2007). Experience informs us that organizational leaders rarely concern themselves with the views of innovators, in large part because their notions of innovation are disconnected from those who innovate.

RETHINKING THE CENTRAL ROLE OF INNOVATORS AND CREATIVE INTELLIGENCE

Today's discussions of innovation typically revolve around products and processes, not human initiative. However, the source of innovation is the talented people who

possess exceptional creative intelligence. For them, "creativity acts as a springboard for innovation that requires creative ideas from internal and external sources. Innovation, therefore, is appropriately defined as the successful implementation of creative ideas" (Lovelace & Hunter, 2013, p. 60). Innovators are discoverers who relish in hunting down the nebulous aspects of a budding idea, considering it from every angle, and playing with what-if possibilities. These are the approaches that spark unique ideas, new ways of doing things, insightful changes of direction, and revolutionary products (see Amabile, Conti, Coon, Lazenby, & Herron, 1996; Byrne et al., 2009).

Typically, the outcome of innovation is much easier to recognize than the people who do the innovative work. Who then, are these innovators? What do we know about them? Fortunately, researchers of human traits, high ability, and performance excellence provide a wealth of information. Innovators and advanced thinkers are a relatively small group of people with special abilities that allow them to formulate original concepts and fashion novel, yet practical ways to operationalize them. On the surface, innovator traits might be observed as "wild ideas," effortless problem identification and solving, independent thinking, a love of exploration, playing with possibilities, surprising questions, and/or a discerning eye for excellence (Batey, Chamorro-Premuzic, & Furnham, 2010; Costa & McCrae, 1985; Goldberg, 1990; see Jacobsen, 2000a, 2000b, 2008; John, 1990).

Contrary to popular opinion, the actual characteristics of individuals with exceptional creative intelligence do *not* correspond with the stereotypes so often portrayed on television and in movies (Jacobsen, 2000a). Rather, their behaviors are the result of an interaction of three particular human traits—high cognitive ability, high levels of task commitment, and high levels of creativity (Renzulli, 2002). Together these form the basis of high potential, ingenuity and exceptional accomplishment and are available to be applied to any area of human performance (Lubinski, Webb, Morelock, & Benbow, 2001; Renzulli & Reis, 1997; Renzulli, 2002). Highly creative individuals often take on important leadership roles in the process of innovation as well. Because creative endeavors are replete with risk, it is important to note that effective leaders of innovation approach and handle risk differently from their peers. This difference (as well as situational factors) can significantly affect outcomes of innovative effort, as Benson and Campbell (2007) explain: "the willingness to take risks (calculated compared with outlandish) and think creatively at appropriate times are the very things that can distinguish leaders from nonleaders and great leaders from mediocre ones" (p. 245).

With the growth of competition for innovative employees it would be prudent for organizational leaders to reassess their position, asking themselves key questions: *Are we positioned to advance innovation or lag behind? Would high-value innovators find our company future-focused or stuck in the past?* Indeed, " some of the biggest opportunities for companies to improve growth, innovation, and performance center squarely on how business leaders reimagine, reinvent, and reinvigorate human capital" (Deloitte, 2014, p. 4). As we go forward, serious changes to conventional

work patterns will also create new landscapes designed to foster creative excellence. Innovation-savvy companies will establish a work climate that adequately supports creative people and their endeavors.

These changes are all the more important given that many organizations view innovation from a single perspective—the operation of business (Jacobsen & Ward, 2010a). In doing so, organizations dehumanize innovation by essentially categorizing it as a commodity and working with innovators accordingly (Ward & Jacobsen, 2010b). Although there is no excuse for continuing to robotize the image of creative people, perhaps the elusive nature of innovation is a contributing factor. Prior to the inauguration of an exciting new product or the implementation of an ingenious process, the work activities of innovation are largely unseen. Especially for anyone who is not an innovation insider, one of the prominent features of innovation and design is the ability to "imagine that-which-does-not-yet-exist [remaining] surprisingly invisible and unrecognised in the world at large, [an activity that is] … notoriously difficult to define, tough to measure, hard to isolate as a function, and tricky to manage" (Nelson & Stolterman, 2014, p. 12).

Innovation requires cognition on a much higher level than people may realize—complex simultaneous and multi-track thinking that is extraordinarily original (Ward, 2004). Individuals with exceptional creative intelligence do not need to be prompted to "think outside the box". Their intense curiosity, predisposition to look at things differently, and capacity for managing contradictory viewpoints result in easy shifting between convergent and divergent thinking (Jacobsen, 2000a). This is all the more important in light of the fact that creative thinking can make a significant impact on organizations that successfully embed innovation within a culture of creativity *and* give it a seat at the leadership table. For example, according to the Design Management Institute's 2014 Design Value Index, "Design driven companies outperformed the S & P over ten years by 228%" by using design as an "integrative resource to innovate more efficiently and successfully" (Westcott, 2014, para. 4).

IDENTIFYING BARRIERS TO INNOVATION

From a consumer's point of view it may seem that innovation advances freely and steadily behind the scenes. In reality, this assumption has camouflaged resistance to innovative thinking and overlooked obstruction of creative evolution. The seriousness of this cannot be overstated. More than a few times we have encountered a troublesome disconnect between what organizational leaders believe about their working relationships with innovators and the feelings of the innovators themselves (see Amabile, 1998). When new or unpopular ideas are first presented they almost always encounter resistance. According to Sternberg and Lubart's (1991, 1995) investment theory of creativity, it is the creative people who are willing and able to pursue the ideas that are unknown or out of favor but have growth potential,

persisting in the face of resistance to eventually sell high before moving on to the next idea or innovation (Sternberg, 2006).

The innovator's perspective is essential in this regard, though oddly a rare focus of interest for organizational leaders. From nearly two decades of direct experience advising an array of highly creative individuals around the world (Jacobsen, 2015), and from consulting with scores of global talent managers (Ward & Jacobsen, 2010b), two critical errors repeatedly emerge, errors of omission that can seriously undermine innovators and thwart innovation goals: (1) organizational leaders do not have an accurate or sufficient understanding of innovative people to attract and successfully engage them, and (2) valued innovators are almost never asked about what they need to thrive in an organization. Generally, management is completely unaware of these two critical errors, paving the way for a serious rift between innovators and administrators that could have been prevented.

Stress also presents a barrier to innovation. Recently, investigators have studied the effect of various stressors on the creative process (see Ren & Zhang, 2015). Contrary to earlier assumptions, not all stressors are harmful or negative. Some researchers have found that the relationship between stress and creativity is curvilinear arguing that moderate stress is optimal for creative performance (Baer & Oldham, 2006; Gardner, 1986). Stressors can exert positive pressure if they are interpreted by the innovator as stimulating or the kind of tension that inspires creative thinking. Stressors can also have a negative impact when they are perceived as unnecessary obstruction that suppresses innovative efforts. A particular stressor, job control (opportunities to influence one's work and working conditions), has been found to have a direct positive effect on both initiative and innovation (Fay, Sonnentag & Frese, 1998). It is important to note, however, that even in organizations with an innovation-supportive climate, when innovators are confronted by high-hindrance stressors, idea implementation is likely to decline significantly and idea generation may utterly disappear (Ren & Zhang, 2015).

Of all the barriers to innovation—financial constraints, stress, interpersonal conflict, limited resources—distrust is perhaps the arch enemy. Ivanov (2012) argues that innovation thrives only in organizations of trust, and when employees do not trust their organizations they tend to withhold new ideas. Similarly, employers do not always trust their employees. Consequently, management might be inclined to establish rigid control mechanisms and strict policies such as extensive reporting and suspiciously checking employees' activities.

In some ways the innovation process itself is susceptible to distrust. The roles of innovator and manager are two very different things. On the one hand, the innovator's job is to shake things up, dispute conventional thinking, propose and lobby for new ideas, and firmly believe that their dreams and imagined designs can become realities. On the other hand, innovation management is necessarily attentive to more concrete matters like budgets, allocation of resources, financial risk, production costs, and making decisions based on what's "best for the organization." That being

the case, managers approach creativity from a different vantage point, more focused on the probability of innovation success, return on investment, mounting expenses, and the cost of unmet deadlines. Amabile and Kramer (2012) refer to this as the *mediocrity trap*.

Trust is essentially a matter of perception and belief and must be built over time. According to Mayer, Davis, and Schoorman (1995), trust is comprised of three key factors: ability, benevolence, and integrity. Trust is especially important for innovation given the high level of interaction needed to take a fuzzy idea, grow it, and ultimately implement it—innovation is not accomplished in a vacuum. One could define trust as a collaborative process, though it might be better understood in simpler terms: *sharing, openness to others' views, and willingness to be vulnerable to others' reactions.* In effect, trust is a form of permission to be authentic and free to explore. It "allows actors involved in innovation to share information and collectively solve problems" (Shazi, Gillespie, & Steen, 2015, p. 83), and thereby helps manage risks. Yet trust is rarely on the meeting agenda. In fact, it is almost impossible to discuss aspects of trust in hard-driving business terms when trust is about relationships among human participants. Trust is not easy to earn, and people are very perceptive. Therefore, organizational leaders must purposefully and authentically set an example of trustworthy behavior and insist on practices throughout the company that promote trustworthy conduct (Hurley, Gillespie, Ferrin, & Dietz, 2013; Shazi, Gillespie, & Steen, 2015).

One of the best methods of building trust and motivating innovators is to establish a *climate of innovation* (innovation culture). A climate of innovation can be defined as the degree to which an organization's values and norms reflect a commitment to innovation (West & Anderson, 1996; West & Wallace, 1991). Fortunately, interest in the contextual factors of innovation-promoting environments has been on the rise (King, de Chermont, West, Dawson, & Hebl, 2007). Amabile (1988) suggests that such an environment would include encouragement of creativity, autonomy, and resources. Studies call attention to the strong relationship between work climate and innovation performance, confirming the significance of an innovation culture (West, Tjosvold, & Smith, 2005). Since creative work is complex and often done under pressure, it is worth noting that a climate of innovation also tends to "relieve the negative consequences associated with demanding work" (King et al., 2007, p. 640).

ADVANCING INNOVATION AND SUPPORTING INNOVATORS

Innovation victories are rare, despite what people may think. Consumers have come to expect dazzling new products and technological wonders at every turn. Yet, for every 100 innovative new products that successfully come to market, the standard failure rate is 80 to 90 percent (Ernst & Young, 2015). Although failure can be attributed to many things, frequently it is because innovations are developed and launched in the wrong way when working better with innovators can often prevent it. Not surprisingly, such a high failure rate engenders a fear of risk. It's common

for senior executives to become anxious about innovative projects, though if not carefully considered, anxiety can lead to rejection of higher-risk ventures that might have become high-value products.

There's no denying that some great ideas fall by the wayside while others are shot down at the outset or fizzle, never getting off the ground. Effective leaders of innovation understand that risk is unavoidable, making adjustments as things change without abandoning their belief in the project. In light of the perilous nature of innovation, savvy leadership is essential. However, a decennia-long lack of trust in creativity has slowly reduced its role in innovation to a prescriptive production process to be monitored as sequential, repeatable units of output. As Nelson and Stolterman (2014) observe, "design and creative problem-solving processes for business have been commoditized into branded approaches for delivering expected outcomes … And yet, taming of design by recipe will more often than not disappoint" (p. 29).

Failure to adequately balance the cost of creativity against its value ensures a culture driven by efficiency, quality control and risk reduction. Ironically, this runs counter to the core requirements of creativity, thus establishing organizations in which innovation cannot thrive. Innovation requires giving adequate space to the uncertain exploration and the indefinable aspects of creativity (Martin, 2009; Nelson & Stolterman, 2014) and promoting learning through failure (Tellis, 2012). Without these, the end result is restriction of the evolution of creativity itself, rendering innovators ill equipped to adequately respond to the rapidly evolving forces of disruption.

These approaches to creativity management lie in stark contrast to a significant evolutionary approach initiated by Irene McWilliam, Director of Design Research at Philips Design in 2000. An internal corporate research project was launched to develop a deeper understanding of new approaches, ways of thinking and communicating about the emerging discipline of experience design. Building on comprehensive research into the psychology of human memory and sensorial experiences the innovation team established new methods and tools for innovating designed not only to support with iterative development but also to reduce resistance to these new ideas (Goulden, 2001; Goulden & McGroary, 2003).

This need to evolve the creative process is also an individual characteristic of creative innovators as illustrated by Dutch furniture designer Michael van der Kley (2013) in a presentation at the *One Idea at a Time* event. After purchasing one of the first desktop 3D printers, he gave himself a year to explore the emerging possibilities that this new technology might afford. With no definitive goal or end result in view, he focused purely on a vision to create more humanly appealing, analogue and organic forms with this digital fabrication technology; a common challenge of the creative innovator, transforming the sometimes non-human aspects of technology and tools into value in the human domain. The resulting synthesis of a year of discovery, learning through failure and instigating a shift within his own creative paradigm (early creations illustrate initial struggles to break free from his

well-established "furniture paradigm") gave birth to his breakthrough Project Egg, a global collaboration to print an architectural egg-shaped pavilion first presented at Dutch Design Week in 2014. Yet the evolutionary approaches of both McWilliam and van der Kley are rarely permitted in organizations claiming or desiring to be innovative, or, as pressure rises on an organization's bottom line, these innovation activities will likely be the first to go.

Perhaps the biggest challenge in innovation is when teams are brought in to work on developments in creative isolation by key business decision makers who are either too busy, unfamiliar with, or simply uninterested in taking part in the innovation activities. By failing to participate in the process of generating the insights that lead to breakthrough innovation, these decision makers subsequently struggle to place the innovation results within their current frame of reference. As the innovators communicate the value they have created, yet struggle to do so *because* they are challenging the status quo, the irony is not lost on them—this is often precisely what they have been tasked to do.

With a growing number of high profile disruption failures, such as the Kodak and Blockbuster bankruptcy cases (Lappin, 2012), and the increasing speed and complexity of innovation change, business leaders are becoming noticeably less resistant to radical innovation proposals than a decade ago as the risk of failure becomes more closely balanced with the risk of inaction. Sustained resistance to novel ideas may have driven some innovators to refrain from communicating their ideas before they are more fully formed for fear they will be crushed before they are able to get underway. Others, however, have been creatively evolving approaches to communicate and engage with business decision makers much earlier in the innovation process to bridge the gaps in understanding and reduce the level of resistance.

One example is to visualize the complexity and patterns of insight generation, in an attempt to make it more accessible to a wider audience. For instance, in a recent investigation into the Internet of Things: 300+ examples of ways that Internet-of-Things-related technologies are being applied (triggers and signals) were gathered and clustered from different perspectives. Clustering allows patterns to emerge that are related to developing behavioral impacts being triggered by emerging technological developments. These patterns were perhaps not visible when only looking at one or two examples in isolation. But by presenting the clusters of examples and related insights on a large wall-sized poster, they are externalized for active discussion with the business audience (how the creative brain works internally). Trends can literally be *seen* and more easily discussed from a value, threats, and opportunities perspective (Goulden, 2014). Efforts like these make it possible for administrative decision makers to increase their trust in innovation output, and even to hesitate before killing an idea early on. Getting the right balance of evaluators to be directly involved in the creative process is not without its challenges; with too many *creativity killer*s (> 20 per cent) the innovation level drops dramatically. When that happens, there is often a quick regression to reinventing the wheel or dismissing

any subsequent idea, ingenious though it may be, before it can plant a single seed that might have grown into a truly new and promising innovation.

Fortunately, organizations have constructive options. They can choose to become more knowledgeable about the practical nature of innovative processes and obtain an accurate understanding of innovators and how to best support their efforts. With that as a foundation, barriers to innovation are more readily apparent and therefore more easily corrected. Organizations can develop specific strategies to establish a culture of trust. When organizations and innovators are aligned toward a common goal, and work in an atmosphere of mutual trust, creativity flourishes, outstanding performance becomes the norm, and the results can be extraordinary. As Olivero (2011) predicted, "Once we get the limited thinking out of the way – watch out – that's the world of true globalization where 'anything' is possible" (para. 12).

CONCLUSION

In many respects, life as we know it is fading into history. As inhabitants of a fast-moving world, we all face unprecedented and inescapable change. Globalization is shattering our sense of separateness and technological advances hurry us into a new normal, whether we are ready for it or not. And yet, as we are confronted by challenges and uncertainty, wrestling with questions for which we have no answers, unexpected opportunities will emerge and be seized by those who are prepared and courageous. At this point in history, organizations must decide how they will respond to mounting demands for new products and solutions to complex problems. Leaders will need to redirect their attention to the innovators—the idea generators and ingenious thinkers among the people they employ. Executive decision makers will be called upon to learn how to foster creative thinking and build an innovation-friendly culture. Attitudes will need to be adjusted and practices that undermine innovation will need to be replaced with supportive policies and procedures. Organizations intent on succeeding in the 21st century will take up the challenge of globalization, not only meeting paradigm shifts head on, but creating them with their determination to lead change and advance innovation.

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CATRINEL HAUGHT-TROMP

7. FACILITATING CREATIVE THINKING IN THE 21ST CENTURY

When Constraints Help

Progress often depends on creative thinking and innovation. Be they transformative, paradigm-shifting breakthroughs, or smaller, incremental improvements that may have less of an impact on their own but still contribute to progress, creative ideas can help solve problems and lead to domain-specific innovations or broader, transdisciplinary advancements. In particular, the new, complex challenges of the 21st century often require creative solutions.

How can such creativity be facilitated, across a wide range of domains and contexts? The Green Eggs and Ham hypothesis proposes that constraints can help. They anchor the creative process, circumvent clichéd associations and encourage the exploration of previously uncharted paths to novel and useful ideas. Empirical data, along with examples from business, education, science and art, are used to illustrate the power of constraints, especially in the context of globalization, and further applications, with emphases on opportunities unique to the 21st century, are suggested.

THE EFFECTS OF GLOBALIZATION ON CREATIVITY

In our increasingly interconnected world, the 21st century brings a host of macroproblems and macro-opportunities that cannot be addressed by a single nation, or a single specialized field, or in a single, well-defined, small time frame (Ambrose, 2009; Ambrose & Sternberg, 2012). Instead, they span national borders and disciplines, and take time to solve, in the case of problems, and to bring to fruition, in the case of opportunities.

The impact of globalization on the wellbeing of individuals and societies alike has spurred a debate. On the one hand, globalization has contributed to exponential knowledge growth and cognitive diversity, two of the most important macro-opportunities available in the 21st century. On the other hand, there is the extreme view, well articulated by a character in Michael Crichton's 1995 novel *The Lost World*, that globalization, and cyberspace in particular, leads to "the end of innovation" (p. 311) and "global uniformity" (p. 312):

This idea that the whole world is wired together is mass death. Every biologist knows that small groups in isolation evolve fastest. You put a thousand birds on an ocean island and they'll evolve very fast. You put ten thousand on a big continent, and their evolution slows down. Now, for our own species, evolution occurs mostly through our behaviour. We innovate new behaviour to adapt. And everybody on earth knows that innovation only occurs in small groups. Put three people on a committee and they may get something done. Ten people, and it gets harder. Thirty people, and nothing happens. Thirty million, it becomes impossible. That's the effect of mass media – it keeps anything from happening. Mass media swamps diversity. It makes every place the same. Bangkok or Tokyo or London: there's a McDonald's on one corner, a Benetton on another, a Gap across the street. Regional differences vanish. All differences vanish. In a mass-media world, there's less of everything except the top ten books, records, movies, ideas. People worry about losing species diversity in the rain forest. But what about intellectual diversity – our most necessary resource? That's disappearing faster than trees. But we haven't figured that out, so now we're planning to put five billion people together in cyberspace. And it'll freeze the entire species. Everything will stop dead in its tracks. Everyone will think the same thing at the same time. Global uniformity.

Levitt (1983), a well-regarded Harvard economist, also warned about the lack of diversity that globalization ensures, decades before the 21st century even began: "Chinese food, pita bread, country and western music, pizza, and jazz are everywhere. They are market segments that exist in worldwide proportions. They don't deny or contradict global homogenization but confirm it."

Such economic and social perspectives are useful and informative, but so are the psychological ones, especially regarding creative thinking. For example, Cowen (2002) argues that while globalization may create less diversity between cultures, it also creates more diversity between individuals. Global trading allows for more cross-cultural pollinations, as does the availability of information made possible by technology. Trends that may otherwise perish end up thriving, as Cowen points out in his examples of Indian hand-weaving and music from Zaire.

But what happens to individual creativity, from a cognitive perspective? In particular, what is the impact of exponential knowledge growth and cognitive diversity? These two macro-opportunities play a significant role.

Exponential knowledge growth has allowed access to more information than ever before. With search engines at one's fingertips and technology developments that allow easy access to data from across domains, the search space becomes vaster than ever, whether looking for a solution to a problem, or aiming for a creative output where the goal is ill-defined or nonexistent. So, this macro-opportunity comes with a challenge: how does one filter through all these data in order to bring forth a breakthrough or a discovery? This is where constraints can help. Narrowing down the potentially overwhelming search space could well be one of the keys to

modern creativity. The other key could be taking full advantage of the unprecedented cognitive diversity available. Modern progress is often the result of collaborations, many of them interdisciplinary.

Take, for example, modern seismology. Massive amounts of data are constantly gathered all around the world, from tens of thousands seismometers. Such data, which used to be stored by the individual country or institution that owns the machines, would often collect dust. Now, thanks to the right computational tools and open source software, they are increasingly available to most researchers. These individuals, endowed with access to such rich, detailed information from different parts of the world, can put their individual and collective creativity to work and generate better-informed theoretical models that are also tested more easily. They almost always need a starting point, a constraint of sorts, which often means limiting the data to a smaller subset. Once the constraint is in place and the model is derived, the remaining data are incorporated and the model is finessed in the process. Thanks to such models, we now have a better understanding of what the earth looks like beneath its surface.

Knowledge growth and the availability of such knowledge contribute to such scientific progress and discoveries. So does cognitive diversity. Teams often include specialists from different disciplines. For seismology, they may include mathematicians, physicists, geologists, and computer scientists, each bringing their unique perspective and tools to the table. These different, interdisciplinary perspectives act as additional constraints. For example, Ambrose (2009) took seventy-two theories and research findings from twenty-nine academic disciplines and professional fields and then cross-referenced them to see how ideas from one discipline or field could make one think creatively about an idea from another discipline/field, through the process of creative association. What would grouping together the rational actor model from economics with discoveries about empathy in animals from primatology yield, Ambrose wondered? This sort of wide-ranging interdisciplinary exploration imposes constraints by forcing one to make connections between clearly specified, domain-specific constructs. Might constraints facilitate creative thinking?

CONSTRAINTS AS CREATIVITY ANCHORS

The term *constraint* is used in a wide range of domains, with context-specific meanings. In mathematics, constraint optimization refers to a condition of a problem that must be satisfied by the solution. In business management, the Theory of Constraints rests on the assumption that the performance of a system is determined by the performance of its biggest constraint, and that constraints represent obstacles that must be removed in order to achieve a goal. In classical mechanics, a constraint limits the freedom of movement of a system of particles. In artificial intelligence, constraint satisfaction refers to the assignment of a value to each variable in the set, such that the solution meets the specified constraints. In engineering, the Theory

of Inventive Problem Solving (also known as TRIZ) puts forth a toolkit based on constraints, which helps with the development of new products, making new discoveries and solving problems. In literature, constrained writing requires the writer to follow a certain pattern or to embrace some limitations. Palindromes, alliteratives, and lipograms are examples of the sort of outputs that emerge. In Bayesian inference, a "prior" probability density function is combined with a "likelihood" function to produce a "posterior" probability density function. The prior expresses a constraint on permissible values of the model parameters, whereas the likelihood expresses the probability of a model given the constraints of the data.

In creativity research, two main conceptual pillars have framed the role of constraints: "freedom to create" and "thinking outside the box." According to the "freedom to create" myth, no limits on the opportunities to be explored allows access to an infinite number of options from which to choose, which in turn leads to a vast array of creative outcomes. The proponents of the "thinking outside the box" framework also endorse the lack of limitations and suggest that the exploration of the immense field of options that lie elsewhere, outside the proverbial box, facilitates creativity and its ensuing outputs.

I argue that both premises are flawed. Limitations, or constraints, should be sought out and embraced, rather than avoided and removed. In theory, an infinite field of possibilities may sound appealing, but in practice, the prospect is daunting: where to begin the exploration, and how?

De Brabandere and Iny (2013) propose an interesting alternative: instead of aiming to "think outside the box", and therefore viewing the proverbial box in a negative light, they suggest thinking "in new boxes." What they mean is experimenting with new frameworks or mental models. This approach is especially useful in a business setting. In line with the cognitive diversity opportunity (Ambrose, 2009) discussed in the focus chapter near the beginning of this book, one suggestion for increasing the sort of interdisciplinary thinking that stimulates creativity, is to bring in experts from different domains, e.g., ask a nurse to evaluate an accounting firm's performance. The new "nurse box" is used to guide the generation of novel and useful ideas. Indeed, team member diversity has been shown to yield more creative team decision-making (Jackson, 1996).

One could go a few steps further. First, instead of representing a way of thinking, a "box" could simply be a constraint, be it formal or semantic, chosen arbitrarily or thoughtfully, self-imposed or externally generated. Second, several such "boxes" could be used simultaneously. Imagine a container filled with different boxes, akin to a computer folder that holds different files from which data are extracted. The goal remains the same: to generate novel and useful solutions to a problem. The path to such solutions is guided by the various independent constraints and/or the interplay among them.

Stokes (2014) cleverly proposes "thinking inside the tool box." Since expertise in a domain leads to vast knowledge acquisition, these tools inevitably accumulate in a "box" that frames the way experts think about a problem. When it comes to creative

thinking, such expertise can become a liability: it's easy to fall back on the numerous past tried-and-true solutions to a problem. This is where imposing constraints can help (see Boden, 1991; Johnson-Laird, 1987, 1993, 2002; Haught-Tromp, 2015, in press; Haught-Tromp & Stokes, in press; Stokes, 2005).

One additional note about these proverbial "boxes": specialized silos, or boxes, be they internal frameworks or organizational structures, lead to thinking that is myopic. The parable of the blind men and the elephant illustrates this problem. What happens when a group of blind people (or people in the dark) aim to find out what some object or creature, such as an elephant, looks like, and each person proceeds to touch a different part of the elephant and limits himself to that one part, be it the tail or a tusk? Not surprisingly, after such individual data collection, no agreement emerges from the group on what the elephant is. The tail, studied in isolation, could be a rope. The tusk could be a spear. But the Gestalt, "seeing" of the full elephant, only emerges after taking into account the other fellow blind men's perspectives. Once again, this is an example of taking full advantage of the cognitive diversity available. These additional constraints anchor the hypotheses about what the creature is, and they are instrumental in forming a full understanding.

The term *anchor* may describe the concept more aptly than *constraint*, which conjures up negative imagery about lack of freedom and lack of opportunities. The etymology of the word explains its modern negative connotations. From the Latin *constrictus,* through the Old French *constreinte*, meaning "binding, compulsion", the term has firmly rooted its representation of *"coercion"* and "tied up", "inhibited."

THE *GREEN EGGS AND HAM* HYPOTHESIS: CONSTRAINTS IN CREATIVITY

What makes a search difficult, be it for a job candidate, a romantic partner, a thank-you gift, a solution to a technical problem, or a 21st century macroproblem (Ambrose, 2009; Ambrose & Sternberg, 2012)? The process is often challenging because the search space is vast. This is particularly true for problems that do not have a single specified, correct solution, i.e., those that typically require "creativity." Constraints help narrow down the search, limiting the area of exploration to a more manageable section. Within it, a deeper divergent search is more likely to avoid existing, well-trod, clichéd paths and instead yield a creative solution.

Working with constraints, even unexpected, Kafkaesque, or Dr. Seuss ones, may help spur creativity. This is the Green Eggs and Ham hypothesis (Haught-Tromp, in press). Theodore Geisel's ("Dr. Seuss") best-selling children's book emerged in response to a challenge from his publisher to work with a very tight constraint: the story cannot use more than fifty different words. Creativity was not inhibited. It flourished. The trick is to be open to new experiences and willing to experiment with constraints. Once you do, even though at first the process may seem challenging and you may be tempted not to like the constraints, "try them, try them and you may."

The following section presents support for this hypothesis, in the form of anecdotal and empirical data. Much work remains to be done to test and refine this hypothesis, but the premise that constraints facilitate creativity is worth further exploration.

CONSTRAINTS IN CREATIVITY:
APPLICATIONS TO 21ST-CENTURY CHALLENGES AND OPPORTUNITIES

Empirical research on the role of constraints in creativity is sparse. Nonetheless, findings from existing studies lend support to the Green Eggs and Ham hypothesis. In a series of experiments, Finke (1990) asked participants to come up with practical inventions by combining certain parts, such as a hook, wheels, a cone, etc., to create a new object within a category, such as furniture or appliances. Finke (1990) manipulated whether the category and the parts were externally imposed or selected by the participant. The number of creative inventions was greatest in the constrained condition, when both the parts and the object categories were specified.

Haught (2015) showed that sentences generated in response to pictures are more creative than those in response to words. Pictorial representations are more constraining than the corresponding words and pictures turned out to be a better source of creativity. Haught-Tromp (in press) continued testing the role of constraints in language production. In two experiments, I asked participants to generate two-line rhymes to convey a special message, such as *Happy Birthday*, *Thank You*, or *I Love You*. Two constraints were tested. In the first experiment, the messages had to include a given word. In the second experiment, the messages had to include a word that the participants had previously generated. Interestingly, not only were the rhymes more creative in the constrained condition, but both experiments showed a carry-over effect: in the non-constrained condition, the participants were more creative after having first worked with constraints. Mere practice with constraints seems to help facilitate creativity in a subsequent identical task. It remains to be seen whether this carryover effect holds for different types of tasks and whether it extends to dissimilar tasks.

Marguc, Forster, and Van Kleef (2011) showed that obstacles can enhance creative thought. In one experiment, participants were asked to play one of two versions of a computer maze game: an easier one, with fewer obstacles, and a more difficult one, where more obstacles increased the difficulty of escaping. The participants' creativity was then assessed, using the Remote Associates Test (Mednick, 1962). Forty percent more of the problems were successfully solved following the constrained condition, with more obstacles to overcome. This effect was attributed to a "global processing" mode triggered by the obstacle condition, which led participants to focus on the "big picture." In a similar vein, Marguc, Van Kleef and Forster (2015) found that obstacles lead to the generation of broader solution categories and more original means of achieving a goal.

Stokes (2005, 2009, 2014) illustrates the facilitative role of constraints with case studies from art, which support the paired constraints model (see also Haught-Tromp &

Stokes, in press): one constraint limits the search for a solution, precluding clichéd responses, while the other directs the search, promoting novel associations. She also applies the constraints model to teaching place-value in American kindergartens (Stokes, 2014). A more effective math curriculum emerged, in which children are taught explicit base-10 count and they use one rather than many different manipulatives.

Other applications to education can be envisioned. For example, let's contrast for a moment the following two scenarios. First, imagine a child is surrounded by dozens and dozens of toys, and is free to play with any of them for 30 minutes. What is she likely to do? She'll probably choose a favorite set, and after a while get bored. Now, imagine a child is given fewer toys – one dozen, instead of, say, ten dozen – along with the freedom to play with any and all of them for 30 minutes. What is *she* likely to do? Spend more time exploring each toy, and postpone boredom, or get bored even faster? Imagine further that the child is given a task, for example, to engage in as many different pretend-play scenarios as she can with the given toys. When will she be more creative: when fewer or more toys are available? The Green Eggs and Ham hypothesis predicts the counterintuitive answer: creativity will be spurred when the starting points are constrained and the process is anchored. Granted, the child's imagination will also be more taxed in the process (Exactly how many different uses can one think of for a wooden spoon, for example? It's not easy.), but that's exactly the point. The task may be more challenging, but it may also yield more creative responses.

Empirical studies should test such predictions. If they are supported, then perhaps curricula would place more emphasis on teaching children how to become more creative. Specific strategies on how to seek out and use constraints to bring a creative task to fruition could be incorporated.

Anecdotal data from different domains, such as art, business, science, medicine, and day-to-day lives, complements empirical research on constraints. In the domain of art, celebrated composer Igor Stravinsky (1956) acknowledged the importance of constraints: "The more constraints one imposes, the more one frees one's self […], and the arbitrariness of the constraint serves only to obtain precision of execution." Nonfiction writer John McPhee (2013) also relies on constraints to overcome writer's block: "Sometimes in a nervous frenzy I just fling words as if I were flinging mud at a wall. Blurt out, heave out, babble out something – anything – as a first draft. With that, you have achieved a sort of nucleus."

Architect Frank Gehry (cited in Sims, 2011) refers to constraints as "guard rails" which he uses to his advantage. Such constraints can range from deadlines to budget restrictions to materials to the building site specifics. The growing "tiny house" movement, is another, extreme example of space constraints. This minimalist, "conscious living" approach forces one to think creatively about ways to maximize the use of a mere few hundred square feet of available living space, while keeping both functional and aesthetic considerations in mind. Many New York City or Tokyo apartment dwellers are familiar with such constraints.

In business, so-called "blue-sky" projects are not as successful as one may think. Without guiding constraints, the solutions that emerge are not as creative or they lack the practical implementation element. Marissa Mayer, formerly of Google and now the CEO of Yahoo, wrote about the key role that constraints play in arriving at a creative solution: "Constraints shape and focus problems, and provide clear challenges to overcome as well as inspiration. Creativity loves constraints" (Mayer, 2006).

In science, illustrations of creative, interdisciplinary thinking based on constraints abound. For example, tomography, initially used only as a medical technology, is now a key method in a number of fields, including seismology. More generally, when tackling a large-scale scientific problem, constraints can help. For example, computer modeling, a widely used technique in many disciplines, unfolds by the judicious use of constraints. Typically, an overwhelming amount of collected data is available that cannot be tackled all at once. So, the initial challenge lies in the selection of the variables to input, and the attribution of weights and other specifications. Once some boundary conditions are specified, these constraints frame the model, and the problem becomes more manageable and easier to solve.

In medicine, the so-called "tumor paint," currently in the stage of human clinical trials, uses chlorotoxin, a protein derived from scorpion venom, to help surgeons distinguish between cancerous areas and healthy tissue, which are notoriously difficult to tell apart during surgery. This was pediatric oncologist Jim Olson's discovery: the substance lights up the malignant tissue, so that it can be removed completely, even when it is hidden behind healthy tissue, and precisely, i.e., without removing unaffected areas. This is especially critical for brain surgery. An equally remarkable point about this breakthrough is how it came about and how. When an idea as outlandish as using scorpion venom to highlight cancer did not garner the needed agency funding, Dr. Olson was not dissuaded. Once again, he displayed ingenuity and started actively fundraising, and these efforts paid off: "Through bake sales and golf tournaments and chili cook-offs, they raised 8 million dollars and that funded the early discovery work that allowed Tumor Paint to get FDA approval for human trials," Olson said (Mohney & Olson, 2014).

In our day-to-day lives, we are surrounded by constraints. Some of them are a matter of choice. Virtually all sports and games are rule-bound, and it is precisely these constraints that make a tennis match or a Pictionary game so much fun: they trigger creativity. Others, such as budget restrictions, deadlines, or the weather on vacation, are outside of our control. Even for this latter category, remembering that creativity thrives when constrained may help refocus efforts towards generating creative solutions.

A growing body of psychological research is dedicated to the study of happiness and wellbeing, under the umbrella of positive psychology. This subfield focuses on the study of the "good life" and what factors contribute to the experience of a happy, meaningful and fulfilled existence. Day-to-day lives could be improved by an understanding of the variables that affect wellbeing, and creativity plays a key role. There is a particular feeling of self-satisfaction that we all experience after we made

a good joke, or thought of a creative experiment, or figured out a creative solution to a problem. If constraints can help trigger such positive experiences that enhance our wellbeing, then why not seek them out?

If you have only 5 minutes to make a pitch, use that limit to express your message more concisely. Seize the opportunity to crisp up the pitch, rather than complain how hard it is to do it and how much you have to leave out. If you only have a few ingredients in the fridge that constrain what you can fix for dinner, do not be discouraged. Let the limitations guide your creativity.

Twitter is a prime example of the successful use of an extreme constraint: just how much can one convey in a 140-character message? A lot, it turns out. Even recipes, which, within the Twitter constraint, become "awesome acts of compression. Ingredients, actions, quantities, times and temperatures—both Fahrenheit and Celsius—boiled down to utmost richness, density and clarity. A dish, a meal, a trip to deliciousness magically packed into the tiniest carry-on bag" (Downes, 2009).

Similarly, six-word memoirs have attracted a cult following. This powerful, creative story telling method is fueled by a very tight constraint. How would you tell a story in six words? Ernest Hemingway is said to have embraced the challenge. He wrote: *For sale: baby shoes, never worn.* The Hemingway legend inspired the online Smith Magazine to jumpstart an ongoing project, aptly called Six-Word Memoirs, which captures what are probably the world's most concise autobiographies. How would *you* encapsulate your life in six words? Daunting as it may seem, the extreme constraint forces one to focus on the content that matters most and to engage in creative thinking. One such brilliant 6-word autobiography, cited by Seelig (2012): *I'm the careless man's careful daughter.*

An equally powerful example of a creative program that serves a dual function is the concept of intergenerational day care, which is gaining traction. By providing day care for elderly adults and children and integrating the two age groups, such programs propose a creative solution to two separate, constraining challenges, and it's a win-win proposition: each group benefits from the company of the other's, and everyone's overall daily experience is enriched.

CONCLUSION

Many of the issues with which we are confronted in the 21st century are bounded by constraints. Often, these constraints are perceived as insurmountable or as obstacles that must be eliminated before a successful solution can emerge. What if, instead, challenges were reframed as opportunities, and constraints were viewed as anchors that aid rather than hinder? The problem solving or creative discovery process might proceed differently.

The Green Eggs and Ham hypothesis (Haught-Tromp, in press) proposes that creative thought is grounded in constraints, and preliminary evidence supports this postulate. In this spirit, whether tackling daily problems or global issues, one should work *with* constraints, not against them.

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SECTION III

UNSHACKLING STUDENTS, TEACHERS, AND SCHOOLS: RECOGNIZING CONTEXTUAL CONSTRAINTS

YONG ZHAO AND BRIAN GEARIN

8. SQUEEZED OUT

The Threat of Global Homogenization of Education to Creativity

The 21st century has seen a rise in homogenization of educational experiences around the globe. Driven largely by the perceived need for global competitiveness, and reinforced by policy recommendations derived from international assessments such as the PISA, educational systems around the world are emulating (or are trying to emulate) the highest performing countries on the international league tables. As a result, most education systems now focus on a narrow set of cognitive skills in a limited number of subjects. This tendency limits the educational experiences of children around the world in terms curriculum, pedagogy, and assessment. The narrowing of educational experiences in turn has a detrimental effect on creativity. This chapter discusses how global homogenization affects creativity and has dangerous consequences for all.

Human society has entered an era in which everyone needs to fully develop his or her creative potential. As automation continues to displace human workers throughout the Second Machine Age (Brynjolfsson & McAfee, 2014), human ingenuity is needed to: create new opportunities, take advantage of opportunities brought about by technological advances, and address the existing and future problems societies face. The creative class can no longer be a small minority of the population: it must be the majority (Florida, 2012). Mass innovation and entrepreneurship rather than mass employment must be the new normal (Auerswald, 2012; Wilson, Vyakarnam, Volkmann, Mariotti, & Rabuzzi, 2009; World Economic Forum, 2012; Zhao, 2012, 2015c). However, our traditional mass education system—the educational institution we built to prepare employees for the Industrial Age—is ill-equipped to transform the masses into creative and innovative individuals (Robinson & Aronica, 2015; Wagner, 2012; Zhao, 2012; Zhao, 2015c).

There is a global consensus that we must improve our education systems to meet the challenges of the 21st century. Thus, education reform has dominated the political agendas of many nations. Unfortunately, most of these reform efforts have worked to threaten rather than enhance the development of creativity of the masses. For a multitude of reasons, education reforms around the world have led to a global homogenization and standardization of educational experiences of children (Zhao, 2015a). This dangerous process is homogenizing individuality, standardizing thinking, and stifling creativity.

GLOBAL HOMOGENIZATION OF EDUCATION

Educational systems around the world follow the same basic paradigm. Yong Zhao (2012) calls it, *employee-oriented education.* Except for a few alternative approaches that remain marginalized, such as the Regio Emilio and Montessori approaches, the essence of educational institutions and processes are very similar across nations, and they have been similar for several decades. Of course, due to cultural, historical, and societal differences, the degree to which the traditional paradigm is fully implemented varies across different societies: some societies are more effective than others in homogenizing individuals. These sources of variation are the primary sources of differences in international test scores, as well as the creative output in different societies.

However, the traditional variations are disappearing quickly. Education systems, processes, and values around the world are becoming increasingly homogenous (Carney, Rappleye, & Silova, 2012; Green, & Mostafa, 2013; Sellar, & Lingard, 2014; Tröhler, 2013; Zhao, 2012). Centralized decision-making, test-driven accountability, and narrow core curricula are now the rule rather than the exception in many education systems. A direct cause of this trend has been the advancement of standardized educational measurement by the Organization for Economic Co-Operation and Development (OECD) and the International Association for the Evaluation of Educational Achievement (IEA; Sellar, & Lingard, 2014; Tröhler, 2013; Zhao, 2012). These organizations are responsible for creating influential international comparison tests such as the Programme for International Student Assessment (PISA), Progress in International Reading Literacy Study (PIRLS), and Trends in International Mathematics and Science Study (TIMSS).

Driving Standardization and Homogenization: The Power of PISA

Technically, these international assessments are innocuous as a way to gather data about policy and practice in different educational systems. Early studies, such as the First International Mathematics Study (FIMS) and Second International Mathematics Study (SIMS), did just that. However since the Third International Mathematics and Science Study (TIMSS) in 1995, these international assessments have become a driving force behind educational policies and practices in many countries, encouraging close alignment with those systems that produce the best results (e.g., Kimmelman, Kroeze, Schmidt, van der Ploeg, McNeely, & Tan, 1999). The launch of PISA in 1999 further intensified the trend of global homogenization (Green & Mostafa, 2013; Sellar & Lingard, 2014; Tröhler, 2013; Zhao, 2012).

PISA started as a tri-annual assessment in three subjects: reading, math, and science, with problem solving added in 2012. Each round focuses on one subject. In just over a decade, PISA has become the world's most influential and successful educational assessment program. The number of participating education systems has increased from 32 (28 OCED member countries and 4 non-member countries) to

65 in the most recent round administered in 2012. Over 70 economies have signed up for the 2015 round of assessment. With over 510,000 students taking the test in 2012, the OECD claims it represented "about 28 million 15-year-olds globally" (OECD, 2010). PISA has firmly established itself as the *de facto* gold standard for educational quality.

Today PISA commands the attention of world political and education leaders, media pundits, and educational researchers because-PISA results have been equated with nations' educational quality. Thus countries with high PISA scores have been automatically accepted as having better education quality and those with lower scores lower quality. For example, after students in Shanghai scored number one on the PISA in 2010, media stories immediately call them the smartest, best-educated in the world (Coughlan, 2012; Sawyer, 2010), while Germany's poor ranking in the first round of PISA caused a national uproar (OECD, 2011). Doubts about the PISA as a gold standard for educational quality have often been drowned out in the overwhelming questioning about why some countries have much better scores than others (Breakspear, 2012).

One of the reasons for PISA's emergence as a global standard of education quality is the successful marketing of PISA outcomes as a valid and reliable indicator of nations' human capital and future economic prosperity. PISA claims to "assess to what extent students at the end of compulsory education, can apply their knowledge to real-life situations and be equipped for full participation in society" (OECD, 2013). To further affirm the claim, a publication of PISA/OECD makes the direct connection between PISA performance and national economic growth. The authors claim that an increase of 25 points in PISA scores over the next 25 years would result in an aggregate gain of 115 trillion U.S. dollars in GDP in OECD countries over the lifetime of the generation born in 2010. The gain would be 260 trillion dollars if all OECD countries could raise their average PISA scores to that of the best OCED performer Finland (Hanushek & Woessmann, 2010).

In the age of globalization, when all nations are concerned about their competitiveness against others, this linkage between PISA scores and economic prosperity has worked very well to mobilize governments and education leaders to look for ways to improve their education. Given the belief that PISA marks the potential for economic competitiveness and educational quality, it suggests that whatever factors contribute to PISA scores should be good practices and policies. It is thus no surprise to see numerous attempts of governments, research groups, international consulting firms, and the OECD itself to identify and recommend policies and practices that should be adopted around the world (Bieber & Martens, 2011).

For example, the OECD, in connection with Pearson Foundations, produced *Strong Performers and Successful Reformers in Education: Lessons from PISA for the United States*, a book and a collection of video cases that make explicit recommendations of policies and practices drawn from high performing education systems (OECD, 2011). McKinsey & Co., the New York-based international

consulting firm, summarized the best practices in its report as *How the World's Best-Performing School Systems Come out on Top* (McKinsey & Company, 2007). The Grattan Institute, an independent research group in Australia, conducted a study on the high performing countries in Asia and published an influential report *Catching up: Learning from the best school systems in East Asia* (Jensen, 2012). Marc Tucker, president and CEO of the National Center for Education and the Economy, makes a series of recommendations based on observations of high performing systems such as Shanghai in the book *Surpassing Shanghai: An Agenda for American Education Built on the World's Leading Systems* (Tucker, 2011). Andreas Schleicher, director of PISA, recommends that education systems should have a focus on social and gender equity, decentralized school management, a cooperative school structure, strong centralized assessment systems and accountability measures with high and demanding educational standards (Schleicher, 2006).

PISA has prompted major policy changes in many countries (Breakspear, 2012; Knodel, Martens, & Niemann, 2013). Many of the changes are strikingly similar: centralizing curriculum and standard-setting, global benchmarking in curriculum and standards, strengthening testing and accountability measures, and encouraging local autonomy and market competition so as to reach the same outcomes (Breakspear, 2012). The Global Education Reform Movement, or GERM as Pasi Sahlberg (Sahlberg, 2012) calls it, is an excellent acronym for the global standardization of education phenomenon. In parallel are similar efforts to standardize teacher recruitment, preparation, and incentivization. Students' experiences are also increasingly homogenized as countries emulate or attempt to emulate the successes of high performing nations: more time on academic studies and focus on the PISA subjects—reading, math, and science.

Easternization in the West: Successful Attempts at Reform in the West

The power of PISA to homogenize education globally of course does not come from just its marketing strategy alone. It has much to do with the timing and context. It arrived just around the time when globalization 3.0 was taking shape and Asia was evolving into the economic power in the world (Friedman, 2007). The rapid economic development in Japan, Korea, Singapore, Hong Kong, and China over the past few decades caught the attention of the world and raised much admiration and concern in old developed nations in Europe and North America. It also came on top of early suggestions that Asian education systems were superior to those in the West based on cross-national studies such as TIMSS (Schmidt, 1999; Stevenson & Stigler, 2006; The National Commission on Excellence in Education, 1983). In other words, PISA results confirmed what many people were already primed to believe because of widespread economic development across East Asia: that East Asian education systems were the models to emulate (e.g., Cannae, 2012; Duncan, 2010, 2013; "Michael Gove…", 2013; Marc Tucker, 2011, 2014).

It is an overstatement to say that education reform efforts in the West, particularly in the United States, England, and Australia, have been explicitly copying educational practices and policies in East Asia. Nonetheless, the actions taken by these countries have resulted in practices and policies with a very strong Asian flavor. Central governments have gained more control over the educational experiences of children. National or *de facto* national curricula have been developed and implemented in countries without such a tradition, like the U.S. and Australia. High stakes testing has become common practice. Direct instruction has been praised and adopted. Curriculum has been narrowed. Education in the West is on its way to becoming test preparation (Nichols & Berliner, 2007), much like education in East Asia (Zhao, 2009, 2012, 2014). PISA results have served to either stimulate or affirm such actions.

Westernization: Unsuccessful Attempts at Reform in the East

While the West was working on Easternizing their education, East Asian countries have been trying to Westernize theirs (Zhao, 2015b). East Asian education systems recognized that centralized decision-making, test-driven accountability, and narrow core curricula were barriers to improving their education systems because they created a variety of unintended consequences (e.g., Education Commission, 2000; Guojia Jiaowei [National Education Commission], 1997; OCED, 1998). The most studied of these unintended consequences include the corrosive emotional atmosphere in schools, large shadow education systems, the normalization of corruption, and a focusing on testing instead of richer, more authentic learning (e.g., Baker, Akiba, LeTendre, & Wiseman, 2001; Bray & Lykins, 2012; Ho, Xie, Peng, & Cheng, 2013; Kim, Lee, Chae, Anderson, & Laurence, 2011; Köllner, 2012; Lee, 2011; Zhao, 2014). Over the past two decades, East Asian governments have made numerous attempts to reform their education systems in order to uproot these problems (Zhao, 2014). Recent speeches by China's Premier Li Keqiang at the 2015 World Economic Forum in Davos, Korea's President Park (2014) and Singapore's Education Minister Heng Swee Keat (2012) underline the central motive for doing so: the efficient East Asian model actually hinders mass entrepreneurship and innovation.

Unfortunately, the reforms in East Asian education systems have not been nearly as successful as reforms in the West (Zhao, 2015). Despite the strong desire and numerous policy changes to diversify educational content and measurement, the essence of East Asian systems remain pretty much the same as before. The reasons are complex. But PISA and other international assessments are certainly a contributing factor. By placing East Asian systems as the top performing education systems in the world, these assessments make East Asian systems hesitant to completely move away from their traditions. Additionally, the complex cultural and practical concerns of the people in these systems lead to ineffective execution of policies, and explicit resistance from parents and practitioners (Zhao, 2014).

Now that the West, exemplified by the United States and Australia, has taken major steps towards centralized education and high-stakes testing, the new homogenized education paradigm is poised for global dominance. This is cause for alarm. The homogenized education paradigm offers efficiency at the cost of creativity at a time when creativity is most needed. Moreover, the history of education reform in East Asia suggests that once these components of the homogenized education system are in place, they are quite difficult, if not impossible to reverse.

HOW HOMOGENIZATION SQUEEZES OUT CREATIVITY

As Sternberg (2012) states, "Creativity is a habit." Everyone is born with the potential to be creative, but creativity can be encouraged or discouraged. Where it is discouraged, we see fewer examples of everyday creativity (i.e., Kaufman & Beghetto's [2009] "little c"). Discouraging everyday creativity in turn reduces the changes of historically creative acts (i.e., "big C"). To promote creativity, Sternberg (2012) suggests that people need "(a) opportunities to engage in it, (b) encouragement when people avail themselves of these opportunities, and (c) rewards when people respond to such encouragement and think and behave creatively." We would add that in order to achieve the type of historically creative behaviors Gardner (1993) describes in *Creating Minds*, students need opportunities to practice creativity in their domain of interest. While the extent to which creativity is domain- and task-specific continues to be debated (Baer, 2014; Barbot & Tinio, 2014; Jauk, Benedek, & Neubauer, 2012; Reiter-Palmon, Illies, Cross, Buboltz, & Nimps, 2009), we think it is uncontroversial to assert that where creative acts require skill or discipline, it is essential that people have time to practice that skill or discipline. Thus, even if creativity proves to not be task-specific, historically creative works nevertheless require practice and training.

Schools have the capacity to promote and constrain creativity by providing the appropriate practice and training (Sternberg, 2012). However, if they take away the opportunities for being creative, they take away creativity. Currently, schools in the West are taking away opportunities to be creative. Worse, they are replacing them with practices, like standardized test preparation, which actually punish divergent thinking by emphasizing questions and tasks for which there are right or wrong answers (Plucker & Makel, 2010; Runco, 2010; Sternberg, 2012). But standardized testing is not the only way the homogenized education paradigm threatens creativity. The unintended consequences of the homogenous education paradigm also squeeze out creativity. These include curriculum narrowing and teacher-centered pedagogy, corrosive emotional atmospheres, and the deterioration of local culture and practices.

Curriculum-Narrowing and Teacher-Centered Pedagogy

In education systems driven by high-stakes tests, the *de facto* (if not *de jure*) purpose of education is test preparation. Students must focus on tested-content to succeed

academically. Educators, meanwhile, are not within their right to disadvantage their students by focusing on objectives that could jeopardize test outcomes. This dynamic gives educators a powerful incentive to eliminate practices that are not related to the test. The elimination of these practices in turn deprives children of opportunities that may trigger their passion, interest, and creativity.

At the school level, the homogenous education paradigm squeezes out creativity by reducing non-essential courses. For example, in the five years following the passage of the No Child Left Behind Act of 2001, 71% of American school districts reduced the amount of instructional time spent on history, music, science, and art (Dillon, 2006, see also Au, 2007, Madaus & Russell, 2010, and Zhao, 2014). In 2012, a Congressional report found that less than 4% of elementary schools offered daily physical education and less than 14% offered physical education three days per week despite the fact that the United States was in the midst of a childhood obesity epidemic (United States Government Accountability Office, 2012). Meanwhile, a report by the National Center for Education Statistics (NCES, 2012) showed that dance and drama have essentially been eliminated from public elementary schools, and the visual arts have declined at both the elementary and secondary levels. Unsurprisingly, children from low socioeconomic backgrounds have had the least access to arts education.

At the classroom level, the homogenous education paradigm squeezes out creativity by changing how teachers teach. There is overwhelming evidence that high-stakes testing leads to teachers focusing on prescribed content, instead of students' desires and interests. Au's (2007) meta-synthesis of 49 qualitative studies found that high-stakes testing led to an increase in teacher-centered pedagogy, teaching to the test, and fragmenting curricula so that it better reflects tested-content. Au (2007) reports that 32 out of 49 qualitative studies reported teacher-centered instruction was favored as opposed to instructional methods that rely on collaboration and exploration, such as problem-based learning. The most common teacher-centered instructional method was direct instruction. At its best, direct instruction requires teachers to deliver short, highly-produced lectures and demonstrations. It is a highly effective pedagogical strategy for teaching information with right or wrong answers (Hattie, 2013); and it has the potential to promote critical reasoning, at least with adolescents (Marin & Halpern, 2011). But experimental studies with young children underscore the limits of direct instruction compared to less structured teaching strategies (Bonawitz et al., 2011; Buchsbaum, Gopnik, Griffiths, & Shafto, 2011; Gopnik, 2012).

In one study, children were placed in a pedagogical condition, a naïve condition, an interrupted condition, or a control condition (Bonawitz et al., 2011). In every condition, they were given a toy with four PVC tubes, each of which contained a hidden stimulus that was revealed if the student pulled on it. One tube squeaked, one contained a mirror, another a light, and the last played music. In the pedagogical condition, an adult demonstrated how to use one feature of the toy as would be the case in direct instruction. In the naïve condition, the adult pretended to accidentally

discover that one of the tubes squeaked. In the interrupted condition, the adult began the demonstration but did not complete it. In the control condition, the adult simply drew the children's attention to the toy. In all conditions, the adult ended by stating, "Wow, isn't that cool? I'm going to let you play and see if you can figure out how this toy works. Let me know when you're done!" The researchers then measured the amount of time the children played with the toy, as well as the number and types of interactions the children made with it. They found that children in the pedagogical condition played with the toy for significantly less time than all other conditions. They were also significantly less likely to discover the other functions of the toy than all other conditions. In other words, direct instruction seems to have a detrimental effect on intrinsic motivation and curiosity.

In a second series of experiments, children were placed into a pedagogical condition during which an adult demonstrated how to make a toy play music, a naïve condition, or a control condition (Buchsbaum, Gopnik, Griffiths, & Shafto, 2011). However, the demonstrations in the pedagogical condition were intentionally inefficient: the adult would try three actions to make the toy play music even though it only required two. Children in the pedagogical condition were significantly more likely to imitate the teacher's inefficient method for operating the toy than children in other conditions. Thus, direct instruction seems to be a great tool for imparting knowledge, but also a great tool for imparting false knowledge and inefficient behaviors. Problem-centered instruction, like the type used in the naïve condition, may be better at promoting exploration and consequently new discoveries.

Corrosive Emotional Atmospheres

The homogenous education paradigm also poses a threat to creativity by increasing stress and anxiety and lowering self-confidence and enjoyment. According to Beghetto (2005), when classrooms use assessments to compare students to each other, students tend to experience high levels of stress, exert less effort, give up, and are more prone to cheat (Kumar, Gheen, & Kaplan, 2002; Pintrich & Schunk, 2002; Urdan et al., 2002 as cited by Beghetto. See also Amabile, 1996). These behaviors tend to suppress creativity in the classroom (Beghetto, 2005). Beghetto therefore recommends minimizing the pressure associated with assessments, and minimizing social comparisons using test-scores.

Unfortunately, this is not how high-stakes assessments are used in the homogenous education paradigm. A multitude of studies found that American students are reporting debilitating levels of stress due to high-stakes assessments (e.g., Triplett & Barskdale, 2005; Watson, Johanson, Loder, & Dankiw, 2014). While we are unable to provide an estimate of how students perceive high-stakes testing at the national-level, a recent report by the American Psychological Association (2014) found that school was the most commonly reported source of stress for American teens, with 83% of American teens describing school as a moderate or significant source. Meanwhile, teachers cited the negative effects of high-stakes testing on teaching,

learning, and motivation (e.g., Dawson, 2012; Kruger, Wandle, & Struzziero, 2007; Jones, 2007, Jones & Egley, 2004; Nichols & Berliner, 2007; Smith, 1991). It is doubtful that students and teachers can have these feelings and simultaneously maintain a classroom environment that promotes creativity. However, the practice of publishing school and teacher ratings almost seems designed to ensure that these feelings will continue; as does the related and seemingly ubiquitous practice of keeping classroom "data-walls", which identify individual student's progress or lack thereof on state assessments (Strauss, 2014).

The Asian countries that are often lauded for their PISA scores are even worse in terms of the emotional environments that they create for their students. A poll by the Korea Health Promotion Foundation (2014) found that 50% of teenaged students thought that "it would be better to not live." Academic anxiety and fears about the future were the most frequently cited causes of stress. Sadly, this is not just teen angst. South Korea's actual suicide rate has remained the highest amongst OECD countries since 2002 (Lee, 2014; Organization for Economic Co-operation and Development, 2011; 2013), and suicide was the leading cause of death amongst Korean youth during the same period (World Health Organization Database; "Suicide no. 1 cause…," 2013). It is widely acknowledged that the harsh test-centered education system deserves the brunt of the blame for the suicide rate (e.g., Köllner, 2012; Salmon, 2013). Meanwhile, a poll by Xinhua (2010) found that 86% of Chinese high school students experience "high stress." A follow-up survey study by Sun, Dunne, Hou, and Xu (2013) found that most of the factors contributing to student stress were school-related (see also Zhao, 2014). China likewise had one of the highest suicide rates in the world in the 1990's ("Back From the Edge", 2014). It rapidly declined as the country began to experience financial prosperity and social change, including the liberalization of education. We are not suggesting that recent trends in education are responsible for driving up the youth suicide rate in these countries. After all, the teen suicide rates of South Korea, Singapore, and Hong Kong have historically been far lower than those of the United States, Canada, and even countries like Finland, and Norway (Wasserman, Cheng, & Jiang, 2006). But we find it alarming that so many students attribute their anxiety and stress to their education, and we think it bodes poorly for the creative development of children.

One might assume that the natural corollary of the increased stress and anxiety imposed by the homogenous education system is a decrease in self-confidence and enjoyment of education. Longitudinal and cross-sectional data suggest that this assumption is correct. While East Asian countries are generally the top performers on PISA, TIMSS, and PIRLS, they also regularly report low levels of self-confidence and low levels of interest in the tested subject areas (Zhao, 2015). In comparison, American students generally report high levels of confidence and enjoyment, despite comparatively lower achievement on these tests (e.g., Loveless & Diperna, 2000; Loveless, 2002; Martin, Mullis, & Foy, 2008). In light of this dynamic, films like *Waiting for Superman* (Kimball, 2011) have glibly implied that compared to Asian students, Americans are confident idiots who are too stupid to know that they should

have less self-confidence about their academic performance. However, education leaders in East Asia have not jumped to the same conclusion (Chang & Cheng, 2008; Ho, 2003; Kim, 2010; Li, 2013; Singapore Ministry of Education, 1998). Instead, they express their belief that standardized tests are not the end goal of education, and that self-confidence and interest in academics are vital to children's long-term development. Recent news articles suggest that higher education professionals in the West are finally beginning to recognize that East Asia's failure to develop a healthy student affect amongst its students may hinder their academic performance at the university level, especially if they attend Western universities (Crawford, 2015; Kunter, 2015; Swain, 2014).

How do these students fare after they leave the university compared to students in the West? It is difficult to say because the history of industrialization and economic development between Western and East Asian nations is so different that causality cannot easily be inferred. However, we note Tienken's (2008) finding that PISA rankings for countries in the top 50% do not correlate with their ranking on Florida's (2011) Global Creativity Index (GCI), and Zhao's (2012) finding that national PISA math scores negatively correlate with national perceived entrepreneurial capability scores on the GCI. These studies provide tentative evidence that the lack of creative development during childhood may hinder creativity and innovation during adulthood. Moreover, they call into question the practice of using international comparator exams to predict economic success in developed nations (Tienken & Mullen, 2014). It may be the case that promoting academic achievement through high-stakes testing engenders a widespread fear of failure, which is generally not compatible with creative endeavors that require iterative development and critical feedback (Zhao, 2012).

The Deterioration of Local Cultures and Practices

Finally, globally homogenized education deprives children of their local culture, local strength, and opportunities to be creative with local resources. The idea that education is a formal institution, spanning from childhood through adulthood, in order to promote "universalistic values and knowledge, human empowerment, social justice, citizenship, scientific truth claims, meritocracy, and rationality" is now widespread (Baker, 2009). Rather than questioning these values, we simply note that this conceptualization has a dark side. For example, in East Asia, the beliefs about the meritocratic and empowering nature of education help sustain a private tutoring system, which students attend instead of engaging in more creative activities. These systems, which are comprised primarily of cram schools for state-run university entrance exams and the SAT, are often referred to as "shadow-education systems." Bray and Lykins (2012) provide an overview of the proportion of students enrolled in supplementary education systems in Asia. They found that 73.8% of Chinese primary students, 87.9% of Korean primary students, and roughly 97% of Singaporean students attend cram schools in addition to their regular schooling. Estimates for the

amount of time spent in cram schools are generally not provided, but the average student in Taipei spends approximately 6.8 hours per week in a cram school, while students in Maotanchang attend class from 6:10 am to 10:50 pm. Meanwhile, South Korean students spent on average 10.2 hours per week in cram schools in 2011 (Köllner, 2012), but this estimate may be low since students routinely violate the government curfew that requires cram schools to close by 10 pm.

In 2009, citizens in France and Germany, which also use national assessments for university admission, were spending more than $4.49 billion dollars per year on supplementary private schooling (Bray, 2009). Even in the United States, where there is no national university entrance exam, there is a multi-million dollar market for private test preparation. For example, Princeton Review alone earned $214.4 million dollars in 2010 (The Princeton Review, 2011) for its services. Parents and students engage in the system because they prepare children for examinations that are used for social sorting, not because they believe that these assessments measure important aspects of intellectual and creative development. Imagine if students in East Asia dedicated their time and energy to one or two unique extracurricular activities instead of an examination that all children must take every year: It is hard to argue that such a change would not have a dramatic impact on creativity and innovation in the region. Ironically, however, there seems to be little concern in the West about the reverse trend. That is, the possibility of high-stakes exams fueling the market for private supplementary education thereby displacing extra-curricular activities.

Meanwhile, the emphasis on universalistic values and knowledge may help students develop basic skills with widespread application, but only at the expense of non-universal, local knowledge that may have to be acquired before the universal knowledge can be applied. For example, education reformers frequently discuss P-20 education systems as if we can create a pipeline that will guide students from birth into jobs that will exist 20 years in the future by simply helping students achieve a common set of standards. This is a highly dubious proposition considering how quickly technology and the economy changes, but even if we were to accept that schools could prepare students for the careers of the future, we are beginning with the premise that children should aspire to be employees first and foremost. However, children could be taught to harness local talents and resources for their own creative endeavors. Even if they eventually decide that their futures would be more secure as employees, they would be better off for having gained a deep understanding of their locales because they will have to rely on the environment to succeed regardless of their end destination. By imposing universal standards, the global homogenous education paradigm not only attenuates the teaching of local languages and regional knowledge, it imposes an ideology that treats students as products or employees-in-the-making instead of creators.

By reducing local knowledge, we will also reduce cognitive diversity thereby weakening our ability to solve global problems. Research on the effects of group composition on task performance has demonstrated that heterogeneous groups

frequently outperform homogenous groups at problem-solving (e.g., Bowers, Pharmer, & Salas, 2000; Laughlin, 2011), especially when group members have diverse theories, philosophical perspectives, cultural backgrounds, and problem-solving heuristics. The primary exception is during group brainstorming sessions. Research suggests that individuals are more effective at brainstorming than groups because the production of ideas across group members reduces the ability of each individual group member to share his or her ideas (Stroebe & Diehl, 1994), and because diverse groups (especially socially diverse groups) can engender anxiety about performance (Camacho & Paulus, 1994). In a sense, current trends in education offer the worst of both worlds: the standardization of curricula and standards will reduce diversity of perspectives, strategies, and knowledge; while the reliance on normative practices and policies in mass-schooling creates social pressures and bureaucratic barriers that prevent many students from developing as much or as quickly as they are able. We know that we do not have the answers to the most challenging problems facing humanity in the 21st century. At the very least, it seems misguided to place these additional limitations on our ability to generate creative solutions. Even if the homogenization of education can raise overall productivity, it will mean nothing if we do not have the solutions toward which we can apply the productivity.

COUNTERING THE NEGATIVE IMPACT

In order to counter the harmful effects of the global homogenous education paradigm, we suggest that countries adopt broad curricula, allow for local variation, and tailor instruction to individual children as much as possible. In the homogenous education paradigm, learning is conceptualized in terms of subject areas: a practice inherited from Ancient Greece and Rome. The basic architecture upon which the homogenous education system is built is the Industrial Era's take on the *trivium* and *quadrivium*. This architecture cannot be upgraded in a way that meets the demands of the 21st century, which include a global marketplace and an exponentially growing body of knowledge that is hopelessly beyond individual mastery. While there is utility in defining areas of knowledge to make them more manageable, it is not practical to continuously adjust and reconfigure educational standards, the curricula that deliver them, the instruments that measure mastery over them, and the bureaucracies that integrate and manage all of these moving parts just to keep schools one-step behind the demands of the marketplace. Instead, schools should make it a priority to provide safe, supportive, and cognitively engaging environments that emphasize project-based learning. Zhao (2012) discusses project-based learning at length, and the various ways that it can be implemented. The key takeaway, however, is that schools should move students away from passive consumer roles into active, participatory roles by making creativity and entrepreneurship the goal rather than a feature of education.

Effective project-based learning is also tailored to local needs. The world is deeply unequal in terms of the resources and opportunities afforded to individual students. The homogenous education paradigm is a boon to some students, and an impossible hurdle to jump for others. Project-based learning is focused on solving-problems and entrepreneurship. To be effective, students and teachers have to take local needs into consideration even if they aim to have a global impact. They have to convince local investors and influencers to support them in their endeavors. Great teachers already adjust their practices to meet local needs. However, policymakers focus on raising students to predefined global standards instead of directly addressing the immediate needs of students. We suggest that policymakers act more like venture capitalists or consultants by directly addressing the needs of their students. Schools meanwhile could help students understand local social networks and bureaucracies that will either serve to help or hinder them.

Finally, we suggest that schools follow their students rather than trying to lead them (Zhao, 2012). Pinker (2003) summarizes what cognitive and evolutionary psychology has taught us about the innate capacities of children. We know that children are not born blank slates. They are certainly not blank slates by the time they enter school. Children are born with curiosity and a desire to be creative. They come to schools with different values and skills from a combination of nature and nurture. Schools should endeavor to expand unique student talents instead of trying to standardize them. Montessori and Waldorf schools already take this approach, as does the Summerhill School, the Roeper School, and the Albany Free School, but these schools are anomalies in the education landscape. In order to truly transform global education, we need to stop discussing education in terms of whether we can make an efficient mechanism for producing employees in a broken economic system, and start discussing how to teach students to harness their creativity.

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JANE PIIRTO

9. THE CREATIVE INTELLIGENCE OF TEACHERS RESISTING THE PEARSONIZING OF GLOBAL EDUCATION

Don Ambrose, in a thought piece used as a target for commentary on where global education and creative giftedness should intersect in the 21st Century, said: "The murder of creativity comes from dogmatic adherence to accountability initiatives driven by widespread, high-stakes measurement of superficial, narrow abilities through standardized testing" (chapter 2, this volume).

While his piece is wide-ranging and comprehensive in discussing the macro- and micro-challenges brought about by globalization, few can comprehend the massive influence and impact of just one or two international companies that are close to having a monopoly on textbooks for both K-12 and higher education, on assessment, on remediation, on sales, on thought, on technology, on aspects of the creative process which I have discussed in my own work (Piirto, 2004, 2011, 2014). One of these companies is the Pearson Publishing Company. Another is the Educational Testing Service. This essay is an attempt to (1) make the case that there is an overemphasis on assessment which has been driven by legislators seeking an easy fix to the problem of poverty and by commercial publishers seeking to make profits; (2) respond to Ambrose's call for an interdisciplinary approach to research on education, and (3) show a possible solution from creative teachers using their creative intelligence to organically weave classroom magic even with these influences, which seek to standardize human learning, response, and knowledge.

Ravitch (2012) coined a term for the omnipresence of commercial testing and assessment companies that are making huge profits from developing and supervising these assessments. She called it *Pearsonizing*. One cannot live in the education world without being solicited to use one or more of this company's products. The company's omnipresence was even recognized in a popular financial magazine, *Fortune*, which published an article called "Everybody Hates Pearson" (Reingold, 2015). In this article, Reingold detailed the rise of the educational division of Pearson through acquisitions of many companies such as NCS, Merrill, Prentice Hall, and MacMillan. She said that liberals hate Pearson because of its profits, and conservatives hate Pearson because it is a foreign company trying to influence U.S. education. She stated that "analysts think Pearson controls some 60% of the North American testing market" (p. 80).

Let me tell a few stories.

- I was leaving my office in the College of Education the other day, and a young man in his twenties was coming in. "Is this where the Pearson Test is?" he asked. Pearson Test? I thought. Which one of the thousands? I pointed him toward the office.
- At the 2014 meeting of the National Association for Gifted Children in Baltimore, the higher education professors had their annual meeting. About 35 of us were there. We were all wearing nametags, large oblong canvas golden two-part monstrosities. The top said, in bold letters, *PEARSON,* while below, tucked into a small pocket, was our own name and institution, in much smaller letters, letters so small we had to lean down and squint when meeting people. But the PEARSON was big, bold, and black. We discussed new business, such as CAEP and PARCC. CAEP is the replacement for NCATE, an accreditation duty for all of us. PARCC is, of course, the new assessment states will be using for the Common Core. We professors of gifted studies, from many states, also had as an agenda item, a short discussion about high stakes testing and its influence on our students and their students. I, being a rascal, suggested we refuse to wear our name tags advertising this company. I later wrote a poem I read when I received the E. Paul Torrance Creativity Award later at the conference. Here it is.

Inadvertent Billboards Pearson

–read at NAGC Conference, 2014

All through the halls here
I see inadvertent yellow billboards
advertising a British company
that makes millions, nay, a billion
from many states of our union.
This company misidentified
2,067 gifted students
in NYC in 2013.
This company aspires to
create and monopolize
the tests and textbooks
for children and their teachers'
teachers' teachers.

I say this, people.
Be no company's billboard.
Cross out the "A"
Say you are a Person
not a Pearson.

–with thanks to James Bishop
by Jane Piirto

Such is the poor protest of an aging poet. The brilliant and somewhat grandiloquent protests of such writers as Berliner, Ravitch, and others (Berliner and Biddle, 1995; Berliner & Gene, 2014; Ravitch, 2010, 2014; Kozol, 1992) have done little to slow the steady march of this company to monopoly.

I myself was once a Pearson author. My textbook, *Talented Children and Adults* was first published in 1994, by Merrill but my checks for the 2nd edition came, variously, from Prentice Hall, which had bought Merrill, and then from Macmillan, which had bought Prentice Hall, and now they come from Pearson (for permissions for figures and graphs that others have sought to use). They gave me back my rights to the book, and my Pyramid model, and it is now in a 3rd edition with another publisher. This Pac-Man-like gobbling up of competitors continues.

Pearson was the only company that bid for the Common Core assessment contract in March 2014. The blogosphere includes Valerie Strauss, writing for the Washington *Post* (March, 2014), who described this monopolistic coup in an article the headline writer called, "Pearson, Of Course, Wins Huge Common Core Testing Contract." She wrote: "Pearson, the largest education company in the world, which already has numerous contracts with states for testing and materials, just won a whopper: a contract with one of the two multi-state consortia that are designing new Core-aligned tests with federal funds" (Straus, 2014). Pearson has been pilloried in a series of blogs by university professor Alan Singer (2014), who described the company's complicity in an iPad scandal in Los Angeles. Schneider (2014), another blogger, described how Pearson has sold its products to Saudi Arabia: "Saudi Arabia will be steeped in Pearson, standards and assessments included. And teacher prep." They will also do professional development of science and math teachers and English language instruction providers. India also has a large Pearson presence (Timmons, 2009).

Investigative reporter and parent Jason Stanford described how Pearson met with President Obama and Secretary of Education Arne Duncan to recommend more tests (Stanford, 2014). He described the financial windfalls Pearson has obtained from various states as well: Florida has spent $254 million, New York has spent $32 million, and Texas has spent $468 million. "This month Pearson executives met with Barack Obama and Duncan at the White House to discuss ways to help low-income students get into college. I'll match every dollar Pearson makes if you don't think the solution that Pearson proposed was more testing." One would need an investigative reporter with money and time to trace the path of these acquisitions in all of the areas and fields in which Pearson operates. The National Center for Fair and Open Testing has compiled a list of testing problems associated with the company's recent history in the U.S. (Schaeffer, 2015).

However, we have no trust-busting Teddy Roosevelts around, it seems. The hopes of many educators, who lean left, for the educational policies of the administration of Barack Obama to correct the abuses of President George Bush's No Child Left Behind in 2002, have been dashed by the assessment-obsessed Race to the Top program, which one educator called at a public speech by U.S. Secretary of Education Arne

Duncan, "No Child Left Behind on steroids" (personal communication, American Educational Research Association Q & A during Arne Duncan speech, May, 2013). In 2009, 46 states adopted the Common Core Standards, which have also been under fire as being too influenced by Pearson, though many think that such national standards are long overdue. Pearson was strategically placed to be the company to deliver the related tests and materials.

What are the implications for our gifted children of the hegemony of such scale? Our students do well on tests. In fact, we could say that the field of gifted education is defined by tests. We, along with our colleagues in special education, are the most modernist of fields within education (see the discussion of modernism-postmodernism in Piirto, 1999). In fact, the identification tests for gifted students in New York City were mis-scored by Pearson in 2013, and 2,700 students were not admitted until the mistake was rectified. The city withheld $500,000 from the $5.5 million Pearson contract as a result (Baker, 2013).

Ambrose's call for interdisciplinarity may be met with deaf ears among the research community in gifted studies. For example, on the research front in gifted studies, at the American Education Research Association, our Special Interest Group is called Research on Giftedness, Talent, and Creativity. The papers that are accepted are heavy with statistics and light with other creativity. Of course, the varied use of various statistical methodologies is itself creative, and it is an entry skill that Ambrose called for in his target essay. He said, "the ever-more complex macroproblems of the 21st century cannot be solved from within the confines of insular disciplines" (p. 13), but in the research area within our own field, peer reviewers overwhelmingly select mathematically-based statistical studies that are ever more disciplinary. Psychology is the parent discipline of education, and psychological research is what is valued in education.

Within AERA there are creators who do research that is not statistically based. I myself also belong to the Arts-Based Research SIG and the Poetic Inquiry SIG, and have done research in both areas, but few of my colleagues in gifted education have heard of nor do they respect either area as "real" research. The field of education contains many who are not statisticians, but who are highly-trained artists and creators in other fields. In gifted research circles, we do not value them. I brought a colleague in gifted education to a poetic inquiry session where I was going to read from my new poetry book, and, though her expertise is in literacy, she said she had never been to such a session, and was quite shocked. Such is the narrow disciplinarity of our field as presently constituted, where there is an emphasis on test-taking, on assessment, on STEM, and a corresponding de-emphasis on creativity and on the arts. James C. Kaufman, a prominent creativity researcher, recently commented on the lack of knowledge by people in other fields about the work of creativity researchers (personal communication, Facebook July 10, 2015):

> Am I the only creativity researcher who becomes notably less likely to bother reading/understanding/citing a creativity paper when I see it doesn't cite ANY

creativity journals, just social psych (or whatever field they're in)? If they can't be bothered to do the most cursory of PsycInfo searches, I feel less compelled to think they have anything to say worth caring about…

Why this emphasis on statistics and de-valuing of a multi-disciplinary approach to knowledge matters in the current climate relates back to the distressing problems that are presented in the focus essay by Ambrose. Ambrose (in Chapter 2) noted the current tendencies in our American education system for creaticide (Berliner, 2012) and apartheid "that derive from current pressures to push American education back toward alignment with the worst forms of 19th-century pedagogy" (chapter 2, this volume). Ambrose stated, "influential but dogmatic, ignorant, and unscrupulous profit-seeking educational reformers" pressure "school systems to impose more high-stakes testing, quasi-militaristic discipline, and barren, robotic instructional methods throughout the schools while cleansing them of higher-order thinking" (chapter 2, this volume). Ambrose noted that such school systems perpetuate the class separation in the society, because the mostly private, or affluent suburban schools do not have the accountability strictures that the mostly poor, rural and urban public schools systems are subject to after the advent of No Child Left Behind.

The situation is in flux at the time of this writing. In July 2015, the U.S. Senate stepped back from this role in supervising and judging schools with the passing of the Every Child Achieves Act (Stern, 2015), to emphasize more state and local control over assessment and its consequences. This tempering of the increased federal role in education was guided by the backlash to the monopolistic practices of the testing companies mentioned above. By mid 2015, several more states had stepped back from PARCC assessments, including New York, Colorado, Massachusetts, Florida, Illinois, Utah, and Ohio (Ujifusa, 2015). Parents and teachers have spoken about the clock hours spent on testing and test preparation, about the anxiety of young and vulnerable students taking the tests, and the frustration of teachers who must teach the students how to take the tests, spending much-needed curricular time answering the demands of the assessors. The teachers are warned that their jobs are in jeopardy if test scores of their small charges do not improve. It seems that the time is ripe for a reassessment of what teaching creatively means.

Perhaps a trip down to the trenches, where real teachers teach real children, could inspire us. I recently edited a book with personal essays by 22 subject matter specialists who are presently 21st Century classroom teachers. Collectively, they have over 500 years of teaching experience from grades pre-K to doctoral level. One might treat the essays in this volume as a small research study. The contributors have written about how they teach creatively, even in the present climate of assessment and critique and judgment. They focused, in their essays, on how they teach thus, even with the heavy emphasis on testing and assessment. As Erin Daniels (2014) said, "With all of these mandates being pushed down from the top, it is more important than ever to be able to infuse students with the freedom to be creative and to exhibit what is lying somewhere in between" (p. 22). Tarik Davis (2014), a teaching artist

in the tough schools of outer New York City, talked about his disappointment with President Obama's 2013 State of the Union address, where he called for STEM subjects but not for arts and culture: "Where in that system for America's future is dance? Theatre? Visual arts? Music? Hell, where is civics?" (p. 136). He said,

> It's about standing up against the system that keeps them mindlessly filling in the bubbles with a No. 2 pencil, being a statistic taking orders at McDonald's, and not ever tapping into their own artistic souls. It's about engendering a culture that champions creativity, curiosity, and intuition. I teach this culture. (p. 137)

I myself have written much about teaching creatively using the Five Core Attitudes, Seven I's and General Practices into which I have organized my creativity research and about which I have taught in my own creativity classes (Piirto, 2002; 2004; 2005; 2008a, b; 2009; 2010; 2011; 2013). The Five Core Attitudes for creativity are Naiveté, Risk-taking, Self-Discipline, Tolerance for Ambiguity, and Group Trust. The Seven I's are Inspiration, Intuition, Improvisation, Imagination, Imagery, Incubation, and Insight. The general practices are use of ritual, meditation, solitude, exercise, silence, and a creative attitude to the process of life. I have derived these from extensive reading of biographies, memoirs, and interviews of creators in the domains of creative writing, visual arts, architecture, music (both popular and classical), theater, film, sports, science, mathematics, invention, and entrepreneurship. I regularly speak and teach about how to teach creatively. But I would like to focus on others in this essay.

The teachers wrote about their own experiences as teachers who teach their subject matter creatively. Perhaps the light of creativity applied with the gentle but stout resistance of teachers who are being blamed for made-up deficits and for the poverty of 51% of the nation's children can provide a corrective to the top-down racing to the top assessments. Here are some themes from the essays of these experienced teachers, commonalities that signify that resistance is possible. These teachers know about teaching and its joys and heartbreaks and know that having their own creative work is important: Jennifer Groman (2014), a teacher of the gifted and professor of pre-service teachers said, "I found that life as a teacher of the talented and gifted is very difficult. Heartbreaking, even." A musician and singer, she found that her personal creativity helped her teaching creativity:

> Now when I hear stories of the breaking hearts of teachers around me and the questions my young teachers-to-be ask about the difficulties of the profession, I think back to these days. Today I think my creative work made the road a bit more difficult: I saw the slow, steady movement toward standardization with the No Child Left Behind Act and the standards-based legislation and at the same time was aware that teaching could be different—deeper, and more soulful. (Groman, 2014, p. 273)

CREATIVE INTELLIGENCE USED IN RESISTING

In studying how these 22 experienced teachers have developed their teaching practices, fifteen themes emerged. Here they are, with at least one example of each theme, though there were many.

Theme 1: Students Matter. Knowing Your Students Matters

Carl Leggo (2014), a Canadian poet and professor and teacher of writing and of pedagogy seeks to create a spirit of community within his classes so that differences can be celebrated as he and his students write and share the stories of their lives. "We reveal ourselves in intimate ways, and we grow stronger in our conviction about the power of words to write our lived stories and to transform our living stories and to create possibilities for more life-enhancing stories" (p. 192). He sought to have a nurturing connection with his students:

> I want to nurture a relationship that is mutually supportive, a complementary relationship, a relationship of writers who sing in our unique voices and who in our unique singing also seek ways to harmonize with one another. We are word-smiths, weaving our ways and our words, on journeys that are separate and isolate, occasionally convening to sing together, recognizing how often our journeys are parallel, how often our journeys intersect, how often our journeys are redirected and mapped anew in our sharing, how often our journeys are fueled by the conviction that we are not alone. My hope is that my words will invite others to enter into dialogical relationships of word-making founded on risk-taking, trust, truth-seeking, courage, encouragement, nurture, desire, and unwavering commitment to the power of words for singing our worlds into creation. (p. 192)

Theme 2: The Teacher Should Teach Improvisationally—That Is, the Lesson Can Be Changed When the Situation Changes

Todd Kettler and Laila Sanguras (Kettler & Sanguras, 2014), longtime English teachers, discussed what they call "a creative pedagogy of literature"—(1) teaching as disciplined improvisation, (2) centrality of imagination, (3) modeling and developing creative dispositions, and (4) problem solving. They do not apologize for emphasizing the noble purpose of teaching literature: "We teach literature creatively in hopes that our students will catch even a momentary glimpse of the sublime—a brush with truth so pure that it takes one's breath away" (Kettler & Sanguras, 2014, p. 5).

Of improvisation, they said that improvising takes a more skillful and prepared teacher:

> When we improvise as teachers, we are sensitive to teachable moments while maintaining the overall focus on our learning goals. We enter the learning space of the classroom with a broad idea of where we are headed, but retain the flexibility to emphasize ambiguity and possibility. Do not take improvisation to represent poor preparation or lack of skill as a teacher. The jazz musician must practice his craft for years before he is ready to improvise on stage. The teacher must know the stories of the literature curriculum deeply to be able to improvise. (p. 8)

Theme 3: The Teacher Should Feel Free to Stray from the Lesson Plan and Use His or Her Intuition to Determine the Direction of the Classroom Situation and the Lesson

Erin Daniels, a high school teacher of Advanced Placement calculus and regular calculus has had her students create their own problems. She has also encouraged solutions that are not the lockstep solutions proposed in the textbooks and manuals. She had her students come up with their own problems, rather than the common "nicely worded problems about a ladder leaning against a building falling down at 5 feet/sec and finding the rate at which it was being pulled away from the building" She said:

> One day, I had decided to have the students come up with their own problems to solve at the end of a unit on related rates … So with students having their own say in the process, creativity entered the math arena. One student created a problem with different sized cylinders stacked on top of each other and asked about the rate the water was flowing into them. Another student took up the entire chalkboard to write his problem on the rate the distance was changing between Einstein and Hawking. He included black holes, rates of acceleration, and a reference to pi (a tribute to my love of the number) into the problem. He then proceeded to take the remaining twenty minutes and other board space to work on this problem. At the end of class, he was not done, so he came after school to work on the problem, was late to band practice, and still not done. He then took the problem home and came in the next day with a page full of work to show the solution. Interestingly enough, this assignment was completely optional and no grade was given. He was inspired, though. (pp. 24–25)

Theme 4: The Teacher Should Seek to Develop a Climate of Feedback in the Classroom Where the Students Trust Each Other

Christopher Reynolds (2014), a teacher of high school French for 30 years, described how he emphasized creative intelligence with his students in their acquisition of speaking and understanding the French language and culture. He had three goals as a teacher of what he calls "creative capacities": "(1) the capacity to create using French, (2) the capacity to respond to originality using French, and

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(3) the capacity to move beyond school into an authentic, original life enriched by francophone culture" (p. 75). To this end, he encouraged students in a process he calls "feeding back," which is a nonjudgmental sharing of insights about each others' contributions. He created a safe space within his classroom by listening intently to the students and by improvising according to what students bring to class. A poet and singer-songwriter, he often made up songs and sang with the students. He emphasized that adolescence is a period where a rite of passage is globally practiced, and he tried to provide that to his students as well, as a person who deeply understands the adolescent self. He worked with faculty in other disciplines, for example, visual arts, and his French students interacted with the art students in feeding back their art works with their own works. This built trust and caring among the students within the high school.

Theme 5: Students Should Be Encouraged to Learn from Failure and Vulnerability

Jeremy Dubin, an actor who taught Shakespeare to community students, discussed how he encouraged risk-taking that evolved out of his students' fear of risk-taking:

> If fear of failure is not to preclude risk-taking, it is necessary to have a safe environment; an environment in which failure has been de-stigmatized, in which it is encouraged and even celebrated. In such an environment, one can fail without fear of judgment, one has permission to be bad at things— it's pretty incredible just how liberating that idea can be. If embraced whole-heartedly, then failure ceases to be something to be avoided, and becomes what it should be: an invaluable and illuminative tool of learning and growth. This is the first thing that I discuss at the beginning of any course, and I have found that it is a notion that appeals universally. Students are hungry for the opportunity to create such an environment, and all it takes is the decision to do it. (p. 123)

Jessica Nicoll, a teacher of choreography in public schools and at the university, has asked herself the question of what is the least she can bring to her students? "I had to learn to share the space. And if I shared the space, I had to share the power … what was the *least* I could do to make room for each student to discover his or her own feeling of dancing?" (Nicoll, 2014, p. 115). She said that the agenda of many teachers is to impose their own exercises and solutions, and said she wanted to help the students find their own.

Theme 6: Creative Humor Teaches and Engages Students

Daniel Peppercorn (2011, 2014), a middle-school social studies teacher, has enfolded humor into all his classes. He also included humor with the parents on parents' night, having a contemporary events quiz show competition for them. He had activities

such as "Musical Acts with Newsical Facts," where students present their findings with humor. Some of his students parodied the song "Thriller" with a song called "Slater," about the contribution of Samuel Slater to 19th century industrialization. Students sang a song called "I'm Dreaming of an Industrial Revolution" to the tune of Bing Crosby's "I'm Dreaming of a White Christmas." His students played a game called "Fictionary," where they got into teams and wrote descriptions of obscure historical figures they've never heard of, for example, Sybil Ludington, James Armistead, and Deborah Samson. Peppercorn then combined their definitions with the real descriptions, read them out, and students guessed which is the real and which is the fake description.

Theme 7: "Trusting the Gut" Often Leads to a Successful Intervention by a Trained Counselor with Students Having Situational Difficulties

Maria Balotta (2014), spoke as a school counselor at an urban high school, where all the students received free breakfast and lunch (a measure of their poverty). She described several interactions with students where using her intuition (she called it "that 'aha' moment" led her to be able to help them. In one instance, a bullied girl was prevented from attacking her bullies with a switchblade by Balotta's intuition:

> When I think of this case and others I often wonder how many lives could be saved and disasters thwarted just by really looking at our students and by tuning into and following the voice within. Intuition is a gift that we human beings possess. Some may call it instinct, but instinct to me is more primal and much less refined. Our instincts, I believe, can put us in danger while intuition, if heeded, can serve as a life preserver; sometimes our own and sometimes another's. (p. 304)

Theme 8: Field Trips Increase the Likelihood of Students' Engagement and Remembering

George Johnson, a teacher for 40 years, and a teacher of gifted elementary students in a rural poor district for 30 of them, has taken his children on many field trips, to sites throughout the nation and the world. He said,

> I have taught music history in the Rock and Roll Hall of Fame, taught *Beowulf* and Egyptian history in the British Museum, taught structural integrity at the Eiffel Tower, taught art history at the Louvre, taught about fresco painting at the Sistine Chapel, and taught the development of medieval armor at the Cleveland Museum of Art. I've taught about Goya at the Prado, about volcanism in the ruins of Pompeii, and about pterodactyls at the top of Mt. Pilatus in Switzerland … Our school is 70% economically disadvantaged. If it is important enough, it can be accomplished. (p. 235)

Theme 9: The Classroom Is a Mutual Learning Environment,
Not an Environment for the Teacher Alone

After teaching talented high school students at a summer institute, Rodney Michael changed his style in teaching college physics, eschewing lectures for projects. He said that project-based learning is beneficial to the teacher because the teacher is involved and never bored. "It allows the teacher to apply his creativity on a daily basis and insures that every time he walks into the classroom it will be a new experience" He continued: "Imagine that. Such methods are good for the student, good for the teacher, and better student comprehension, all rolled into one" (MacDowell & Michael, 2014, p. 73).

Theme 10: Self-Knowledge Tools such as Mandalas, Walking the Labyrinth,
Reflections, Nature Walks, and the Like Help Give Students Insight

Graduate professor Diane Montgomery (2014) combined the Native American medicine wheel, Jungian psychology, and transpersonal values, and made the Holistic Education Model. She used the Medicine Wheel, which features east, south, west, and north as developmental threads, physical, social-emotional, spiritual, and intellectual. The Holistic Model includes (1) The Mind, (2) The Body, (3) The Spirit, and (4) The Heart (p. 246). Montgomery regularly taught with Jungian mandalas, with labyrinths, with infusion of the arts, with meditation retreats at her lake house, with deep sharing and a trust in her students' own intuition as indicators of what to do. She said, "The reward of teaching is to get the opportunity to witness the holistic development of students who become leaders, wise teachers, authentic psychologists, and compassionate human beings who care for one another in their lives—in work, relationships, and play" (Montgomery, 2014, p. 251).

Cindy Burnett (2014) has revised the venerable Creative Problem-Solving Model (CPS) to include intuition. While teaching at the graduate program at the International Center for Studies in Creativity at Buffalo State University, she noted that her students often had superficial experiences with the process and were not bringing their whole selves to the table. She began to ask her students to slow down and to be mindful of what they were learning. She encouraged periods of incubation. She emphasized ubiquitous intuition, passive intuition, and active intuition. She developed an instrument called the Facts, Feelings and Hunches questionnaire, which encouraged such practice. She recommended slowing down and permitting students to incubate and to be mindful. She recommended breaks in classes for rest and for exercise. "We need to deliberately build time into our classes so that our students can be mindful about what they are learning." Spending time exploring the sensory aspects of what is being studied is a suggestion. "For example, if your students were learning about apples, ask them to spend five minutes exploring what an apple looks like, feels like, tastes like, while looking for new things that they might not have noticed about apples before" (Burnett, 2014, p. 296).

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Theme 11: Music, Theatre, Art, Dance, and Performance Are Not Extras, but Vitals

School principal Rebecca McElfresh (2014) hired poets, dancers, theater people, the Cleveland Symphony outreach program for her students to enhance the arts experience of her students. She also engaged them in art therapy after the sudden deaths from cancer of four popular teachers. Her belief that the arts are necessary for optimal education pervaded, and she listed three necessities for schools in doing such arts infusion.

> First, I suggest strong curriculum development, not only in the areas of visual art, music, drama, and movement, but in the cross-curricular connections that so readily allow for the integration of all art forms. Second, regular and planned school-wide emphasis on the arts promotes the opportunity to learn experientially and to "release the imagination" necessary to promote intuitive work. Finally, guided practice with intuitive working through the arts allows staff members to explore this way of thinking and working within a safe space. All of these factors help to create teachers who feel safe moving forward in their work with students, helping them to explore these same ways of working and of knowing. (McElfresh, 2014, p. 315)

Theme 12: Talent Is Omnipresent, but There Is a "Certain Something" Beyond Talent That Is Indefinable, That Experts and Audiences Know When They See It

The international field of the education of the gifted and talented is and has been rife with controversy. Barry Oreck (2014), the longtime dancer and arts educator (ArtsConnection, Young Audiences, etc.) has developed arts assessment protocols in dance, theater, music, and visual arts and has trained many teachers to do the assessments. He spoke of something called "*A*." Also known as the "It" factor, or "star quality," Oreck said, "There was something else—something about the ways in which the charismatic performer communicates, the level of focus, a connectedness to an emotional source, a sense of calm amidst great effort" (p. 97). Oreck conjectured that "*A*" might be a general characteristic across artistic domains: "I do believe, however, that the characteristics of "*A*" are similar across artistic endeavors; artists bring many of the same qualities to their art in whatever form it is in" (p. 97). This brings a challenge to those who would research talent development. What is it? And how can it be identified?

Theme 13: "Know Thyself" Is a Goal for Teaching and Living Creatively

A teacher is not only a person handing out tests and teaching to prompts. A teacher, like everyone, is a searcher and someone who seeks renewal as they give their students themselves. Stephanie Tolan (2014), a Newbery Award winner, often teaches writing workshops to children. She said, "I have not only engaged in a

purposeful exploration of the nonrational aspects of consciousness." She sought, as a life practice, to cultivate her inner self. "I have actively worked to learn how to use my intuition more effectively not just in writing, but in the rest of my life as well. The exploration has become a spiritual journey as well as a way to increase my own creativity" (p. 180).

Theme 14: Students Should Be Encouraged to Improvise, Theorize,
Elaborate, Discuss, Explore, Create, Conjecture, Ask Why, and
Not to Just Focus on "the Right Answer"

Keith Taber, a science teacher and professor of pedagogy at Oxford in the UK, pointed out that scientists themselves use "inspired guesswork" to frame their theories and models, at least in the initial stages, and that the way science is taught should reflect this. He said, "Scientists and teachers alike are only explicitly aware of some their knowledge, and often have to trust and follow their intuitions because they cannot rely on using logic when they are not actually aware of the basis for their judgments" (p. 55). Taber noted that good science teachers are inherently creative: they are able to use their own past experience in classrooms to be able to react and "change tack, simplify more, offer a new analogy, take on and develop an initially incongruous simile suggested by a student, and even when it is best to admit defeat for now, and return to a problem afresh on another occasion" (p. 57). He said that, "What we are often not so good at is ensuring that students themselves appreciate the creative aspect of science."

> Yet science teaching that asks students to use their imaginations to make sense of new experiences or ideas; to find creative ways to represent and model their thinking; and then to explore the strengths and limitations of their creative ideas as part of a community of peers, is not only likely to be more engaging and accessible for most students, but also to actually offer a more authentic image of the creative processes so essential to science itself. (Taber, 2014, p. 57)

MacDowell and Michael (2014) discussed how their physics students use creative intelligence in their classroom experiments and the projects they attempt: "The students must use their intuition, visualization, imagery, and creative abilities to transform ideas into plans, then build actual devices using their plans … The creative thought process is encouraged, exercised, and celebrated from beginning to end" (MacDowell & Michael, 2014, p. 73).

Theme 15: Teach with the Body

Most of these experienced teachers utilized lessons that required movement and the whole body. Celeste Snowber (2014), a university professor of arts and dance reminded:

> The body is the canvas for creativity. We paint with our hands, dance with our feet, sing with our breath, and sculpt with our palms. Our very beings are creative—we are made with the glorious impossible—ears that hear, flesh that remembers, pulse which regulates, and hair which protects. (Snowber, 2014)

In summary, these fifteen themes had many examples in the teachers' essays, but in the interest of brevity, I have only briefly described them.

TRANSFORMATION THROUGH TEACHING

And what about the students who are taught by such subversive practices? Many experience a sense of belonging, they achieve, and they may even experience transformation. Here are some examples. Dubin (2014) described a shy 12 year old girl who played Marc Antony in one of his class productions. She was a good student, introverted, and wanted to please. Dubin worked with her on the assassination speech, and she was willing, but unable to feel the words. With more work and coaching,

> the language took her and lifted her, inspired her to find whatever she had to find in order to meet the needs of the oratory… The cadence and the rhythm carried her inexorably forward, not allowing her to back off, the pitch rising and building with each new thought. She rose up from the ground, and her protective, apologetic body language was gone. Suddenly she just opened up, whatever blockages and vocal inhibitions she had imposed upon herself fell away, and for the first time in who knows how long, she had direct clear access to her entire instrument. Her voice took on a depth and resonance, and all the energy of the speech, the relentless cadence and rhythm, the tonal build, culminated in a blood—boiling "Havoc!" that seemed all but impossible coming from her frame… Carrie was actually trembling, and looked a little dazed. She looked at me, and after a couple of beats said "Was that okay?" A door opened for Carrie that day that challenged her notions of herself and her capabilities. (Dubin, 2014, pp. 132–133)

Jessica Nicoll (2014) described her student, Lee, in her choreography improvisation class at Hunter College. Lee was not a choreography major, but a business student. She was tentative, and struggled with the English language. "She started to delicately paint the air. Immediately the dancers on stage mirrored her gestures. Lee stopped, dropping her chin to her chest. She took another breath. 'No,' she said. 'How can I say?'" (p. 119). Lee began to move again, very slowly, and her classmates watched her, and then they each moved individually, to the motion of Lee's hands, spinning, dipping, dropping. They Lee began to respond to their movements.

> At the end of this silent, breathtaking symphony of motion … every dancer in the audience and on stage erupted with an ecstatic cheer, on their feet, applauding the most extraordinary improvisation of the semester. Lee stood speechless, hands to her mouth: what had she done? Stunned, I tried not to cry,

aware of my power as a teacher … Every student in conference with me after that day mentioned Lee's improv and how it had changed them. Lee too, spoke of being transformed. "I made it up," she said, "because my English is no good. I asked myself, 'How can I say what I want to say?' … It changed everything. I think now I am a dancer." (Nicoll, 2014, p. 119)

Transformation comes from the personal emotional experience. Sally 'dhruva Stephenson (2014) described working with a man in a songwriting workshop. The man said he "just didn't 'get' music. This stunned me. How could anyone not 'get' music?"

One day … we were given a task to write a song in twenty minutes with the idea-starter of "Don't make me stop this car!" … he casually mentioned that once he drove nine kids in a pickup truck to the Grand Canyon. Fifteen minutes later, a song was born … it took a personal creative experience for him to make a connection with music. (Stephenson, 2014, p. 151)

CONCLUSION

What can an individual do in the face of such macroproblems as Ambrose (2014) discussed? How can global subject matter proficiency, creative and critical thinking expertise, interdisciplinary cooperation, technological literacy, comfort with finance and economics, an inner commitment to self-development and fulfillment, a diversity of types of cognition, and the like, as detailed in the target article, be enacted? The answer is, of course, by teachers. All these skills that Ambrose called for need teachers to teach them. Teachers are the most vulnerable in the chain of changes and so their integrity must be protected and not manipulated by profiteers and their willing enablers, the politicians and profit-seekers. The teachers' organizations are beginning to resist the attempts by what Sturges (2015) called *neoliberals* to homogenize them. And, as the teachers profiled in this essay have shown during their long tenures as educators, one solution comes from curating and developing one's personal creative practice of teaching. As a teacher myself, I join these exemplars discussed here: we can use our own forums, we can speak up in our department meetings and professional organizations, we can skillfully teach what we know and have studied, and we can join the protests when called upon to do so.

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SECTION IV

INVIGORATING CREATIVITY IN EDUCATION

RONALD A. BEGHETTO

10. LEVERAGING MICRO-OPPORTUNITIES TO ADDRESS MACROPROBLEMS

Toward an Unshakeable Sense of Possibility Thinking

> By itself, one small win may seem unimportant … *however … once a small win has been accomplished, forces are set in motion that favor another small win … [and the] next solvable problem often becomes more visible.*
> – Weick, 1984, p. 43

The kinds of 21st-Century macroproblems facing current and future generations of teachers and students can be quite daunting if not downright demoralizing. Even the lucky few – who have traditionally had the resources, access, and privilege to enjoy the macro-opportunities presented by globalization – are in danger of crashing down from the crest of the wave they have been riding. The potential impact of a global collapse, as described by Ambrose (chapter 2, this volume), may serve as a devastating equalizer – crushing both the haves and have nots. What, if anything, can be done to help young people develop the capacity to manage the rapid depletion of natural resources, repair widespread environmental devastation, address increasingly severe inequalities, reverse the erosion of democracy, disrupt dangerous dogmatisms, and address yet to be discovered macroproblems?

One way to address this question is to seek out radical changes. According to this logic, big problems require big solutions. The purpose of this chapter is to challenge such a view and, instead, outline an argument for the value of recognizing and capitalizing on the kinds of micro-opportunities that can be leveraged and brought to scale. One such micro-opportunity is the cultivation of possibility thinking in students and teachers. Democratizing efforts aimed at cultivating the creative imagination can have a profound and future reaching ameliorative effect on macroproblems. As will be argued, daunting problems need not require daunting solutions. Rather, the widespread cultivation of the willingness to tackle ill-defined and complex problems with a spirit of possibility can help break through the crust of the macroproblems we face and move toward more hopeful futures.

The chapter opens with a discussion of how approaching macroproblems with an unshakeable sense of possibility thinking (UPT) can result in the development and enactment of new possibilities. UPT is a motivational orientation towards problem solving that enables people to think *and* act in ways necessary for addressing complex, large-scale and ill-defined problems. Next, I provide a discussion of a longstanding

pedagogical paradox facing educators, which serves as a barrier to cultivating UPT in typical schools and classrooms. The chapter closes by outlining three principles aimed at helping educators resolve this paradox and, instead, cultivate UPT in their students and themselves.

AN UNSHAKEABLE SENSE OF POSSIBILITY THINKING

In order to develop our capacity to understand and address existing and new macroproblems, schools will need to move beyond a focus on fixed ends and move towards cultivating micro-opportunities for students and teachers to develop their creative imagination. The creative imagination acts as a vehicle for moving beyond *what is* to *what could* or *should be* (Beghetto, 2008; Eisner, 2002; Greene, 1995). It allows us to break from old habits and realize new, transformative possibilities (Craft, 2010; Dewey, 1934/2005). It also serves as "the basis for all creative activity" (Vygotsky, 1967/2004, p. 9) and drives personal and social change (Dewey, 1934/2005; Greene, 1995). We can therefore say with Eisner (2002) that "a culture populated by a people whose imagination is impoverished has a static future … there will be little change because there will be little sense of possibility" (p. 5). Given the increasingly complex macroproblems we face, it would not be an exaggeration to claim that a static future represents no future at all.

Philosophers and educational scholars have long argued that cultivating the creative imagination is necessary for our future survival and therefore should serve as a primary aim of schooling. Vygoskty (1967/2004), for instance, argued that "the entire future of humanity will be attained through the creative imagination" (p. 88). He went on to argue that if the primary goal of schooling is to prepare students for the future, then cultivating students' creative imagination "should be one of the main forces enlisted for the attainment of this goal" (p. 88). Similarly, the British philosopher Mary Warnock (1978) asserted, "we have a duty to educate the imagination above all else" (pp. 9–10).

In addition to espousing a value for cultivating students' creative imagination, scholars have also raised concerns that we often fail to enact this value. Dewey (2007/1999), for instance, observed more than a century ago:

> We hear much nowadays about the cultivation of the child's 'imagination.' Then we undo much of our own talk and work by a belief that the imagination is some special part of the child that finds its satisfaction in some one particular direction – generally speaking, that of the unreal and make-believe, of the myth and the made-up story. Why are we so hard of heart and so slow to believe? (p. 72)

Why indeed? Why do so many of us hold on to such a narrow conception of the creative imagination – viewing it as lacking "practical significance" (Vygotsky, 2004/1967), preventing it from occupying a formal role in serious academic learning (Eisner, 2002) and banishing it from schools and classrooms (like Plato famously

did to the poets and artists in his *Republic*)? What math worksheet or spelling word list could be more important than having teachers and students imagine new ways to put their academic knowledge to work on addressing ill-defined and complex problems? How much longer can our schooling practices remain hunched over and tinkering with fossilized curricula, oblivious to the cresting wave overhead? How many more hours, days, and years will be wasted in schools and classrooms with teachers and students asking and answering known answer questions? The stakes, it seems, couldn't be higher.

The good news is: The creative imagination is not something that needs to be taught to students. It is not another curricular add-on or skill, strategy, or body of knowledge to be learned. It is, as Dewey (1899/2007) reminds us, the very "medium in which the child lives." This is not to say that the imagination is restricted to the experience of children. Rather, the creative imagination is central to our daily experience, whether we are young or old. In fact, our creative imagination and everyday experiences are inextricably connected, what Vygotsky (1967/2004) described as a "double mutual dependence" (p. 17). Put simply, our imagination depends on our experiences and our experiences depend on our imagination.

Most people recognize that our imagination is based on experience. Indeed, as Guilford (1950) has noted, we cannot create new insights or ideas in a vacuum. We need some experiential basis for our creative imagination. The more and varied experiences we have the more stimuli we have available for our creative imagination to draw on and combine in new and meaningful ways (Vygotsky 1967/2004). Our experiences also depend on our imagination. This assertion is a bit less intuitive. Scholars, however, have long recognized this dependence.

Dewey (1934/2005), for instance, asserted that "all conscious experience has of necessity some degree of imaginative quality" (p. 283). Indeed, as Warnock (1978) has argued, without daily use of our imagination, "no human discourse and no goal-directed activity would be possible" (p. 202). This, she explains, is because our imagination allows us to ascribe meaning to our experiences, to make sense of them, revisit them in our mind's eye and, thereby, help us to render our experience in familiar and manageable ways. Our daily experiences depend on our imagination because it allows us to comprehend what we have not directly experienced. As Vygotsky has explained,

> Imagination is a completely essential condition for almost all human mental activity. When we read a newspaper and find out about a thousand events that we have not directly witnessed, when a child studies geography or history, when we merely learn what has been happening to another person by reading a letter from him—in all these cases our imagination serves our experience. (1967/2004, p. 17)

In the context of the classroom, the creative imagination can be used to deepen student understanding of what is taught and can be directed to tackling larger issues. One of the greatest disservices we do in schools and classrooms is underestimate

the creative imagination of our students and teachers. What if, instead, we allowed teachers and students to follow Greene's (1995) maxim and "release their imagination" on complex global challenges and problems? What would this look like? The following represent a few examples of what can happen when young people have the opportunity and support to release their imagination on highly complex and important problems.

A group of fourth graders in Marin County, California, for instance, helped save an endangered freshwater shrimp, which sparked an on-going student and teacher habitat restoration program (Stone, 2001). A group of 25 children age eight to ten from Blackawton Primary School in Devon, England, serves as another example. This group of children conducted and published a study, in collaboration with their teacher and a visiting neuroscientist, on bee behavior. The article, written in "kids speak," was novel both in its scientific contribution and style. They eventually published their paper, after persisting through several rejections, in a leading science journal of The Royal Society, *Biology Letters*[1] (Young, 2010). Other examples include, Richard Turere who, at age 11, invented a *Lion Lights* device that deterred lions from preying on livestock in Kenyan towns and villages (Kermeliotis, 2013); and Shree Bose who, as an 11th grader, won the grand prize at the 2011 Google Science Fair for finding a way to counteract drug resistance of ovarian cancer cells (Chang, 2011).

As these examples illustrate, once students and teachers have the opportunity to unleash their creative imagination on complex and challenging topics, the more likely they will be able to put their academic learning to work. This can result in both deeper learning and a contribution that extends beyond the walls of the school and classroom (Craft, Cremin, Burnard, Dragovic, & Chapell, 2012). Importantly, these teachers and students approached challenging projects with what might be called an *unshakeable sense of possibility thinking* (UPT).

UPT refers to a motivational orientation one takes towards conceptualizing challenges and problems. Specifically, UPT refers to persistently directing one's creative imagination toward envisioning and acting on new possibilities. UPT is represented in a combination of possibility thinking and a special form of self-efficacy. The PT portion of UPT refers to what Craft and her colleagues have described as making an exploratory transition from "what is" to "what might be" (Craft, 2015). This includes moving from "what is this?" to "what can I or we do with this?" (Craft et al., 2012). In short, PT is aimed at generating new possibilities of *what could* or *should* be when confronting current (and lingering) challenges.

Imagining new possibilities has little value without the willingness to take action on those possibilities. The U portion of UPT therefore serves as the motivational engine of possibility thinking. It can be thought of as a special case of self-efficacy (Bandura, 1997) in that it refers to a robust self-belief in one's ability to envision and take action on new possibilities. Students' efficacy beliefs can be strengthened through a variety of sources, including successful prior experiences, observing the performance of others who they view as similar to themselves, and persuasive

messages from people who they trust (Bandura, 1997). When it comes to possibility thinking, as with all efficacy beliefs, successful experiences and encouragement will likely increase students' willingness to approach new challenges and setbacks with a commitment to generating and enacting new possibilities. The robustness of one's UPT is of particular importance when attempting to produce and execute innovative solutions to highly complex, large-scale and ill-defined problems. Otherwise, such an endeavor can quickly become overwhelming. As Bandura has explained,

> Innovativeness requires an unshakable sense of efficacy to persist in creative endeavors when they demand prolonged investment of time and effort, progress is discouragingly slow, the outcome is highly uncertain, and creations are socially devalued when they are too incongruent with preexisting ways. (1997, pp. 239–240)

UPT thereby represents a combination of a motivational belief and orientation toward imaginative thinking that can help students and teachers approach complex problems with a spirit of possibility – allowing them to break free of limiting or dogmatic mindsets and sustain their efforts aimed at pursuing new alternatives. Of course, just because one is willing to explore new possibilities doesn't mean that those alternatives will lead to viable solutions. Part of UPT requires awareness of when it is time to abandon one line of thinking in favor of a more viable approach. This level of metacognitive awareness takes time and expertise to develop (Kaufman & Beghetto, 2013). Indeed, without such awareness potentially viable ideas might be abandoned too quickly or dead-ends might be pursued for too long.

Developing UPT therefore involves encouraging students to seek feedback, help, and guidance when needed. This support and guidance could come from most anyone, including: teachers, parents, outside experts, and external partners. The point is students need to experience a learning environment that is saturated with possibility. Indeed, how can we as parents, teachers, and adults expect our students and children to approach problems with possibility thinking unless we model it ourselves? Students need to learn from experiencing and observing possibility thinking when confronting setbacks and working through unanticipated challenges. The class of youngsters who published a scientific paper (described above) serves as an excellent example of how external supports, modeling, and collective persistence led to a unique and important scientific contribution by the "youngest scientists to ever be published in a Royal Society journal" (Yong, 2010). Briefly revisiting this example (as detailed in Yong, 210) may help illustrate the genesis and development of UPT in action.

The classroom teacher and an external expert (a neuroscientist and parent of one of the students) helped establish the conditions necessary for engaging in possibility thinking. They were the first to believe that it was possible to engage a group of 25 eight to ten year olds in doing actual science experiments (rather than learning about science from their textbook or teacher). As a result, the students had the guidance and encouragement necessary to design, carry out, and write-up a new and scientifically

important study on the behavior of bees. When it came time to try to publish the results, the students and visiting expert also had to believe that it was possible to publish a highly unorthodox scientific paper – one that lacked reference to prior work, used "kidspeak," that included handwritten data, and represented the results in colored pencil drawings. Not surprisingly the article was rejected by several scientific journals. But the students and outside expert persisted.

They eventually reached out to four established experts in the field of vision and asked each of them to conduct a review of the paper. Only one of the four "questioned its scientific merit" (Yong, 2010). They shared these reviews with the editor of the Royal Society Journal, *Biological Letters*. The editor eventually decided to publish the paper after receiving four additional positive reviews and with the proviso of having two experts contribute a more detailed scientific commentary that was published alongside the children's paper. The unshakeable possibility thinking of this group of students, their teacher, and the visiting parent-expert resulted in the realization of a novel, scientific contribution from an unlikely source (children) and unorthodox format (a scientific article written in "kidspeak"). And it all started with – and was sustained by – a dogged persistence in asking, *what if*?

In order to find new solutions to ill-defined and highly complex problems, we must first believe that an alternative is possible. When students have opportunities to generate and enact new possibilities, they strengthen their efficacy beliefs and, in turn, increase the likelihood that they will persist and find success in subsequent efforts. In short, small UPT wins accrue overtime and can develop into the kinds of robust beliefs that can make significant contributions in even the most seemingly impossible of situations. The first step in doing so is to develop the habit of approaching problems with orientation toward *what if?* In order for this to happen, however, educators need to be aware of and address a longstanding pedagogical paradox that stands in the way of cultivating UPT in schools and classrooms.

THE UNCERTAIN FUTURE PARADOX

A common goal of K12 schooling is to prepare students for the future. The challenge, of course, is that the future is uncertain and the inherited logic of teaching requires teachers to teach from a fixed curriculum. This results in a pedagogical paradox: attempting to prepare students for an uncertain future by using predetermined curricula. This "uncertain future paradox" is nothing new. Dewey (1897, p. 77) recognized, more than a century ago, that schools are mired in this paradox. What is new, however, is that globalization has led to increased uncertainty in our present-day experience and has made the risks of ignoring macroproblems more imminent (Ambrose, chapter 2, this volume). Consequently, when it comes to traditional teaching methods in schools, business-as-usual is no longer an option. Instead of attempting to eliminate uncertainty with a fixed curriculum, a more fruitful approach would be to use the curriculum in service of helping students' develop their capacity

to better navigate uncertainty (Dewey, 1897). As has been discussed, one of the best ways of doing so is to use the everyday curriculum to cultivate students' UPT. This, in turn, can serve as the basis for breaking through the crust of dangerous dogmatism (Ambrose & Sternberg, 2012) and help us arrive at new ways of conceptualizing and addressing current (and yet to be discovered) macroproblems. In order for this to happen, educators need to be aware of the longstanding pedagogical dogmas that they have inherited from their own prior schooling experiences.

Narrow beliefs about the act of teaching, such as a focus on teaching toward fixed outcomes, represent one of the most robust and problematic dogmas facing educators (Beghetto, 2010). These beliefs start to take shape as early as preschool and Kindergarten and can be seen in young children "playing school" (Cazden, 2001). Indeed, the moment students set foot in formal schooling environments they start developing robust images, beliefs, and assumptions about the act of teaching (Beghetto, 2013, Pajares, 1992, Richardson, 2003). Those students who go on to become teachers have, by the time they have graduated high school, experienced nearly 13,000 hours of indoctrination through an apprenticeship of observation (Lortie, 1975). The insidious thing about this indoctrination is that it blinds prospective teachers from pedagogical alternatives. What is *one* way of teaching becomes *the* way of teaching.

Those who have experienced formal schooling likely put little thought into the question of "What is teaching*?"* If asked, most people might simply respond, "Teaching is what teachers do" and leave it at that. If pressed to give examples, they likely will draw on those from their own prior schooling experience. Moreover, there is evidence that the kinds of examples people give would tend to be quite similar – regardless of their own personal idiosyncrasies and the different locales of schools they attended. Sirotnick (1983), for instance, concluded from studies of large-scale classroom research that, "what we have seen and what we continue to see in the American classroom – the process of teaching and learning – appears to be one of the most consistent and persistent phenomena known in the social and behavioral sciences" (pp. 16–17). What exactly is this highly consistent and persistent practice of teaching?

What Is Teaching?

Scholars who have spent time exploring the question of "What is teaching?" can offer insight into how inherited views of teaching have resulted in the mismatch between the certainties that are expected of students in school and the growing global uncertainty that students' experience in their lives. What, then, is teaching? Hirst (1971) endeavored to take this question head-on and get at the core logic of teaching. Hirst acknowledges that teaching is a polymorphous act. It can take many forms, in many different contexts. Hirst then offers the following formulation, which he argues must be present in order for an activity to be called "teaching":

> A teaching activity is the activity a person, A (the teacher), the intention of which is to bring about an activity (learning), by a person, B (the pupil), the intention of which is to achieve some end-state (e.g. knowing, appreciating) whose object is X (e.g. a belief, attitude, skill). (p. 12)

Hirst goes on to highlight a few key features of this formulation that, when viewed from the vantage point of this chapter, provide the basis for problematic instructional practices. Specifically, Hirst argues, "if teachers are not clear what end achievements their teaching is concerned with, they cannot know what is involved in B's learning X … it is therefore only in a context where both what is to be learnt and who is learning it are clear, that we can begin to be clear about teaching B, X." (p. 13). Hirst also asserts that another necessary feature of teaching is that the X (i.e., what is to be learned) is also clear in the teaching activity so that the "pupil's learning activity can be directed to this as its object" (p. 14).

Hirst's logic is straightforward. Put plainly, teachers need to be crystal clear on what they are teaching (and to whom they are teaching it), so that they and their students can arrive at the intended outcome. Otherwise, what they are doing cannot be considered teaching. This account of teaching represents the modal view of teaching and drives the logic of lesson planning taught to prospective teachers. It is reflected in what Wiggins & McTighe (1998) call "backwards planning." Backwards planning essentially involves: starting with a clear, fixed end in mind, establishing the criteria for determining whether students have attained that end, and building a lesson that moves students toward it.

This all seems perfectly reasonable. We have all experienced, at some point in our careers as students, the frustration, anxiety, and uncertainty of being taught by a teacher whose goals, criteria, and approach were chaotic and unclear. It is not a pleasant experience. Nobody likes classroom chaos. Structure is an important and perhaps necessary element of teaching (Reeve, 2009). The problem arises, I would argue, when structure gets confounded with fixed outcomes. One sign this has happened is when teachers believe that the only legitimate form of teaching requires them to specify – in advance and with certainty – fixed outcomes of teaching. Another sign is that teacher educators and policymakers view the logic outlined by Hirst and proponents of backwards planning as the only viable logic of teaching. When this happens, we seal off opportunities for the kind of thinking needed for addressing the ill-defined and increasingly complex macroproblems outlined by Ambrose (chapter 2, this volume).

Constrained Teaching and Learning

Given that the inherited logic of teaching is focused on attaining predetermined outcomes, the resulting instructional practices and learning experiences become unnecessarily constrained. This narrowed focus is represented in the ubiquitous, Initiate-Respond-Evaluate (IRE) pattern of teacher talk (Mehan, 1979). The IRE

pattern-of-talk positions teachers as the sole initiator of questions to be addressed. Given that the ends of the lesson are fixed, the kinds of questions that teachers ask are known-answer questions. Known-answer questions would be viewed as quite peculiar in any other type of social arrangement. In schools, however, they are part of the standard pattern of teacher talk. Consequently, the main role of the student is to guess what the teacher expects to hear (Black & Wiliam, 1998) and the teacher then quickly evaluates how well the student's response matches the expected answer.

Although there is a time and a place for the IRE pattern-of-talk (e.g., quickly reviewing previously taught factual information), the problem arises when this becomes the only way that teachers approach teaching. Moreover, when teachers limit their teaching to what they already know, then learning becomes a game of intellectual hide-and-seek (Beghetto, 2007a), wherein students endeavor to guess what teachers want to hear and how they want to hear it. As I have discussed elsewhere (Beghetto, in press), this results in a very narrow conception of what it means to "understand" something in a classroom setting. This restricted view of understanding can be represented in the following notation:

$$U_s = W_e \times H_e$$

The U_s represents student understanding, W_e represents *what* is expected (i.e., the expected answer or outcome) and H_e represents *how* it is expected (i.e., the expected approach for arriving at the answer or the expected way to represent the outcome). The key aspect of this formulation is that U_s represents a multiplicative relationship between W_e and H_e. Consequently, successfully demonstrating one's learning requires that students match both what the teacher expects and how the teacher expects it. Again, this conceptualization of demonstrated learning may seem completely reasonable if the aim of teaching is to help students arrive at predetermined outcomes. The problem with this view of understanding is that it leaves no room for the kinds of originality necessary for possibility thinking. Originality is at the heart of possibility thinking. In order to move beyond "what currently is" one must be able to generate original alternatives. Keeping with the notation, originality would be represented as:

$$O = (1 - W_e) \times (1 - H_e)$$

Specifically, originality would be anything different from what is expected and how it is expected. In light of the inherited view of teaching, the originality necessary for possibility thinking becomes logically incompatible with student understanding:

$$O \neq U_s$$

Originality thereby gets sealed out of the typical pattern of classroom discourse. As a result, the creative imagination has limited opportunities to develop into the

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robust kind of possibility thinking needed to take on challenging and ill-defined problems.

Torrance (1959), for example, was one of the earliest researchers to empirically examine the creative imagination of young students in schools and classrooms. He reported "we have seen many indications in our testing of first and second grade children that many with apparently impoverished imaginations seemed to have been subjected to concerted efforts to eliminate fantasy from their thinking too early" (p. 313). As I have argued, this likely is not a result of some *concerted effort* on the part of teachers. Rather, it seems more likely that teachers who impoverish their students' (and their own) creative imagination do so inadvertently. It is a consequence of the implicit logic they have inherited from their own prior schooling experiences (Beghetto, 2007b, 2010, 2013). Unless teachers consciously overwrite it with an alternative, it manifests in the overly narrow mode of instruction (Cazden, 2001).

How might teachers consciously override this default logic, resolve the longstanding pedagogical paradox of teaching for uncertain futures and, instead, teach for UPT? There are at least three things that teachers can do: *Position subject matter as a starting point, rather than endpoint; Focus on curricular possibilities, rather than curricular prescriptions; View curricular uncertainty as a pedagogical opportunity, rather than a sign of instructional incompetence.* Each of these principles will be discussed in the section that follows.

TOWARD TEACHING FOR UPT

Position Subject Matter as a Starting Point

The first principle of teaching for unshakeable possibility thinking is to position subject matter as a starting point rather than an end point. This allows teachers and students to put academic subject matter to work in solving complex and ill-defined problems. The subject matter becomes a means to some other end (e.g., learning how to calculate area for the purpose of growing a sustainable roof-top garden). Approaching subject matter as a starting point is at the heart of all creative teaching and learning, including standards-based learning (Beghetto, Kaufman, & Baer, 2014). Adopting this principle does not require making a radical change to the way teachers already teach. Rather, it requires flipping the common assumption about the position of subject matter.

When teachers use academic subject matter as a starting point, they can take a both/and approach to teaching (Beghetto, 2013). This involves simultaneously teaching academic subject matter and providing students with opportunities that will strengthen their confidence in their creative imagination. One of the core problems with the inherited logic of teaching is that it positions academic subject matter as an end point. Consequently, the rationale for learning academic subject matter is circular and lacks meaningfulness to students (and often teachers). Learning fractions for the sake of learning fractions is, for instance, not very compelling. No

wonder fractions are viewed by teachers and students as the real "F word" in some classrooms (Breslow, 2015).

Aristotle reminds us that few things in life are ultimate ends; that is, pursued for their own sake (Sheilds, 2008). Happiness (eudemonia) is an example. Academic subject matter is not. Students intuitively understand this and thereby often ask their teachers, "Why do I need to know this?" Conversely, when subject matter serves as a starting point, students and teachers immediately see the value and need of learning the subject matter. As a result, they can enage their creative imagination to apply their subject matter knowledge in the context of addressing meaningful problems and challenges. An example of this, described earlier, was the fourth grade class learning about endangered species and one student raising the question, "what can we do?" Again, the academic content – learning about habitats and endangered species – was not the end goal, but the starting point. Subject matter served as the catalyst for sparking student curiosity and engaging them in possibility thinking. Students were able to move from "this is the way it is" and ask, "What if we did something about it?" Asking "what if" and acting "as if" are core signifiers of possibility thinking (Craft, 2015) and allowed this group of fourth grade students to apply academic subject matter beyond the walls of their classroom by putting it to work in the service of addressing a challenging and meaningful real-world problem.

Focus on Curricular Possibilities

A second principle of teaching for unshakeable possibility thinking is to focus on curricular possibilities, rather than curricular prescriptions. This is sometimes difficult to accomplish given that the inherited logic of teaching focuses educators' attention on predetermined educational ends. This default logic likely kicks in – even for teachers who most ardently value the creative imagination – when they feel pressured internally, externally, or some combination thereof to quickly move through academic content. Such pressures have seemed to intensify in the face of recent accountability mandates, but they are nothing new. Teachers and students have long been pressured to "conform for the sake of economy and for the sake of satisfying prescribed standards" (Guilford, 1950, p. 448).

Teachers will always face external pressures: It comes with the job. The issue therefore seems to be less about external pressures and more about the instructional logic teachers' hold when attempting to face those pressures. Specifically, if teachers believe (or are coerced to believe) that outcomes must be *pre*-scribed (literally, written in advance), then their instructional response will likely seal off opportunities for developing possibility thinking.

Teaching for possibility thinking therefore requires teachers to approach their lessons as a "developmental teleology" (Anderson, 1987, p. 6). That is to say, paraphrasing Anderson (1987), just as artists often do not know in advance what their final artistic creation will be until they create it, teachers who approach their lessons with a developmental teleology will view the ends of their teaching as *partly*

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indeterminate – something *to be developed in the process* of teaching, rather than being *fully predetermined* at the outset of their teaching (Anderson, 1987, pp. 5–6). Indeed, only our past is fully determined. Consequently, teachers who teach for possibility thinking recognize that attempting to prescribe educational ends serves to undermine curricular possibilities. Again, this does not mean that they abandon all forms of structure and completely let go of all curricular aims. Rather, they start by structuring academic rich, curricular dilemmas (such as endangered species, illiteracy, poor nutrition) and then spontaneously move with their students into the problem space by asking, *What is the nature of this problem? Why does it matter?* and *What are we going to do about it?*

View Curricular Uncertainty as a Pedagogical Opportunity

The third principle of teaching for UPT is to view curricular uncertainty as a pedagogical opportunity, rather than a sign of curricular incompetence. Uncertainty is uncomfortable for most people, including teachers. Teachers may be legitimately concerned that unless they are certain about the outcomes of their lesson they may drift into curricular chaos. Moreover, they may worry that unless they know, minute-by-minute, where the lesson is headed they will be viewed by their students, colleagues, supervisors and themselves as incompetent. Strategies such as "backwards planning" and "designing with the end in mind" (Wiggins & McTighe, 1997) capitalize on this concern and are extremely popular amongst educators. Such fixed-ends strategies endeavor to eliminate (or, at least, significantly reduce) uncertainty. Of course, such designs also seal off opportunities for new possibilities to emerge. Another, more generative way to resolve this concern is to recognize that there is bad uncertainty and good uncertainty.

Bad uncertainty, in the classroom context, occurs when necessary structure is lacking. An example of this would be a situation wherein there is no structure or support to help direct and engage students' creative imagination. When there is no structure and no support, the result is chaos (Reeves, 2009). Good uncertainty, on the other hand, refers to the uncertainty represented in the emergent outcomes of a complex and challenging project. Although it may not be clear in advance what outcome will emerge when embarking on such projects, there is enough initial structure to provide some direction to engage students' creative imagination and there is enough support to sustain students' efforts.

Good uncertainty is necessary for sparking possibility thinking and it is represented in the indeterminate nature of the future. An indeterminate end state makes room for alternative possibilities. Teachers therefore need to be willing to trust their students and themselves to be resourceful enough to generate and realize those possibilities. It takes a great deal of competence and confidence to successfully navigate a curriculum punctuated by indeterminate paths and ends. And the only way to develop this confidence and competence is through experience engaging with such a curriculum. The good news is teachers and students can start small, building

their confidence with increasingly more complex and ill-defined problems. UPT accrues with each subsequent attempt. By removing the artificial cap placed on what should be learned and how it should be learned, students and teachers can (and likely will) surprise themselves with how much they learn and how much further they are capable of going.

CONCLUDING THOUGHTS

We live in increasingly uncertain times. The kinds of macroproblems we, and future generations, face are incredibly complex. Unless we find new ways to effectively address such challenges, they could lead to catastrophic outcomes (Ambrose, chapter 2, this volume). When faced with such problems it is tempting to defer responsibility and wait for a group of "intellectual superheroes" to magically appear and find a way to save the day. The ironic aspect of life in the modern digitized and globalized age is that the spatial borders have shrunk and macro-challenges have become personalized and quite literally placed in the palms of our hands. In this way, macroproblems represent an individual opportunity and collective responsibility to think and act in new ways.

In this chapter, I have argued that cultivating an unshakeable sense of possibility thinking (UPT) can go a long way in helping us fulfill our collective responsibility to generate new thoughts and actions when faced with global and increasingly complex challenges. As I have discussed, UPT represents a habit of mind that develops from experiencing and observing challenges, setbacks, and longstanding problems with a spirit of possibility. UPT, like all efficacy beliefs (Bandura, 1997), accrues over time and can develop from the micro-opportunities presented in everyday life and the everyday classroom. In the context of the classroom, teachers can simultaneously cultivate students' UPT and meaningful academic learning by making slight adjustments in how they teach academic subject matter (e.g., position academics as a starting point, focus on curricular possibilities, and view uncertainty as a pedagogical opportunity). By doing so, not only will students and teachers experience putting academic subject matter to meaningful work, they will develop a habit of mind that allows them to approach even the most daunting of problems with a persistent sense of possibility. In sum, attempting to cultivate UPT is a low cost experiment and one that has potential to pay off in unimaginably large ways.

In closing, I recognize that the ideas presented in this chapter are, at turns, modest, aspirational, and speculative. They are modest in that they do not call for radical change, but rather call for making slight adjustments to everyday thinking and acting. The moderate effort required to approach ill-defined and complex problems with UPT is one of its greatest strengths. UPT is something anyone can do. The key is making the conscious effort to do so. Indeed, if entire classrooms of teachers and students started approaching challenges with UPT, then the small wins (Weick, 1984) resulting from those efforts could accrue over time and create self-generating momentum that can quickly bring UPT to scale. Educational leaders also play a

critical role in bringing UPT to scale. By making modest adjustments to how they approach everyday challenges of leadership, instructional leaders can cultivate a school-wide culture of UPT and reinforce the benefits of thinking and acting in new ways.

The ideas put forth in this chapter are also aspirational, because even making slight changes can be difficult when attempting to disrupt longstanding patterns of educational thought and behavior. Moreover, the ideas discussed in this chapter have generally assumed that the kinds of ideas and actions generated by UPT are motivated by benevolent intentions. This assumption should not remain unchecked. Indeed, people can and do use their creative imagination for ill intent (Cropley et al., 2010; Gill et al., 2013). Even when UPT represents a good faith effort to bring about positive change, it is always possible that there will be unintended and potentially negative consequences that result from transforming educational settings. As such, there is a moral and ethical responsibility that comes along with aspiring to bring UPT to scale. Engaging in UPT, like any creative endeavor, comes with risk. It is therefore important when engaging in UPT to be aware of potential risks and be willing to assume the responsibility of monitoring, evaluating, and addressing any unanticipated consequences that emerge from even our most well intended efforts.

Finally, the ideas discussed herein are also speculative. Although there is compelling work on the benefits of cultivating possibility thinking in schools and classrooms (see Craft, 2015) and there is precedent for the assertion that small wins can lead to big outcomes (e.g., Weick, 1984), much additional work is needed. Indeed, research is needed to examine how cultivating this specific version of possibility thinking (i.e., UPT) can be brought to scale and whether it might yield the kinds of outcomes that would help address the macroproblems we face. Consequently, given the modest, aspirational, and speculative nature of the ideas presented herein, critics might dismiss them as naïve and Pollyannaish – arguing that the kinds of challenges we face are not addressable by such slight adjustments or that UPT is an unproven construct. But, *what if?*

What if we were able to democratize an unshakeable sense of possibility thinking in current and future generations of students? What if students left school confident in their ability to generate alternatives to longstanding and newly emerging problems? What if students habitually approached setbacks with a sense of possibility and had the humility to let go of failed approaches in search of needed assistance and guidance? And what if we all unleashed our creative imagination on the emerging global and social challenges we face? We will never know the answers to these questions unless we try to imagine and enact new possibilities for teaching, learning, and life.

NOTE

[1]   The full published article is available here: http://rsbl.royalsocietypublishing.org/content/7/2/168

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JOHN BAER

11. CREATIVITY AND THE COMMON CORE NEED EACH OTHER

OVERVIEW OF THE CHAPTER

Many fear that rigorous content standards will impede efforts of those who want to nurture creativity in students, but the Common Core and creativity offer each other far more potential synergies than obstacles. Creativity requires content skills and knowledge—very substantial degrees of skill and knowledge in some domains, with the degree of expertise needed generally increasing for higher levels of creative performance—so the development of such content knowledge and skills promotes the development of creativity by providing many of the tools needed for creative thinking. Conversely, the best way to acquire skills and knowledge is to use that knowledge and those skills in thoughtful, constructive, and creative ways, making creative thinking an excellent way to help students acquire content knowledge. Learning content shouldn't be thought of as the "rote learning of easily measured knowledge and skills," as Ambrose (chapter 2, this volume) reminds us. "Broad and deep proficiency in the subject areas" can only be achieved by thoughtful, constructive, and often very creative thinking about the content of each subject area.

There are areas of possible contention, of course (e.g., extrinsic constraints often support skill acquisition but may in some cases hinder creative thinking), but many of the alleged content knowledge-creativity conflicts are merely the result of misguided notions, such as the idea that learning content means nothing more than parroting back what Ambrose calls "superficial facts" instead of "grappling with interesting problems in the subjects and mastering key concepts." "[G]rappling with interesting problems in the subjects and mastering key concepts" is what the acquisition of content knowledge is really about—"deep-level cognitive and affective immersion in a variety of subject areas including literacy, the arts, mathematics, the sciences, world languages, history and governance" (Ambrose, chapter 2, this volume).

Another unfortunate misconception is the belief that we must be able to *measure* every outcome that we care about. Valid and meaningful assessment is hard, especially if we want to assess complex kinds of thinking, but the fact that we may not be able to test, in a standardized format, some of the things that we want to teach should not prevent us from teaching or valuing those things. For this reason, Common Core *testing* may be a genuine roadblock and the use of such tests for any high-stakes decisions (e.g., who gets a diploma, or who gets—or gets to keep—a teaching job) should be reconsidered, but that is no reason to avoid using the Common Core (or

another set of rigorous content-based standards) as guides in education. We can (and should) teach things that matter whether or not we can test them adequately.

Promoting content knowledge and skill acquisition in many domains (as outlined in the Common Core) *and* the nurturing of creativity should be part of 21st-century schools. Schools that want to prepare students to meet 21st-century challenges should be thinking more about how they can work toward these two seemingly different goals simultaneously and synergistically, not about creating false conflicts and contradictions that set them at odds with each other.

THE COMMON CORE AND ITS CRITICS

The Common Core outlines a shared roadmap of the concepts, skills, and knowledge students need to learn, regardless of where they live. It was spearheaded by the National Governors Association Center for Best Practices and the Council of Chief State School Officers, but it has more recently become a political hot-button issue.

It is not my intention to defend the Common Core. I happen to think it's a fairly good compromise framework—some would fault if for not being specific enough about content, just as others might argue that it is too specific—but like it or not, it's the framework that most states will be using. Having a state-imposed set of standards isn't something new—states have always had these, some possibly better, most surely worse, than the Common Core. The big difference is that this one is an almost national set of standards, which means that students moving from one school district to another—something poor kids do more often than rich kids (Heinlein & Shinn, 2000; United States General Accounting Office, 1994)—will find their educational programs somewhat less disrupted than in the past.

The Common Core isn't perfect, and when I titled this chapter *Creativity and the Common Core Need Each Other* it was not because of a deep affection for this particular set of standards. What creativity needs is a good set—let's not wait for a perfect set—of standards outlining important skills and content knowledge that students need to acquire. I think the Common Core, albeit imperfect, provides such a set of objectives.

The Common Core's most serious problems—and the loudest criticisms—have to do with assessment, which should not be surprising. I worked at the Educational Testing Service (ETS) many years ago developing alternatives to multiple-choice testing. I know how hard that is, and I'm not surprised that assessment has become a problem for the Common Core. Everyone complains about the current crop of assessment devices, but many then blithely assume that the next time we'll get it right, as if the people who did all previous educational assessments were either stupid or mean-spirited (or perhaps both). But assessment—rigorous, meaningful, valid assessment—is simply hard. Very hard.

The difficulty of valid assessment of complex learning is not a problem that I can fix. It's also not a problem that only came to light with the Common Core. And it's not a problem that critics of the Common Core can fix either, nor is it a problem

that will go away if the Common Core is repealed or gutted. We can assess simple things rather easily and quite validly, but assessing complex things like thinking and deep understanding, like creating and analyzing and applying ideas in new and unexpected ways—that's hard. Not impossible, but hard, *very* hard. It's especially hard if we want to do it with a test that can be nationally standardized, and even harder if we want individual test results that can be used for high-stakes decisions, like who gets a diploma or who gets (or gets to keep) a job. If all we want is a snapshot of how different groups of students are doing, tests don't need to be as good because many of the unreliability problems tend to disappear when averaged over a large number of test takers. But getting reliable and valid *individual* scores? That's asking a lot, probably far too much, of a 2- or 3- or 5-hour activity. I don't think anyone wants students to need to spend 40 or more hours taking tests every year, which might be needed to get enough data to make valid individual assessments of higher-level skills in diverse domains (nor does anyone want to pay teams of experts to read and grade those test papers). We need to scale back what we think tests can reasonably tell us.

Our expectations of tests may be way too high, but that doesn't mean we can't have high expectations of students. We may not be able to assess how well each student is meeting those expectations in a nationally standardizable way, and we may not be able to fairly compare teacher competence in helping students meet those high expectations with a single test. But I don't think we want to give up on having kids think deeply and understand ideas deeply, on having them create and analyze and apply ideas in new and unexpected ways, even if we can't assess those abilities as well as we'd like. Whether it's the Common Core or the next set of curricular standards, assessment will be hard, but that shouldn't stop us from teaching and promoting complex thinking or expecting students to do complex thinking. Right now the standards most widely in use are the Common Core State Standards, so those are the ones we need to address, but pretty much everything I'm going to say about the Common Core and creativity would also be true with any rigorous set of curricular standards or guides (something I've been researching and writing about for a long time, long before there was a Common Core; see, e.g., Baer, 1999, 2002, 2003; Beghetto, Kaufman, & Baer, 2015).

HOW DO CREATIVITY AND THE COMMON CORE NEED EACH OTHER?

We're going to have curricular requirements, whether those are based on the Common Core or some other set of standards. But having rigorous standards that expect students to acquire a great deal of content knowledge and a wide range of skills need not push creativity out of our classrooms. In fact there are real synergies between teaching the Common Core and nurturing creativity.

But first, an acknowledgement: Creativity has a dark side (Cropley, Cropley, Kaufman, & Runco, 2010); some terrorist groups have been remarkably creative in very malevolent ways—and even in our classrooms there are some kinds of creativity

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we want to promote and others, like creative classroom disruptions, we might wish to minimize. I will nonetheless take it as a given that we want to promote students' creative-thinking skills in many areas, just as I am taking for granted the existence of the Common Core or some other rigorous set of standards that might one day supersede the Common Core. The question is, can creativity and the Common Core get along? Can they play nicely, or must they be at war with one another?

Many teachers seem to think that they must choose between nurturing student creativity and conforming to the Common Core standards. How can creativity, which requires producing things that are unusual and original—and therefore decidedly *un*common—be combined with the Common Core, which even its name declares is common and which would therefore seem to be the exact opposite of creative? With the Common Core claiming so much of teachers' time and attention, creativity—which invites uncommon, original, and boundary-breaking thinking—seems a prime target for being crowded out of an already over-stuffed curriculum.

The Common Core Needs Creativity

There are many parts to the Common Core, and some standards look like the kinds of things that might in fact require fairly rote practice to learn. For example, in the Common Core (http://www.corestandards.org/) students need to do these things in kindergarten:

- CCSS.Math.Content.K.CC.A.1. Count to 100 by ones and by tens.
- CCSS.Math.Content.K.CC.A.2. Count forward beginning from a given number within the known sequence (instead of having to begin at 1).
- CCSS.Math.Content.K.CC.A.3. Write numbers from 0 to 20. Represent a number of objects with a written numeral 0–20 (with 0 representing a count of no objects).

Drills and rote memorization are likely to be involved in learning the first two of these, and to lesser degree the third as well, but even learning this very basic math content will require what Beghetto and Kaufman (2007; Kaufman & Beghetto, 2009) have termed "mini-c" creativity—the creativity that happens in the learning process—which recognizes that every understanding must in some way be constructed in the learner's mind. Students' minds are not empty vessels into which we can simply pour content, even very basic content; each learner's mind must undergo some change to accommodate what is being learned, and those accommodations, those (however slight) changes in one's understanding, require some, very modest, degrees of creativity. There is also a rote component to acquiring these skills, however, and it's important to acknowledge that some rote memorization will play a role in this (and any) curricular scheme. Like simple math facts, these are things that students need to understand, but also to automatize. The goal of such automatization is to be able to do them without thinking so that other, more interesting kinds of thinking can occur. It's hard to think of a set of curricular standards that would not

include the three listed above in some form, and in whatever form they appear, some rote memorization will be part—but only a part—of acquiring these skills.

Rote memorization will play a role in teaching to any curricular standards, but most of the things one finds in the Common Core are *not* things one could successfully learn via drills, rote memorization, or simple repetition. Drills and repetition are simply not the most effective ways to learn most skills and content, which are more readily, more flexibly, and more usefully learned by using and applying them in a different contexts; by connecting them to what one already knows; and by analyzing them to gain a deeper understanding (Woolfolk, 2012). Put another way, most skills and knowledge are best acquired by thinking, not by rote memorization. The Common Core State Standards are for the most part (and with limited exceptions like those described above) not things one could learn through rote memorization. The Standards require students to be able to *do* things with the skills and content knowledge they are acquiring and to produce original, constructive, and meaningful ideas (which is another way of saying they will need to think creatively).

Here are three skills (the first three) in the grade 3 English Language Arts standards for reading literature:

- CCSS.ELA-Literacy.RL.3.1. Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- CCSS.ELA-Literacy.RL.3.2. Recount stories, including fables, folktales, and myths from diverse cultures; determine the central message, lesson, or moral and explain how it is conveyed through key details in the text.
- CCSS.ELA-Literacy.RL.3.3. Describe characters in a story (e.g., their traits, motivations, or feelings) and explain how their actions contribute to the sequence of events.

Memorization won't work here. One must produce ideas, not from a void, but based on the content with which one is engaged. To do this one first needs to understand what one has read, but then one must go beyond this and come up with answers that have not been provided, answers that are new and original (at least new and original to the student). There is no regurgitation, no drill-and-kill called for. What is called for is thinking, including a great deal of creative thinking.

And this isn't just in the English Language Arts Standards. Here's one from the Grade 8 Math Standards:

- CCSS.Math.Content.8.F.B.4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

Constructing a function to model a linear relationship between two quantities isn't about rote memorization, and it's not something one can do without both

understanding something about functions and figuring out how to apply that understanding to new situations. It requires understanding a number of things, figuring out how to use those things, and coming up with answers students have not been given, answers that fit the specific situation described in the problem. Doesn't "coming up with answers students have not been given, answers that fit the specific situation described in the problem" sound a lot like creativity? A teacher who tried to teach to this standard by rote and without encouraging creative thinking would be handicapping her students.

So the Common Core has only a little to do with rote memorization or content regurgitation. It's much more about using facts and using skills to make sense of things; it's about constructing new knowledge and new ways to understanding things. It requires creative thinking. So teaching the Common Core should not lead to lots of mindless drill and repetition. There will be some—as there has always been, such as in learning things like multiplication facts and spelling. But learning the skills of the Common Core will mostly require *thinking*—thinking hard and deeply, and sometimes very imaginatively—about content in many different domains so that one can understand and *use* those skills and that content knowledge, not so that one can parrot something back. Drill-and-kill should play a very limited role in Common Core classrooms, and if teachers rely heavily on rote recitation they won't be very successful in teaching the Common Core. And if the test designers who create the tests for the Common Core devise things that reward parrot-like responses, they will have failed utterly in their assignment. That is not what the Common Core, or any good set of curricular standards, calls for.

Creativity Requires Content Knowledge

One may need sometimes to think outside the box, as the cliché goes, but one also needs to understand what is actually *in* the box, as well as what the box itself is made of. As Ambrose has pointed out in his focus chapter, we are facing some very big problems, problems that will require a great deal of creativity to solve. But facing these challenges will also require a great deal of content knowledge and a great deal of domain-based skill. To pick an especially troubling example, I don't know how the climate-change crisis will be solved (or if it will be solved), but I am confident that dealing with it will require such things as a knowledge of chemistry and a rather full calculus skillset—knowledge and skills that are very much *inside* the box. Outside-the-box thinking may also be needed—we will need certainly responses that go beyond current knowledge and ideas—but the fact that original, creative thinking must be involved in no way negates the importance of more routine (common) skills and knowledge.

So acquiring content knowledge isn't inimical to creative thinking or teaching for creativity; in fact, it's *necessary* for creativity. And some of the best ways to acquire content knowledge is to *think about it* in interesting, creative ways, as discussed in the previous section. The two can go hand-in-hand in many instances, but they may

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sometimes seem at odds because of one troubling misconception about creativity that I hear far to often: *Creativity means everything goes and that there are no wrong answers*.

It has been agued that divergent thinking is an important component in creativity, and brainstorming is one widely used technique to promote divergent thinking (Baer & Kaufman, 2013; Woolfolk, 2012). There is evidence that brainstorming, especially when conducted in groups, may not be as productive as once thought, and one might even question how important divergent thinking is, but for the sake of argument let's assume both divergent thinking and brainstorming are valid and valuable contributors to creative thinking.[1] The important point in regard to the anything-goes misconception about the nature of creativity is that brainstorming is often viewed as a prime tool for generating creative ideas and that its first commandment is *Thou Shalt Not Judge*.

Does *Thou Shalt Not Judge* when brainstorming mean there are no wrong answers in creativity? Not at all! It means that *in one stage* of a creative process it may be useful to *defer* judgment, and during that time there are, indeed, no "wrong" answers. But that's just temporary—defer means put off until later, not abandon forever. It's rather like the use of invented spelling with new (kindergarten and first-grade) writers, who may be told to spell words initially any way that makes sense to them (Clarke, 1988). In invented spelling, no one is saying spelling doesn't matter, only that it doesn't matter right now. Ditto for deferring judgment when brainstorming. Defer means defer. Judgment matters, but it will come later.

Some creativity-training programs have indeed stressed divergent thinking and de-emphasized convergent and evaluative thinking. But an over-emphasis on divergent thinking to the exclusion of everything else is simply a problem with having a very limited understanding of the creative process. Successful creativity involves multiple iterations of divergent thinking combined with a great deal of convergent and evaluative thinking. For example, students may first engage in divergent thinking when confronting a new problem, doing such things as brainstorming many possible ideas about just what is the problem that needs to be solved ("In what ways might we…?"). But they will then need convergent and evaluative thinking to help choose the best problem to tackle or the best way to understand the problem. Divergent thinking may then be used again to produce a variety of possible ways that the problem might be solved, but convergent and evaluative thinking will once again be crucial when it comes to selecting the best way to proceed. There may be multiple iterations of divergent thinking, each followed by evaluative and/or convergent thinking. These stages will not generally have neat demarcations between them. Only in the most formal problem solving practice is the distinction among divergent, convergent, and evaluative thinking crystal clear, but all are generally needed to find the best possible and most creative solutions (Baer & Kaufman, 2013). As Persaud (2007) wrote:

> Creativity is usually defined in terms of the production end of ideas or products, yet a neglected aspect of creativity, though no less vital, is the process by

which creative products are critically evaluated, selected, altered or dismissed by the creator. Any attempt to promote creative thinking skills in schools needs to also address this aspect of critical thinking in creativity—failure to do so results not in usefully creative children, but merely indulgent ones. (p. 68)

Consider this Common Core standard, one we looked at briefly in the previous section:

- CCSS.ELA-Literacy.RL.3.3. Describe characters in a story (e.g., their traits, motivations, or feelings) and explain how their actions contribute to the sequence of events

To help students do this, teachers might encourage them to list every possible way they might describe the character (divergent thinking), then go through that list to pick out the descriptors that seemed to best fit the character (evaluative thinking). Then for each of those traits, motivations, or feelings, students might be asked to list ways those characteristics could have influenced the plot or outcome of the story (divergent thinking). Choosing among the list of traits, motivations, or feelings the ones that seemed to have the biggest impact on the events of the story (evaluative thinking) would put the student in a good position to begin her essay.

Skills and content knowledge are important in evaluative thinking—judging ideas—and in convergent thinking—finding the right answer. And skills and content knowledge are also important contributors to divergent thinking, because the more one knows about a domain, the larger the problem space (the bigger the "box") within which one can work (and the greater the range of possible solutions one can imagine). One needs content knowledge to think well and creatively, and generally speaking, the more content knowledge the better (Reilly, 2008; Weisberg, 2006). It may be true that at the extremes, too much content knowledge can sometimes hinder creative thinking—this is the functional fixedness problem (e.g., not recognizing that a hammer can be used for more things than driving nails)—but that's really a problem of how one *uses* knowledge, not of having it. (Most skilled carpenters readily use hammers in other ways than driving nails, such as propping something open, extending their reach to push something, or holding something down. Their content knowledge need not be a barrier to their creative thinking.)

Creativity researchers are nearly unanimous in arguing that creativity involves coming up with new ideas that *work*; as Mumford put it, "we seem to have reached a general agreement that creativity involves the production of novel, useful products" (2003, p. 110). Creativity isn't usually about finding the one right answer to a problem that has one, and only one, right answer, although that is sometimes the case. Creativity is more often about messy problems, ones that offer no single right answer. Creativity requires imagining ideas that work, that get the job done, that fit the constraints of the situation, that solve the problem in a way that is deemed effective. Divergent thinking and the production of wild ideas may,

or may not, be part of that process. No one would argue that divergent thinking and wild ideas never lead to creativity, and no one would dismiss creative ideas simply because they were not sufficiently wild or the result of brainstorming or some other divergent-thinking technique. But everyone agrees that being creative means coming up with ideas that are useful, ideas that are interesting *and* in some manner workable.

Finding ideas that work, ideas that are interesting and useful, typically requires some amount—often a very large amount—of knowledge and skill. That is to say, it requires exactly the kinds of things the Common Core says students need to learn. Creativity doesn't work in a vacuum. Creativity needs the skills and content knowledge of the Common Core.

Conversely, divergent thinking, a theorized component of creativity, can also be helpful in acquiring factual knowledge. For example, if a teacher is starting a unit on Abraham Lincoln, the teacher might have students brainstorm what they already know about Lincoln, listing all the class's ideas on the board. This serves the important function of activating prior knowledge, so the new things learned will become connected to what students already know. It also gives the teacher a sense of what her students do already know and what misconceptions they may have. All this because of a brief brainstorming session—an activity generally associated with teaching creative thinking.

Are creativity and the Common Core natural or inevitable partners? Perhaps that would be going too far, because there are times when they do seem to conflict, and teachers need to recognize those rare but nonetheless troubling conflicts. One of the most common conflicts of this type has to do with motivation. Intrinsic motivation tends to promote creativity in many situations, whereas extrinsic constraints (like rewards and evaluation) tend to depress it.[2] With skill development extrinsic constraints work differently: rewards and evaluations are often very helpful in promoting the development of skills, and in many cases (such as providing feedback on students' work, which is a form of evaluation) they may be essential. But this is not a huge obstacle: teachers can and should promote intrinsic motivation when possible and employ extrinsic constraints when necessary, and finding this balance need not sacrifice either creativity or skill development greatly. It's important to understand that, for the most part, creativity and the Common Core *can and should be* allies, as shown above, whether such an alliance is viewed as natural and inevitable or one that needs to be sought out and strategically nurtured. We need to recognize that creativity and rigorous content standards are not natural enemies and look for all the synergies we can find. Fortunately there are far more ways in which creativity and the goals of the Common Core can work together than there are ways in which they are in conflict. In most respects, teaching for creativity and teaching the Common Core should promote one other. Neither the goal of creativity enhancement nor the goal of skill and content knowledge acquisition will be very successful if its counterpart is ignored.

*The Need for Domain-Based Content Skills and Knowledge Is in Accord
with an Interdisciplinary Approach to Problem Solving*

In his focus chapter and elsewhere, Ambrose (2012 and chapter 2, this volume) has emphasized the value of interdisciplinary thinking and problem solving. I really like that word, "interdisciplinary." It doesn't suggest that disciplines or domains don't matter—in fact, it suggests just the opposite, because without disciplines, there can be no interdisciplinary anything. Just as creativity requires the kinds of skills and content knowledge that the Common Core is designed to promote, interdisciplinary thinking requires the kinds of expertise that disciplines develop.

Interdisciplinary thinking and problem solving can sometimes run off the rails, as I have argued elsewhere (Baer, 2012), but when that happens the most likely culprit is lack of disciplinary knowledge. It can sometimes be extremely helpful to bring perspectives from different disciplines to bear on a problem, and at times an idea or metaphor from a distant discipline can be exported productively into a seemingly unrelated discipline. But it is far too easy (and I fear much more common) for those lacking the relevant expertise to misunderstand the issues or constraints that someone with expertise in the relevant domain(s) might have. Good interdisciplinary thinking and problem solving require strong disciplinary skills and knowledge (the kinds of things the Common Core was designed to promote).

THE PROBLEM OF TESTING

It is understandable that people want schools to be accountable for their results. Students should be learning, and they should probably be learning a lot more than most students are in fact learning. That was part of the motivation for the creation of the Common Core State Standards.

Accountability has a counting problem, however. It cannot account for things it cannot count, and the things that can be measured well by the kinds of tests currently available (and likely to be available any time soon) do not include many of the outcomes that we most care about, such as creative, higher-order thinking in diverse domains. Assuming that the answer to this counting problem is simply getting better tests ignores the fact that "better tests" has long been seen as the answer. Unfortunately, it is an answer that has not been rewarded by the production of tests that actually measure important things like creativity in a fair and valid way, at least not with the kind of precision and standardization that any high-stakes decision requires.

We need to acknowledge that there are things we can't measure well (at least not in a standardized format) but that nonetheless matter to us a great deal.[3] In addition, we need to recognize that if we do have high-stakes tests in some areas and no tests in other areas, the areas tested will get all the attention. An economist who specializes in value-added modeling made both these points in arguing that "Decisions about standardized testing should be driven by the testability of particular subjects and

with an eye toward ensuring that they don't distort teaching in unproductive ways" (Harris, 2011, p. 181). By (a) focusing our attention only on the things we can test and (b) pretending that we can reduce interesting, heuristic, productive, and creative thinking in ways that make them testable (but rendering them uninteresting, algorithmic, nonproductive, and formulaic in the process) we subvert both the goals of nurturing the most important skills embodied in Common Core and of cultivating creative thinking in our students.

There is an odd incongruence in the thinking of those who believe that high-stakes testing will motivate teachers to teach better but that the same teacher-motivating tests will not encourage teachers either to cheat or to distort their teaching practice. Arne Duncan, for example, argued that "The existence of cheating says nothing about the merits of testing" (*Washington Post*, July 11, 2011), and President Bush asserted without qualification that "We're teaching a child to read so he or she can pass the test" (in a speech, "Remarks on the No Child Left Behind Act," January 8, 2009).

It's hard to understand how the rather widespread reports of cheating on tests, the scores of which will be used to determine teachers' and administrators' futures and which were put into place with the express goal of changing the behavior of those teachers and administrators, can fail to be seen as one effect of those tests (Goldstein, 2014). Why would the teachers and administrators cheat if the outcome did not affect them in a significant way? That was the point of the assessments.

A behavioral economist contributor in the same *Washington Post* "leadership roundtable" in which Education Secretary Duncan suggested that cheating was not the fault of testing made a very different argument, using this story from a CEO he respected highly who confessed that he had over-incentivized his employees: The CEO "had tried to create a specific performance evaluation matrix for each of his top employees, and he asked them to focus on optimizing that particular measure; for some it was selection of algorithms, for others it was return on investment for advertising, and so on. He also changed their compensation structure so that 10 percent of their bonus depended on their performance relative to that measure. What he quickly found was that his top employees did not focus 10 percent of their time and efforts on maximizing that measure, they gave almost *all* of their attention to it" (Ariely, *Washington Post*, July 18, 2011).

Teaching to the test is a more complex phenomenon than cheating, one that (unlike cheating) is not necessarily a bad thing if the test in question can be shown to be an excellent measure of whatever it is one wants students to learn. Unfortunately, tests of higher-order thinking (including creative thinking) tend not to be very good, especially if those tests need to be standardized in a way that makes them comparable across students, schools, and states. To the extent that such a test is *not* an excellent measure of the kinds of thinking one wishes to promote, it means that teachers are teaching to something other than their stated objective. In such a case, teaching to the test changes the goal from promoting thinking to passing the test, which (to the extent that the test measures something different, or less than, the original goal)

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means that testing has significantly changed the goals of the teacher. If the test not only fails the "excellence" standard but is in fact a very poor measure, the warping of instruction by teaching "so that he or she can pass the test" will be extreme.[4]

High-stakes testing has not improved the quality of education in this country, and it is unlikely that it is going to. In a survey article for *Educational Leadership,* Amrein and Berliner (2003) reviewed research in 18 states that required students to pass state examinations to graduate from high school, evaluating whether student achievement—as measured by the SAT, ACT, Advanced Placement tests, and the National Assessment of Educational Progress—was connected to the implementation of that state's graduation exams. They found no evidence of an increase in student achievement. That was last decade's attempt at implementing high-stakes testing, of course, but there is no reason to believe that the next round of testing will produce different results. There has been no revolution in testing, no new approach that completely overturns all that has come before. As noted above, testing is hard, and the more interesting and complex the thinking one wishes to assess, the harder testing becomes.[5]

Low-stakes testing programs that (a) look only for mean scores of large groups of students and (b) are not used for any high-stakes decisions (e.g., teacher promotion or retention, student admission to colleges or special programs) can give us some information about how students are doing while avoiding some of the harm that seems to be caused by high-stakes testing (Ravitch, 2011). But we need to remember that what is important are the skills and knowledge that students acquire, not our measures of those things. High-stakes tests are getting in the way of achieving the results we all want. The answer is not more testing, but less high-stakes testing.

Creativity and the Common Core should be allies—for the most part they are on the same team—but there are some areas in which creativity and the Common Core have genuine conflicts. The biggest such conflict is not really between creativity and the Common Core, however; it is between the acquisition of complex skills, like creativity, that matter to us, and our desire to test and measure everything that matters.

CONCLUSION

Creativity matters. It matters because the world—all the world, not just select parts of it—will need all the creative thinking we can muster to solve the many gigantic global problems we are now confronting (not to mention the ones that we haven't recognized yet and the ones that have not yet come into being). In his focus chapter Don Ambrose has aptly described many such challenges.

Creativity also matters because even on smaller scales it helps us make the world a better place. Creativity in the arts, in teaching, in science, in engineering, in history, in philosophy, in personal and interpersonal problem solving, in spiritual quests: in all these and many other areas creativity has the potential to make life better, richer, more meaningful, and more interesting.

Finally, creativity also matters—perhaps most of all—because, apart from the need for creativity to help us survive the problems of the present and the future and make our world an ever-better place for human and other forms of life, life is also better on an individual level when we have the skills, the knowledge, the dispositions, and the freedom to think and act and live creatively, for the very simple reason that thinking creatively and doing things creatively are themselves important parts of what makes life so wonderful. Creativity matters because the experience of creating and of thinking creatively are good things, even when they don't change the world in noticeable ways. Creative play by children, creative writing, creative cooking, creative woodworking, and creativity in all the things we do—even creative daydreaming—makes doing those things more exciting, more joyful, and more worthwhile, even when those activities make no imprint on the world at all. Creativity is something we should all want to nurture because it has the potential to make the world a better place, but also because it is a good unto itself.

There are many things teachers can do to teach creativity in a Common Core classroom. It is beyond the scope of this chapter to describe in more than a rudimentary way how to do this (but please see the book in which some colleagues and I have done just that; Beghetto, Kaufman, & Baer, 2015). Teachers will need support in pursuing the twin goals of nurturing creativity and teaching content knowledge.[6] The danger is that they might falsely assume that these two goals—meeting requirements of a Core-based curriculum and nurturing students' creativity—are essentially at odds. They are not, and these two complementary goals will both be better achieved if thought of as partners rather than as adversaries. We need also to recognize, however, that extensive high-stakes testing is hurting, not helping, our efforts to improve schools. We therefore need to de-emphasize high-stakes testing to improve education. Unimpeded by ill-conceived high-stakes tests, the Common Core and creativity can achieve the kinds of synergies that, by their natures, should make them mutually supporting allies.

NOTES

[1] Brainstorming might work well in some domains and situations and not others (Baer, in press). The erratic results of studies of group brainstorming—sometimes it produces creative ideas, but sometimes it appears to hinder creativity—suggests this might in fact be the case (Diehl & Stroebe, 1991; Mullen, Johnson, & Salas, 1991; Nijstad, Stroebe, & Lodewijkx, 2003; Rickards, 1999). Resolving those conflicting results is beyond the scope of this chapter, but whether or not it reliably produces creative thinking, brainstorming can be a useful teaching tool, as discussed below. It has unfortunately contributed to the misconception that creativity means there are no wrong answers, however.

[2] There is some dispute about whether or not extrinsic constraints consistently depress creativity, and in fact in some studies the impact has been just the opposite. It may be that in different domains or situations the impact is different (Baer, in press), which would account for the many contradictory studies in this area, some showing a pronounced negative impact of extrinsic motivation, others showing a positive impact or no impact (see, e.g., Amabile, 1996; Baer, 1997, 1998; Conti, Collins,& Picariello, 2001; Eisenberger & Cameron, 1996; Eisenberger & Shanock, 2003; and Eisenberger & Rhoades, 2001). Like the question of the impact of brainstorming on creativity, this is a controversy larger than the scope of this chapter.

3   This is not to suggest that creativity can't be measured, merely that it cannot be measured in the ways that those calling for accountability in schools seem to require. Just as Nobel Prize committees in particular fields can successfully judge (albeit imperfectly) creativity at the highest levels in their respective fields, experts in a domain can judge the creativity of more garden-variety creativity in that domain (e.g., poets can reliably and validly assess which of a group of poems are the most and least creative, and artists can reliably and validly judge which of a group of collages are the most and least creative). But such consensual assessments (Amabile, 1982, 1983, 1996) cannot be scaled up to provide nationally standardized creativity scores, even on a domain-by-domain basis.

4   In the same *Washington Post* article cited above, Dan Ariely (2011) concluded that the warping of instruction is a much greater problem than the more publicized cheating scandals, writing:

> The notion that we take something as broad as education and reduce it to a simple measurement, and then base teacher pay primarily on it, has a lot of negative consequences. And, sadly, I suspect that fudging test scores is relatively minor compared with the damage that this emphasis on tests scores has on the educational system as a whole.

> Interestingly, the outrage over teachers cheating seems to be much greater than the outrage over the damage of mis-measurement in the educational system and over the No Child Left Behind program more generally. So maybe there is some good news in all of this: Perhaps we now have a reason to rethink our reliance on these inaccurate and distracting measurements, and stop paying teachers for their students' performance. Maybe it's time to think more carefully about how we want to educate in the first place, and stop worrying so much about tests.

5   There have been conflicting views about the impact of high-stakes testing, of course, and this is yet another controversy that this chapter cannot solve. Mitchell (2006) wrote a review of the evidence for The Center for Public Education (an online publication of the National School Boards Association) that was more favorable, although it began with a rather strong disclaimer: "Although there are many articles on high-stakes testing, only a few qualified for our consideration because most did not report empirical research. As is often the case with research on educational topics, the research on the responses to high-stakes tests needs to be approached with judgment and caution. Above all it needs to be approached with an open mind. Research does not give us the definitive answers we seek, rather it provides us with tools to arrive at our own conclusions."

6   According to a recent poll, "Three-quarters of public school teachers surveyed support the Common Core State Standards, yet just 27 percent said their district has provided them with the tools and resources necessary to teach the standards" (American Federation of Teachers. 2013, p. 1).

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KAREN MAGRO AND KATHLEEN M. PIERCE

12. CREATIVE APPROACHES TO LITERACY LEARNING

A Transformative Vision for Education in the 21st Century

Our idea of what constitutes literacy has moved beyond developing fundamental skills in content areas as Mathematics, Science, Social Studies, and English and into essential skills of lifelong learning and living more meaningfully. We are compelled to advocate literacy strategies that do so much more than practice skill sets like reading, writing, speaking, listening, viewing, and representing. This chapter explores some critical literacy strategies that expand the notion of merely teaching English as a subject into literacy experiences that encourage motivation and creativity among adolescents and the teachers who prepare them for 21st-century learning and living. A creative, transformative critical literacy helps students rehearse and learn to question, argue, understand, and create informed, aesthetic, ethical action on matters of individual and social significance.

The 21st century demands that educators pay a different kind of attention and care to their pedagogical practices. With increasingly large portions of the world's wealth controlled by an ever narrowing few, the world and its inhabitants are experiencing macroproblems like diminished natural resources, economic disparity, and global warming. The ethical and practical confusions created by the escalation of conflict and socioeconomic imbalance worldwide have generated macroproblems for individuals and families leading some to leave their homelands in search of better lives. Consequently, one of the defining global issues of the 21st century is migration with immigration and diversity changing the faces of urban and rural centres across North America. In this volume and elsewhere, Ambrose (2012 and chapter 2, this volume) suggested that education could help shift perspectives and solve problems if, for instance, educators engaged "students in critical analyses of the socioeconomic and cultural contexts that surround them" to make them aware of factors affecting their own aspirational development—whatever those factors might be and whether or not they be advantages or obstacles (2012, p. 108). Educational institutions, at all levels, can play major and constructive roles in promoting cultural and social cohesion. As classrooms become more multiethnic and multicultural, the roles and responsibilities of teachers must become more complex and creative to equip both teachers and students with skills to navigate the micro and macro challenges of the

21st century. Curricula in all content areas can offer the possibility for learners to make *networks* to understand the human condition.

Creative approaches to teaching literacy include: creating opportunities for students to develop emotional intelligence in literacy learning, fostering social and intercultural intelligence by using multicultural texts to expand students' awareness of other cultures, and teaching from social justice and interdisciplinary perspectives. These literacy learning stances and examples require teachers to select diverse and multimodal texts in the first place then use texts as curriculum springboards for students' creative, thoughtful, engaged learning and action.

CREATIVE AND TRANSFORMATIVE APPROACHES TO TEACHING LITERACY

Acknowledging that the term *reading* is too limiting a concept for 21st century educators, the former International Reading Association recently changed its very name to the *International Literacy Association* because they "… believe in the transformative power of literacy, … and will work toward ensuring that literacy is a fundamental, inalienable human right worldwide" (International Literacy Association, n.d.). As educators, how can we authentically and creatively engage students with literacy to explore the world of ideas? Take inspiration from literary texts and expand our very notion of literacy. Juxtapose various texts of fiction, nonfiction, poetry, music, art, drama, film, or photography to create curriculum units of study that invite students to learn and explore. Such curriculum experiences require using myriad literacy skills—listening, speaking, reading, writing, viewing, and representing—in meaningful, artful, and socially-relevant ways. Rosenblatt (1938/1983) extolled the benefits of literary experience for its ability to foster imagination and empathy, but she warned that teachers should not co-opt that experience for their students by privileging their own interpretations of literature:

> A preeminent condition for success is that teachers themselves possess a lively sense of all that literature offers. They should avoid inculcating their own assumptions about human beings and social values and should support the student in his efforts to understand himself and forces that pattern society. (p. 275)

Offering curriculum experiences with broader literacy bases can shift students from states of passivity to active engagement. Issues such as racism, joblessness, addiction, and alienation can be explored in meaningful ways leading to personal and social awareness and change. In *Releasing the Imagination: Essays on Education, the Arts, and Social Change*, Greene (1995) stressed the vital importance of literacy as a way of helping individuals from diverse backgrounds understand, appreciate, and empathize with those perceived as different and posed three questions to teachers: How can teachers intervene and say how they believe things ought to

be? What can they do to affect restructuring? What can they do to transform their classrooms? (p. 9). First, teachers need to view their students as active learners who can be motivated through experiential learning and authentic tasks that engage them to think deeply about their own lives and the larger world.

Teachers must adapt and develop their own traditional literary practices and instructional strategies that draw upon multiple literacies and modalities. For instance, Bucolo (2011) suggested that classical texts like Dickens' *Great Expectations* could be taught in the form of "installments" similar to a television series. Comparisons between the novel and popular television programs can emerge. Interestingly, the novels of writers like Dickens and Twain were originally presented as weekly or monthly chapter installments in newspapers during the late 19th century when new technologies of the era made paper, lighting, and even eyeglasses affordable to an emerging global middle class. Rather than "fighting against" new literacies and technologies that include social media, literacy educators are finding innovative ways to integrate multiple modalities of literacy with classical as well as contemporary texts. According to Greene (1995): "Literacy in more than one medium will be required if people are to deal critically and intelligently with demagogues, call-in shows, mystifying ads, and news programs blended with varying degrees of entertainment" (p. 13). Frye (1978) linked literacy learning to personal empowerment and active participation in democracy and accused the media of attempting to "privatize human consciousness" through slanted news, entertainment programs, and advertisements:

> We cannot take any part in a society as verbal as ours without knowing how to read and write: but unless we also learn to read continuously, selectively, and critically, and to write articulately, we can never take a free or independent part in that society. (Frye, 1978, p. 19)

Reinforcing the view that advertisements are a way to encourage group conformity and reverence for consumerism, Guy (2006) suggested that media and technology have become a "powerful global communications network" that influences our thoughts, actions, relationships, and perspectives about the world in which we live in unprecedented ways. The mass media is not simply a passive tool that can access new information (p. 74). Conceptions about social class, gender, ethnicity, and lifestyle are all influenced by various media forms. The concentration of the media has the potential to divert learners away from "critical, social conscious forms of learning and social action" (p. 64) and that "critical media literacy is a necessary step toward addressing the underlying issues of control, homogenization, and conformity" (p. 74). Teachers can play a pivotal role in helping learners critically analyze the role and influence of media in their own lives. Texts such as Huxley's *Brave New World,* Bradbury's *Fahrenheit 451*, and *The Matrix* films revolve around totalitarian societies that prevent literacy learning and critical thinking. Computer-generated dream worlds, manipulating consumer consciousness, predetermined work roles and

duties, using drugs to blunt the personality and escape life's hardships, and passive entertainments that rob individuals of their ability to think independently and critically frame the cultural context of these dystopian worlds. The ideas and themes that surface in these works can provide a rich source of discussion and debate.

Today's social and pedagogic challenges can be met when teachers encourage literacy from diverse sources and encourage students to create bridges between popular novels like Lowry's *The Giver* or Collins' *The Hunger Games* and contemporary classics like Orwell's *1984*. Being able to read, reflect, write, and speak about similarities between fantasy and dystopian worlds and our own society provides students opportunities to explore ideas, thoughts, and feelings about anonymity, surveillance, responsibility, social control, and privacy.

The setting itself of a literary work can be explored through various contextual lenses to develop complex understanding and knowledge. These lenses could be psychological and social, physical or geographical location, or the actual historical time period. These dimensions of setting interact with one another to influence the trajectory of characters' motives and actions. Smith and Wilhelm (2010) drew upon the psychological theories of Jung, Bronfenbrenner, and Vygotsky to suggest the value of using a novel's setting and said:

> … the social/psychological dimensions of setting are a function of the systems of relationships among the characters … the story's geographical dimension addresses the country, city, neighborhood, and street; its features as far as natural artifacts, style, architecture, floor pan, rooms, and furniture. The physical setting is how a story is located in a specific space or spaces. (pp. 70–71)

Emerging areas in critical literacy include ecoliteracies and inter-textual studies (Bruce, 2011; Glasgow & Baer, 2010). These approaches use texts as powerful vehicles for students to explore contemporary issues that impact their lives. Interdisciplinary approaches, experiential, and place-based learning are ways to promote critical literacy and transformative or deeper level learning. Through self-directed and collaborative learning projects, students make connections between the perspectives they read about and planetary or neighborhood sustainability. Bruce (2011) emphasized that English teachers need to reimagine and redirect the focus of teaching classic and contemporary texts in a way that promotes:

> …empathy for both human and nonhuman species, for the soil, water, and air in which all of life depends … English teachers specialize in questions of vision, values, ethical understanding … Our expertise in addressing the aesthetic, ethical, and sociopolitical implications of the most pressing human concerns of our time enable us to reach toward and embrace environmental problems. (pp. 13–14)

From a transformative learning perspective, literacy is interlinked with life experiences and the importance of self-expression (Freire, 1997; Green, 1995).

Becoming literate gives individuals opportunities to break the socially constructed boundaries of socioeconomic class, gender, race, and ethnicity. The common themes in transformative learning involve: critical reflection, creativity, self-knowledge, reverence for life, democratic discourse, and the balance of attaining collective and personal goals. When transformative learning occurs, it creates fundamental shifts in the way people see themselves and the world (Magro, 2001; Mezirow, 2000; Taylor & Cranton, 2012). Transformative learning is a process of examining, questioning, and revising assumptions about ourselves and the world through dialogue, reflection, and action.

Hall (2002) emphasized that a transformative education can encourage the "release of our creativity and imagination" and help us become, Freire (1997) noted, "agents in our own history" (p. 44). Reinforcing this perspective within classroom contexts, Miller (2002) suggested that a "meaning-centered curriculum" would not only address the needs and aspirations of students, but it also would examine ways to reduce problems like poverty, conflict, mental illness, homelessness, racism, and social injustice. Learning cannot be compartmentalized and viewed solely as a cognitive process. Transformative learning theory is also deeply rooted in constructivist assumptions. Mezirow (1991) wrote that "meaning exists within ourselves and that personal meanings that we attribute to our experience are acquired and validated through human interaction and experience" (p. 19). Educators can create climates where questioning and reflective dialogues about self and society can occur. In this context, transformative learning can be defined as:

> … a deep, structural shift in the basic premises of thought, feeling, and action … such a shift involves our understanding of ourselves and our self-locations; our relationships with other humans and the natural world; our understanding of power in interlocking structures of class, race, and gender … and our visions of alternative approaches to living; and our sense of the possibilities for social justice and peace, and personal joy. (O'Sullivan, O'Connor, & Morrell, 2002, p. 11)

While the capacity for transformative change exists, it is not always inevitable. Taylor (2008) stressed that transformative learning is much more than a series of activities like reflective journals or experiential learning; it involves "educating from a particular worldview, a particular educational philosophy" that may or may not be shared by other colleagues (p. 55). He further observed:

> One area in particular is the student's role in fostering transformative learning. What are the student's responsibilities in relationship to the transformative educator? Second, there is a need to understand the peripheral consequences of fostering transformative learning in the classroom. For example, how does a student's transformation affect peers in the class, the teacher, the educational institution, and other individuals who play a significant role in the life of

the student? Furthermore, there is little known about the impact of fostering transformative learning on learning outcomes (e.g. grades, test scores). Definitive support is needed if educators are going to recognize fostering transformative learning as a worthwhile teaching approach… (p. 13)

Psychological, situational, and institutional barriers can impact the trajectory of any learning experience. However, in addressing the complex dynamics of learning and motivation, creative educational approaches can emerge to foster transformative learning.

Emotional Intelligence and Literacy Learning

Qualities such as self-awareness, self-regulation, motivation, resilience, empathy, intercultural understanding, and other emotional intelligence skills can be woven into literary as well as non-fiction texts. Mezirow (2012) asserted that individuals who possess personality qualities associated with emotional intelligence are more open to *deeper level* transformative learning experiences, and he explained:

Effective participation in discourse and in transformative learning requires emotional maturity—awareness, empathy, and control—what Goleman (1998) called 'emotional intelligence'—knowing and managing one's emotions, motivating oneself, recognizing emotions in others, and handling relationships as well as clear thinking. (p. 79)

Emotions impact learning in all its dimensions (Magro, 2001). Salovey and Mayer (1990) have written extensively on the concept of emotional intelligence as being more important than traditional measures of "IQ" in contributing to overall success in life. Goleman (1995) noted that deficiencies in emotional competencies could lead to increased aggression, depression, anxiety, social withdrawal, and cognitive problems. Goleman further maintained that the core skills of self-awareness, impulse control, and delaying gratification as well as the ability to manage stress and solve problems in positive and constructive ways can be integrated into the school system at all levels.

Emotional and social intelligence can guide thinking and actions. Vygotsky (1987) recognized the importance of teachers' understanding the complex interplay of emotion and logic, and he highlighted the way perceptions, memories, thoughts, emotions, and imagination can impact action. In *The Psychology of Art*, Vygotsky analyzed how plays like Shakespeare's *Hamlet* can be used to help readers and viewers connect emotion to the artist and the larger culture. Mack (2012) said: "Art becomes our emotional rehearsal for the larger social experiences of our lives, culture, and epoch" (p. 21). In developing empathy, self-awareness, and imaginative thinking through rehearsal with various texts and interpretive lenses and curricular experiences, youth will be better able to puzzle through challenges that are part of the life trajectory.

Intercultural Intelligence and Literacy Learning

Intercultural competence is a vital personal and social skill that teachers need in today's culturally diverse classrooms. Self-awareness, empathy, openness to and an appreciation of diverse cultures, effective listening sills, and a tolerance for ambiguity are just some of the characteristics scholars have associated with intercultural competence (Magro, 2012). Taylor (2006) described intercultural competence as "a transformative process whereby the [individual] develops an adaptive capacity, altering his or her perspective to effectively understand and accommodate the demands of the new culture; he or she is able to actively negotiate purpose and meaning" (pp. 156–157). Consistent with this, Bennett (2007) described the multicultural person as someone who is "open to growth beyond the psychological parameters of any given culture" and who cherishes and affirms the "difference" between people (p. 9).

The intersection of race, ethnicity, nation, class, religion, and gender can be explored through an examination of world literature (Carey-Web, 2001; Arias, 2007). Too often, world literature courses are offered to students at the high school level, and then the courses are merely electives. Finkle and Lilly (2008) emphasized that students' exploration of multiethnic identity and their need for self-examination in terms of *other* should start earlier on in their educational experience. Finkle and Lilly's (2008) *Middle Ground* provides teachers with sample lessons or teaching literature, such as Hosseini's *The Kite Runner*, from a multicultural perspective. Given the growing number of North American students from Middle Eastern, Asian, and African backgrounds, more and more diverse curriculum choices representing different cultures, experiences, and people should be provided.

Diverse texts provide exploration of various societies in the world that are also multiethnic, multireligious, multicultural, and multilingual, yet generalizations are often made about individuals and cultures. Bennett (2007) said that in developing pedagogy for multi-cultural education, there should be:

'… the movement toward equity or equity pedagogy, curriculum reform, or a rethinking of the curriculum so that it represents multiple narratives and perspectives; helping students gain multi-cultural competence.' This would provide a foundation for teaching social justice issues and about discrimination of all kinds such as racism, sexism, and classism. (p. 4)

A MULTICULTURAL LITERACY CURRICULUM

A multicultural curriculum including texts representing different voices from international perspectives can help build intercultural intelligence. Sefa-Dei (2002) explained that education can provide new ways to help students integrate history, place, and culture, and he asserted:

The individual as a learner has psychological, emotional, spiritual, and cultural dimensions not often taken up in traditional processes of schooling.

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> Holistic education that upholds the importance of spirituality recognizes this complexity by speaking to the idea of wholeness. Context and situation are important to understanding the complex wholeness of individual self or being. The individual has responsibilities to the community and it is through [holistic] education that the connection between the person and the community is made. (pp. 124–125)

Teachers can assist their students in developing the creative, analytical, and intellectual skills to clarify, justify, and realize a more positive vision of the future (Sternberg, 2003). Sefa-Dei (2010) further observed that a school system that fails "to tap into youth myriad identities" is shortchanging learners:

> Identity is an important site of knowing. Identity has in effect become a lens of reading one's world … the role and importance of diversity in knowledge production is to challenge and subvert the dominance of particular ways of knowing. (pp. 119–120)

Connecting with others and exploring personal identity through stories creates greater awareness of heritage, history, and culture. All of our students have powerful narratives to share. In reading biographical accounts and in encouraging students to write autobiographies and personal reflections, literacy teachers can honor and validate their students' prior experiences. Narratives reinforce the value of teachers being able to understand the social and cultural background of their students more deeply. Weber (2006) emphasized:

> … the very act of writing invites reflection by both students and teachers, which can take place in journals, letters, poems, speeches, formal essays, or more informal personal essays. Whatever the form used, students should see writing as a means of thinking through changes and dilemmas that they and others face. (p. 26)

Weber (2006) further noted that the larger question concerning the relevance of such personal writing lies in an understanding and appreciation of the way they may have changed or improved, and "an understanding of the larger implications of certain events or actions" (p. 27).

Qureshi (2006) asserted the importance of students' reading diverse literature to challenge their assumptions, values, and lifestyles; she maintained that in a post 9/11 world, students must actively engage in looking through many and varied windows so they can make informed choices as global citizens (p. 35). She developed an English course called "Global Voices" aimed at breaking down cultural stereotypes and improving cultural understanding and critical insight. By fostering empathy and perspective taking throughout the course, Qureshi explained:

> … by the end of the year, students have explored the spiritual, physical, and emotional implications of humane and inhumane acts across cultures. Only

then can they successfully turn the mirror on themselves to evaluate humanity and arrive at a set of universally valued human rights. (p. 37)

Some multicultural texts by writers native to African cultures and that explore contemporary issues revolving around politics, landscape, family/relationships, economics, traditions, religion, and social constraints include Larson's edited collection *Under African Skies: Modern African Stories*, Okri's *The Famished Road*, Beah's *A Long Way Gone*. Themes such as crisis and awakening, betrayal, human dignity, and justice are addressed in texts like these. Universal themes in literature can cross cultural boundaries and suggest a broad range of social justice themes for consideration and discussion.

Social Justice and Critical Literacy

Social justice advocates for the full participation of all people, as well as for their basic legal, civil, and human rights. There are numerous parallels between transformative learning and teaching for social justice. In their analysis of global and planetary perspectives of transformative learning theory, O'Sullivan and Hall (2002) asserted that educators today re-examine the systemic and structural barriers that reinforce poverty, racism, sexism, war, and ecological devastation.

Mitchell (2006) suggested that rather than deny the reality that the present world "is rife with examples of intolerance, lies, corruption, crimes against humanity, conflict, genocide," teachers should be compelled to address these issues while encouraging students to find a way to live in harmony. Freire and Macedo (1987) said:

> … critical literacy involves a pedagogy and curriculum that support students' learning to read and write the word, as well as support students' learning to read and write their worlds. Teaching students to read and write their worlds prepares them to be keen observers of the many texts they will encounter: literature across disciplines, visual media, music videos, commercials, social media, speeches, conversations among friends, and magazine articles and advertisements. Teaching students for critical literacy prepares them to act with greater awareness and understanding in all the contexts in which they choose to participate, including academic, professional, and daily life. (p. 42)

Texts such as Arthur Miller's *Death of a Salesman* and Chinua Achebe's *When Things Fall Apart* can be used to explore essential questions such as: What is truth? How can individual goals be balanced with societal goals? What is the role of materialism in our lives? To what extent can advertising be harmful to our health? What is power? What is freedom and responsibility? Does war challenge us to be fully human? Teachers of critical literacy seek to create "learning environments that support personal transformation—the development of social consciousness—and they prepare students to be both disposed to and prepared for transforming the world

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into a better place to exist for all people" (Mitchell, p. 42). Learning to read and write critically can also help adolescent learners develop empathy. Using multiple texts of different genres gives both teachers and students greater voice and choice. Critical questions that can be explored include:

- Who is in the story?
- Whose voices are missing, silenced, or discounted?
- What does the author want readers to believe?
- Whose viewpoint is expressed?
- How might alternative perspectives be represented?
- What view of the world is the text presenting?
- How else could the text have been written?

Juxtapositioning Literacies

Juxtapositioning various literacies is a useful strategy to encourage critical thinking and transformative learning. Juxtapositioning draws on multiple texts and perspectives. McLaughlin and DeVoogd (2004) explained the value of juxtapositioning is that it entails "expressing ideas from a variety of perspectives and challenges students to expand their thinking and discover diverse beliefs, positions, and understandings" (p. 55). Juxtapositioning accommodates multiple modes of literacy, fiction, as well as nonfiction, uniquely suiting literacy learning through a "cultural studies" framework. Cultural studies can integrate interviews, ethnography, testimonials, surveys, films, and media analysis. Different literary genres are explored and rigid boundaries between disciplines merge into a more creative way of teaching and learning (Carey-Webb, 2001). Cultural studies and the concept of juxtapositioning texts have emerged in recent years out of popular culture, multicultural studies, gender studies, and post-colonial studies. Carey-Webb (2001) wrote: "… the perspectives of 'marginal' groups such as women, ethnic minorities, and working-class people are important in cultural studies. Valuable in themselves, they also help us better understand dominant ways of seeing" (p. 15).

In juxtapositioning texts, non-fiction and literary works are integrated, classical and canonical works are analyzed, multiple viewpoints are explored, and theme-related units are developed so that students can gain a deeper level insight into topics such as war and violence; peace building; relationships and family; and challenges and journeys in life. The social sciences, history, humanities and arts, and contemporary issues are among the disciplines that can be studied through literature and non-fiction. For instance, in reading a graphic novel such as Spiegelman's *Maus*, students can gain an insight into Nazi Germany, the abuse of power, family relationships and many other topics through two powerful narratives depicted in drawing and captions. Spiegelman's first narrative is his father's account of how he and his wife survived Hitler's Europe, and the second is the author's own conflicted relationship with his father as they try to lead a normal life while reconciling

tragic events from past. Spiegelman's story could be used as a comparative text with Wiesel's *Night* and/or with German Expressionist paintings of the 1920s and 1930s to gain insights into the cultural atmosphere of tension, fear, and doom that ultimately gave rise to Hitler. Analyzing posters, propaganda, art, letters, and radio/television news from different epochs and countries at war would present additional perspectives of politics, loyalty, and sacrifice. Assessment might include collaborative and multimodal presentations on research findings. Such presentations would juxtaposition texts and might include the creation and performance of original songs, soundtracks, essays, or poetry accompanied by photographs, collages, or art to demonstrate students' understanding, knowledge, and perspectives.

Empathy and an appreciation of diverse experiences are more likely to occur when learners are given opportunities to identify with struggles that a character endures regardless of ethnic and racial background, culture, and geographic distance. For instance, Irvin (2012) used Jeannette Walls' *The Glass Castle* to teach emotional intelligence skills that her students can apply to their own lives. Irvin teaches in a high-poverty area where many of her students face adversity in the form of chronic self-doubt, depression, poverty, exposure to violence, and parental alcoholism. As a teacher of young adults, she integrated emotional and social intelligence into the curriculum by challenging her students to analyze the characters' motives, actions, and consequences. Despite the hardship she experiences, "Walls continually strives for improvement and she eventually leaves home at the age of 16 to begin her own, more normal life" (Irvin, 2012, p. 58). Teachers have the potential to develop a literature and non-fiction course based on psychological and social topics that involve challenges in young adulthood, the world of work, travel, developing a strong identity and building positive relationships, career choice, family systems, relationships, parenthood, coping with stress, and decision making (Magro, 2009). Johnson, Augustus, and Agiro (2012) explore the way a film adaptation of Shakespeare's *Othello* could be used to study bullying, group conformity, racism, class structures, and the abuse of power. Socratic seminars, surveys, read-alouds, and developing new media are ways that their students responded to questions such as: How do we protect ourselves and others from violent and harmful actions? How do we control our anger or feelings of jealousy? Mack (2012) asserted:

> Emotional literacy has an important place in the English curriculum because emotions cannot be separated from reading, writing, and thinking critically with language. Language gives us the means to make conscious decisions about how we act, speak, think, and feel. If at first we feel hurt or humiliated, thinking through the experience can actually change how we feel about it… Personal tragedy can be rewritten into a lesson in courage that we credit with strengthening our will to survive… (p. 18)

Students' sense of self-direction and motivation is increased when they possess the skills necessary to meet the challenges in life. Motivating teachers create lessons

that encourage students to make meaningful connections between the texts and their own lives.

CREATING CRITICAL LITERACY CURRICULA

The potential to explore external and internal worlds radiates in literacy; but without scaffolded experiences to usher students into the exploration, the potential remains unexpressed. Thinking of students as "designers" and "advocates" for their own rights and the rights of others reframes the educational process. Effective learning occurs when teachers are able to create a psychological climate that encourages self-expression, exploration of diverse viewpoints, reflective dialogue, and creativity. Greene (1995) said: "All depends upon a breaking free, a leap, and then a question. … the educative task is to create situations in which the young are moved to begin to ask, in all the tones of voice there are, 'Why?'" (p. 6). So we trust all the tones of voice among our students and pose provocative questions to help students step into the worlds awaiting their interpretation and action. With literacy curriculum as a springboard, our most creative and socially relevant work as educators is to help students ask "Why?" and support their subsequent inquiries using various literacy skills and content throughout the learning.

Preservice teachers (PSTs) in English language arts present a unique training and mentoring challenge. As undergraduates, they are often English majors whose academic experiences steep them in the literature of various literary and aesthetic traditions. However, teacher preparation programs intend to help PSTs negotiate their own academic and professional transformations from English majors to English language arts teachers of adolescents in secondary schools. Teacher preparation in English language arts must itself create transformative experiences for PSTs so that they will—in turn—employ creative approaches to their own students' literacy experiences. We cannot settle for the status quo for our students in the complex, multicultural world of the 21st century. We must be deliberate about preparing teachers with hearts, minds, as well as strategies for purposeful curriculum design and assessment work. We must also use the 21st century tools and modalities and encourage our students to do the same in their explorations and representations of learning. Albers and Sanders (2010) said:

> Whatever the challenges, we suggest that the arts, multimodality, and 21st century literacies are here, are important to literacy and language arts learning, and must be a part of curriculum. Not only must we embrace these aspects of language learning, but we must begin to play with them as students do daily. (p. 21)

Designing an English language-arts course that could be transforming starts with varied texts that launch inquiry and learning. Varied texts create the prompts for students to ask their own questions and conduct their own inquiries, to experience

creative literacy as agency. Framing curriculum units with essential questions sets the classroom stage for literacy learning, authentic student inquiry, and expression.

Designing Literacy Curriculum with Essential Questions

Framing curriculum units of study with so-called essential questions and complementary culminating projects intended to showcase and further explore what has been learned in answer to the essential question generates multiple paths for students' own inquiry, learning, and empathy. As opposed to leading questions that might inculcate students to a teacher's bias or narrow interpretation, essential questions and culminating project work prompt students to uncover and discover their own answers, problems, understanding, and empathies. Wiggins and McTighe (2005) defined an essential question in this way:

> A question that lies at the heart of a subject or a curriculum (as opposed to being either trivial or leading), and promotes inquiry and *uncoverage* of a subject. Essential questions thus do not yield a single straightforward answer (as a leading question does) but produce different plausible responses, about which thoughtful and knowledgeable people may disagree. (p. 342)

Essential questions invite students' original investigations, collaborations, and empathies. Essential questions do not tell students what to think about a topic; they are not leading questions. Essential questions also differ from hooks or guiding questions that educators ask and are necessary at times. McTighe and Wiggins (2013) said: "… by exploring questions, learners are engaged in constructing meaning for themselves" (p. 19). Essential questions raise more questions, recur, spark continual discussion and debate, and demand evidence.

Here is an example of how an essential question prompted student reading, response, and representation regarding Anderson's novel *Speak*. The novel is a fictional story of a high school freshman traumatized by an attack and who stops talking as she journeys through her first year of high school. The assignment question was: "What concept captures your interpretation of *Speak*?" Students selected concepts that individually resonated for them and created individual graphic representations of those concepts for sharing and discussion with the others in the class. Once composed, students displayed their graphic renderings around the classroom gallery as a basis for class discussion around the shared text.

As English language arts teachers, we need to select provocative literature in the first place then provide the curriculum prompts that help students look inside themselves to interpret a story and articulate metacognitive awareness about the many concepts at work within a novel and within our students themselves. A novel like *Speak* helps young adults process their own high school social systems, family relationships, trauma, gender bias, institutional bias, using art to learn, heal, and find voice. The assignment itself requires students to reflect more deeply into themes

in their own lives. It asks them to re-title their own representations with a verb or action word that captures a concept inspired by *Speak* with titles like *Hide, Bloom, Hibernate*, and *Create*. Each graphic representation elaborates on the concepts inspired by Anderson's novel with photographs, drawings, twigs, leaves, fabric, painting, and 3-dimensional forms—unique graphic renderings that allowed students to move beyond language and words to articulate much in the way of diversity, individuality, and universal commonalities. This kind of assignment in response to text requires students to step into the world of the text as well as their own lives and make connections and develop empathy toward others. Dolby (2014) reminded us that while mounting scientific evidence suggests empathy might be natural to humans, it still must be nurtured and developed (p. 109).

Readers theatre-style presentations are another way for students to work together to process literature and create multimodal representations in response. In this classroom literacy example, students created their own essential questions to capture significant themes in Myers' *Monster*, a story told from various points of view about a fictional a teenage boy being held in juvenile detention as an accomplice to murder. The design of the *Monster* assignment required students to engage with ideas in the text and with each other to create a dramatic, readers theatre-style response. With many variations possible, a readers theatre assignment requires students to create their own brief scenes cut from a novel's actual text. Constructing the assignment became an educative experience for students as they questioned issues of race, ageism, justice, and personal relationships. While reading from their scripts, students used props, costumes, setting, sound, and music to create desired dramatic effect. Some of the essential questions developed in response to Myers' *Monster* included the following titles.

- Do others affect our identity?
- How do labels imprison us?
- How does appearance create prejudice?
- If something is legal, does that make it moral?
- How do we express identity?

For educators designing curriculum, essential questions create practical and philosophical utility. For students, working with essential questions helps rehearse and learn how to ask their own questions. Wiggins and McTighe (2005) explained the usefulness of essential questions in curriculum design this way:

> The best questions point to and highlight the big ideas. They serve as doorways through which learners explore the key concepts, themes, theories, issues, and problems that reside within the content, perhaps unseen: it is through the process of actively 'interrogating' the content through provocative questions that students deepen their understanding. (p. 106)

Exposure to diverse texts does not encourage empathy or even aesthetic appreciation, but robust inquiry and presentations can lead individual students

and groups of young adults through powerful experiences. The list of diverse texts below—fiction, nonfiction, traditional, contemporary, young adult—prompted the accompanying essential questions that in turn framed a variety of student experiential learning and representations.

- Jhumpa Lahira's *The Namesake*: Must we let go of our past to define ourselves?
- Harper Lee's *To Kill a Mockingbird*: What is a hero?
- Lois Lowry's *The Giver*: How does the notion of perfection inhibit us?
- Mark Salzman's *True Notebooks*: How do we create our own prisons?
- Rachel Simon's *Riding the Bus with my Sister*: How can one relationship affect the trajectory of a life?

As suggested in these student examples of themes and essential questions related to literary texts, critical literacy approaches encourage student learning and work that necessarily becomes interdisciplinary as well.

Critical Literacy's Interdisciplinary Nature

Scholars (Ambrose, 2009, and chapter 2, this volume; Folsom, 2009) suggested that interdisciplinary contributions to cognitive diversity just might help save the world from its most challenging problems. At the classroom level, opportunities for divergent thinking required by creative, critical literacy learning are imperative opportunities as students grapple with ever-changing complexities of the 21st century. Students enact a critical literacy stance themselves as they work through their project work, research, presentations, and discussions. Folsom (2009) said:

> … Divergent production includes creative thinking and risk-taking. It is the kind of fluent, flexible, imaginative thinking that students need to succeed in our complex world and to change it.

> Divergent thinking and production are necessary for complex learning to take place. Creative project work provides opportunities to develop both intellectual skills and social-emotional processes. … Creative projects encourage the use of imagination to see alternatives in solving problems. Students learn in a real situation what it means to be flexible and make fair and ethical decisions. (p. 297)

Using literacy and essential questions can prompt deliberately powerful interdisciplinary learning and social action as well. Helping students to develop empathy was a strong pedagogic intention of a unit inspired by an initial reading of John Steinbeck's *Of Mice and Men*. The unit used Steinbeck's novella as a way to step into another's situation and understand root causes of homelessness and hunger in our contemporary culture. Specifically, the unit primed the pump of student understanding so that they could thoughtfully promote participation in their school's annual food drive for a local rescue mission. The unit, entitled *Campaign to Support the Homeless and*

Hungry, asked the following question: "How can facts and data be used to persuade others to take positive action?" The learning goals and objectives were to:

1. Investigate causes of hunger, food insecurity, and homelessness.
2. Read a variety of informational text and data.
3. Listen to and view a variety of sources of information and data.
4. Use research and data to create a visual poster that appeals to high school students and encourages them to participate in school's annual food drive for the rescue mission.
5. Use research and data to create 30-second television appeal to high school students for participation in the school's annual food drive for the rescue mission.
6. Calculate and graphically represent total contributions in a final report.

One discussion prompt in English class said: Many of John Steinbeck's fictional works, like *Of Mice and Men*, show the real hardships faced by people across the United States in an era known as the Dust Bowl. In your small groups, select 4 characters (any characters) from *Of Mice and Men*.

• Think about and discuss Steinbeck's characterization of each.
• What emotion(s) do you feel for each of these fictional characters?
• Using evidence from novella, explain why you feel that way about each character.
• The whole class will discuss the novella and Steinbeck's depiction of real life circumstances and realistic characterizations in his fiction.

In a move to the non-fiction literacies, students conducted interviews with school officials and rescue mission personnel associated with the food drive and were encouraged to generate, ask, and record questions. The answers informed the campaign advertising with facts, evidence, and personal appeals.

• Why does our high school hold a food drive every year for the rescue mission?
• What does our school collect besides food?
• The food drive helps whom? Where does the food go?
• Who are the rescue mission clients?
• What is the mission statement (or purpose) of the rescue mission?
• Does the rescue mission receive any government help/funding?
• If not, where do the funds come from in order for them to continue operating?
• Does the rescue mission need our school to collect anything besides food? If so, what specifically?

It is also important that students understand the many uses of literacy to inquire and research all kinds of information. The following discipline-based prompts required students to go beyond the literary text to develop knowledge and create appeals to their peers to support the hungry and homeless in their midst.

• From Mathematics: One major factor causing people to turn to rescue missions is their inability to afford meals for themselves and their families. Research the

following items to help you come up with powerful and convincing statistics that can encourage your classmates to donate food for the food drive:

- ○ What is the current minimum wage rate in New Jersey vs. cost of basic necessities (vegetables, diapers, formula, milk, eggs, what else)?
- ○ What is the current percentage of individuals unemployed in the City? In the County?
- ○ What is the percentage of individuals living on public assistance in the City? In the County?
- From Social Studies: Most of the homeless in New Jersey do not live on the street or under bridges.
  - ○ Using the Corporation for Supportive Housing's *2013 New Jersey Point in Time Count of the Homeless*, describe the various living situations for New Jersey's homeless.
  - ○ The U.S. Census Bureau releases the poverty threshold data for the previous year every fall. What was the poverty threshold for a four-person family in the U.S. in 2013? What does this income equate to in dollars per day per person? What factors does the Bureau consider in determining the poverty line?
- From World Language: Investigate how other western countries deal with the problems of homelessness and hunger. What lessons can we learn from them for our campaign?

Students used their research uncovered from multimodal sources, disciplines, and varied literacies to create posters and televised appeals to their peers in order to promote participation in a drive to support homeless and hungry people in their region. Based on a literary springboard, the curriculum posed an essential question that required students to use and adapt various literacies to inquire and learn about their world. Then students employed their imaginations, empathy, and varied literacies to promote positive social action.

WORKING TOWARD A TRANSFORMATIVE VISION OF EDUCATION AND LITERACY

As educators, and literacy educators in particular, it is not sufficient to intend that literacy transform students' lives. For an educative experience to be transformative, it must be just that—an experience. The most creative approach that educators can take to literacy learning is designing curriculum that invites students to uncover and create their own inquiries and engaged responses and action.

Working toward transformative or deeper level learning requires teachers to develop a curriculum rooted in the aspirations, needs, and goals of their students. Literacy education should come from a need within our communities that are becoming more multiethnic and multicultural. A creative classroom context can be a dynamic and innovative site for exploration of the emotional, social, and cultural landscapes of the past, present, and future.

Worlds past and present are full of violence, beauty, inequity, and generosity—yet our school bookrooms are stacked with texts to which we perennially ascribe traditional significance and stereotypes. When we use literature and literary analysis as the only arbiters of work and reading in our English classrooms, we limit opportunities for relevant exploration, meaningful inquiry, new learning, and empathy. The 21st century demands our creative, critical pedagogy in order to foster the development of all our diverse students facing a complex, multicultural world. If we intend that our students engage in literacy learning that is personally meaningful, socially just, relevant, and transformative, then our literacy teaching strategies must be transformative as well.

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13. CULTIVATING INNOVATION THROUGH INVENTION

How Rube Goldberg Inventions Can Ignite Creativity

The invention process can be a powerful tool for cultivating an innovation mindset in our students. This chapter explores the importance of cultivating innovation skills in our students and how the invention process can kindle the creativity needed to develop new ideas and implement them. An Innovation Growth model is proposed as a guide to developing innovation skills. The Rube Goldberg invention process is introduced along with a full case study in how it was used with 6th grade students. These activities were aligned with core curriculum standards. Recommendations were made for how this could be further researched in the future.

CULTIVATING INNOVATION THROUGH INVENTION

"Invention is the most important product of man's creative brain. The ultimate purpose is the complete mastery of mind over the material world," (Tesla, 2013) was the opinion of one of our greatest inventors, Nikola Tesla. Invention requires creators to identify a need and then create an original device to address that need. In simple terms, invention is the "creation of a product or the introduction of a process for the first time" (Grasty, 2012).

Innovation involves using inventions in new ways to meet emerging needs. Grasty describes this using a pebble and the ripples it creates when tossed in the water to compare invention and innovation. If invention is the pebble, then innovation is the ripples that change the surface of the water. It is through developing these inventions that we will have an opportunity to innovate in ways that cause ripples that change the world.

Educators are in the business of preparing students for future success. Future success is based on an individual's ability to flourish within an existing environment. In the Industrial Age, classrooms resembled factories where students proceeded along the assembly line of learning. Modules of knowledge were dispensed to each student in a methodical, logical manner. Students were taught to be cogs in the industrial machine. They were "shaped and fashioned into products that meet the various demands of life" (Cubberly, 1916, p. 338).

In the Information Age, students have had access to an almost unlimited amount of information. Instead of acquiring modules of knowledge, these learners have needed to learn how to find information, assess its value and integrate it into their knowledge bases to answer problems. Educators have been focused on Information Literacy, with proponents declaring that "Every aspect of learning and teaching requires the gathering, processing, and communication of information" (Eisenberg, Lowe, & Spitzer, 2004).

We are now in the Innovation Age (Modi, 2012). President Obama declared in his State of the Union Address in January 2011, "We need to out-innovate, out-educate, and out-build the rest of the world" (Obama, 2011). To enable individuals to flourish in this environment, education needs to go beyond delivering modules of knowledge and sources of information to a point where we encourage students to be innovators or change agents. Bill Gates has recognized the role innovation can play today, "Never before in history has innovation offered promise of so much to so many in so short a time." (as cited in Johnson, 2015, p. 10) Our technological connections with the world have empowered individuals to develop and share their innovations internationally.

This international connection brings challenges with it as well. Ambrose (chapter 2, this volume) talks about a world of macroproblems that are "high-impact, global, long term and transdisciplinary." These macroproblems are global and only through the macro-opportunities afforded through today's circumstances can we can address these challenges. "Scientific networking, innovative technologies and the strengths of diverse minds" (Ambrose, chapter 2, this volume) are examples of the tools our students will need in order to address their global challenges and we must empower them to invent new solutions and innovate ways to address the rapidly changing conditions within which we live.

How do educators encourage students' ability to innovate? There is not a straight line from skills to macro-opportunities, but unless essential skills are developed, students will not be equipped to handle macroproblems. There is no efficient path connecting curriculum with success in college or career, but it is the charge of education to make that connection.

As industrialist and engineer Clay P. Bedford put it, "You can teach a student a lesson for a day; but if you can teach him to learn by creating curiosity, he will continue the learning process as long as he lives" (as cited in Vaughan, Cleveland-Innes, & Garrison, 2013). Education has to be a more compelling, richer experience if it is to adequately prepare students to take advantage of these macro-opportunities. Students must be engaged in creative learning experiences so that they will develop creative ways to approach problems and develop solutions. Learning experiences should consist of an artful balance of straightforward, concise concepts and complex, mind-bending explorations. If a lesson rolls along like a marble down a track, it becomes more fascinating as it approaches forks in the road or gains momentum as it rolls downhill. One concept leads to another and soon an activity sparks the imagination, lights a fuse to an explosion of work, and ignites a passion

for specialized exploration and invention. Whether the answer lies in a simple construct or expands into a complex Rube Goldberg-ish contraption, learning needs to involve a sense of fun and accomplishment if it is to invite students to engage in the hard work of preparing for macro-opportunities in the competitive global economy.

The purpose of this chapter is to explore an example of invention curricula that cultivates innovation skills bringing macro-opportunities within reach of students so they will thrive in this global economy. We begin our chapter by defining innovation and declaring the need for integrating it into our present-day curricula. We present an innovation growth model that contextualizes the invention process and demonstrates a learner's growth process building simple inventions to innovating solutions to complex problems.

Having connected invention and innovation, we share a case study of how 6th graders developed their innovation skills inventing Rube Goldberg-style contraptions. We share how the complexity of Rube Goldberg inventing heightened student engagement, encouraged collaboration, nurtured creative thinking and extended critical thinking skills. While some may view inventing Rube Goldberg contraptions as frivolous, it is actually an opening strategy for using invention to develop visual-spatial thinking skills that enable learners to create and interpret conceptual models of complex systems and issues.

THE IMPORTANCE OF INNOVATION

The Merriam-Webster Online Dictionary (2015) defines innovation as "the introduction of something new" or "a new idea, method, or device." If you look at its Latin origins, innovation means "to renew or change into new." Twentieth century economist and Harvard University professor Joseph Schumpeter said that innovation was the product of new combinations or patterns, and identified them as: the production of a new good; introduction of a new method of production; development of a new market; acquisition of a new source of supply of raw materials; or new organization of an industry (Andersen, 2011).

Innovation can be categorized by its extent. *Disruptive innovation* is a radical change that starts at the bottom of a market and relentlessly moves up until it replaces the existing leader (Christiansen, Horn, & Johnson, 2008). *Sustaining innovation* makes a change on an existing model that makes a big difference in its use (Modi, 2012).

With the rise of technology, increasing use of the Internet, and the expansion of the global economy, the ability to innovate and change has become integral to the survival of all organizations. Maintaining the status quo is a short-lived luxury. Regarding the need to innovate, management guru Peter Drucker said, "Every organization has to prepare for the abandonment of everything it does." (1992, p. 97) Companies and organizations cannot simply abandon, they must move forward by anticipating the future needs of their current and potential market or stakeholders.

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These needs are shaped by current problems or changes in their environment. The ability to continuously create viable, competitive solutions is the secret to thriving in the Innovation Age. Preparing students to do that is today's educators' challenge.

INTEGRATING INNOVATION INTO THE CURRICULUM

Innovation has been identified as an important part of today's curriculum. The *International Society for Technology in Education* states this in their *Standards for Teachers*. Standard One recommends that, "Teachers [shall] use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments" (ISTE, 2008). A clear strategy for innovation at the organizational and curricular level is necessary in order for innovation to become part of the culture. We need to ensure that innovation is part of each student's learning experience and that our learning environments promote innovation. School communities need to discuss what they will acknowledge as evidence of innovation. Beyond rewarding correct answers, using an insightful questioning process to arrive at those answers should be examined as well. Innovation is the creative process of developing an idea into a solution.

The need for innovation in today's world was verified when The Partnership for 21st Century Learning (P21) surveyed experts in education, business, and policy. (Partnership for 21st Century Learning, 2009) Based upon their input, P21 developed a framework of learning outcomes that students would need to thrive. The outcomes were divided into three major components: "Life and Career Skills," "Learning and Innovation Skills – 4Cs," and "Information, Media, and Technology Skills" as well as the Key Subject areas. They identified new 21st-century student learning themes. Two of these themes that directly relate to this chapter are "Global Awareness" and "Financial, economic, business and entrepreneurial literacy." The 4Cs are broadly identified as: "Creativity and Innovation; Critical Thinking and Problem Solving; Communication; and Collaboration." The activities shared in this chapter suggest instructional strategies for engaging students in these 4 Cs of 21st Century Learning.

The need for learners to develop an innovation mindset is certain. It involves learning strategies that enhance students' innovation aptitude by inspiring their creativity, cultivating successful innovators' traits, and involving them in activities that put students in the position to innovate.

Traits of Successful Innovators

Nurturing innovators requires an understanding of what traits or characteristics they need to possess to successfully innovate. Dyer, Gregersen and Christensen (2013) studied 25 innovative entrepreneurs' habits and surveyed over 3,000 executives and 500 individuals who had started innovative companies. They identified five traits that compose what they call the "Innovator's DNA."

- Associating – The capacity to connect apparently unrelated ideas, problems and situations.
- Questioning – They constantly ask questions that challenge the common wisdom.
- Observing – Constantly observing the world and people's behavior to find ways to address their needs.
- Experimenting – Having identified needs, innovators explore possible solutions by creating interactive situations and observing the outcomes.
- Networking – Innovators work to connect with diverse individuals to develop new perspectives on the world and receive varied feedback on their ideas.

Tony Wagner (2012) supports these findings with his compilation of characteristics. In reviewing the literature, he has distilled the list to:

- Curiosity – The habit of asking good questions and a desire to understand more deeply.
- Collaboration – This begins with listening to and learning from others who have perspectives and expertise that are very different from your own.
- Integrative and Associative Thinking – Involves the ability to ask insightful questions and make connections based on the answers and observations.
- Bias toward Action and Experimentation – The actual application of one's idea is what transforms ideas into innovation. An innovator must mold new ideas through real-world interaction.

While the list of *DNA* traits and *Innovator's Characteristics* are similar, Wagner notes a significant difference. He questions whether DNA is an accurate description because these lists "represent a set of skills and habits of mind that can be nurtured, taught and mentored" (p. 15). DNA is built into the nature of an individual while behavioral characteristics can be developed. The essence of this article is that through the invention process, it is possible to develop an innovation mindset.

Developing an Innovation Mindset

Carol Dweck of Stanford University identifies two different types of mindsets: the fixed mindset and the growth mindset. Mindsets are not hardwired biologically. They are based on the beliefs people have about their abilities and talents. Dweck defines mindsets as "the view you adopt for yourself." (2006, p. 6) The *fixed mindset* individuals believe that their qualities are "carved in stone." They were given certain levels of intelligence, personality and moral character – that's it. The *growth mindset* individuals believe that they were given a set of characteristics, but they could cultivate these characteristics through their efforts. Successful education requires learners to be in a growth mindset.

The personal beliefs that promote a fixed mindset are based on previous failures. An individual tried to achieve specific outcomes but met with disappointment. It was easier to yield to a feeling of limitation than to expend the effort needed to succeed.

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Educators need to help learners conquer the fixed mindset by building a "can do" attitude amongst their students. They need to support their students' small successes beyond their perceived limits so that they can experience the possibility of growth.

The innovation mindset is a "can do" mindset that includes aspects of the characteristics listed previously. It involves a curiosity that is constantly questioning the status quo. It nurtures the ability to connect the answers to those questions with possible solutions. It thrives on an opportunity to apply possible solutions and evaluate their outcomes so that they may be modified and iteratively reapplied to find a working answer. The innovation mindset is a condition that will grow as educators challenge their learners and then support their innovations.

Govindarajan and Srinivas (2013) describe the innovation mindset from a business perspective. They describe its elements as the ability to (1) seize opportunities, (2) use "and" thinking, (3) be resourceful, (4) focus on flexible outcomes, and (5) expand the pie. Educators can incorporate aspects of the innovation mindset to student learning outcomes.

- *Seize Opportunities:* being able to recognize the right opportunities based on alignment to their vision. The implication for educators is to help students become empathetic thinkers who can spot users' needs and develop creative solutions that work from the perspective of their target audiences.
- *Use "And" Thinking:* pursuing projects that work with the current rhythm of operations AND strike the right balance between opportunities and current performance. Educators can help students gain an appreciation for problem complexity AND being open to related opportunities and solutions.
- *Resourcefulness:* Create a climate that rewards resourcefulness and the ability to power through obstacles. Educators can encourage creativity and appreciation for problem complexity.
- *Focus on Flexible Outcomes:* seek new accountability for reaching goals and making progress in the right direction. Recognize a balance between innovation and performance. This also speaks to understanding problem complexity where students measure their accomplishments against evolving standards.
- *Expand the Pie:* after the project becomes stable, reach out to convert non-consumers into consumers and expand revenue streams. Educators challenge their students to look beyond the solution.

Creativity and Empathetic Thinking

By definition, creativity involves using imagination to generate new ideas. Innovation means taking creative ideas and implementing them. Creativity is a necessary ingredient of innovation. "It is a means to an end, but not an end in itself" (Sloane, 2002). Creativity is not an innate ability that does or does not exist; it can be nurtured according to proponents of design thinking and innovation.

David Kelley, founder of IDEO, has been in the creative innovation business for a long time. "The big thing about design thinking is it allows people to build on the ideas of others," declares Kelley (2013). To support this claim, Kelley established the Hasso Plattner Institute of Design at Stanford University. This school embodies creativity-based learning. Graduate students from different disciplines engage in "design thinking" building upon each other's ideas. Their innovations are guided by their understanding of their user's needs. Through direct human observation they learn what people need and want so that they are able to develop an empathy for their users that leads to successful and relevant solutions.

Empathy involves seeing the world from the viewpoint of others rather than centering on one's own perspective. "Empathy means challenging your preconceived ideas and setting aside your sense of what you think is true in order to learn what is true" (Kelley and Kelley, p. 90). Empathetic thinking is a core skill in designing, thinking and creating solutions for human users. It redirects the design and evaluation process by prioritizing the user's needs and success metrics over the creative genius of the inventor.

Empathy or empathetic thinking is an important part of creating new, effective solutions but it is not mentioned specifically in the Partnership for 21st Century Learning Framework (2009). Under "Work Creatively with Others" in the Creativity and Innovation section, the framework advises that students "be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work." Design thinking takes that a step further by asking designers to begin with understanding the problems and challenges of target users and prioritizing their needs in the design process.

Problem Complexity and Empathetic Thinking in Innovation

Beyond creativity, successful innovation is based upon the innovator's ability to understand the complexity of a problem as well as the ability to empathize with the ultimate user. Complexity has to do with the size and intricacy of a problem. As the quantity of elements involved in a problem increase, the number of possible interactions between these elements surge.

At a simple level, a problem like turning off a light can be simple and straightforward. The problem-solver needs to find a way to disconnect the electricity from the light bulb so that the light will extinguish. When one considers additional facets of the task (e.g., light location, switch location, electricity availability) the problem becomes more complex. When the user's needs are included (e.g., size of the user, mobility of the user, location of the user) the problem's complexity increases as well.

On a larger level, a problem might be extremely complex (e.g., transporting water to a village in the sub-Saharan desert of northern Africa.) The logistics of identifying a water source, implementing a transportation system, and distributing

the water once it arrives at its destination are riddled with complexity. Considering the requirements of the village residents the problem becomes even more complex.

This theoretical exploration suggests ways in which teachers can encourage students' ability to innovate by nurturing their abilities in empathetic thinking and dealing with problem complexity. This development is described in the Innovation Growth Table (Figure 1.) This table depicts the transition progression in problem-solving challenges as well as the levels of sophistication seen in the students. It maps User Empathy (Empathetic Thinking) against Problem Complexity to illustrate each of these dimensions.

Figure 1. Innovation Growth Framework: How increasing user empathy and problem complexity encourages the ability to innovate (designed by Sharon "Sam" Sakai-Miller)

The lower left quadrant *initiates* students who are new to innovation or feel disengaged from the system. They need to enter into the innovation process through projects of low complexity, preferably requiring low empathy to encourage them to participate and engage.

Students with "low user empathy, high problem complexity" skills tend to prefer working solo, often because they feel they are more productive that way. They are not as concerned about their relations with others as they are about the problem itself. They would benefit from *associating* with other students because they would be exposed to a broader range of perspectives, which should improve their empathy levels. If they were to raise their empathy levels and exhibit "high user empathy, high problem complexity" traits they would be in a better position to innovate.

Students who feel a high sense of empathy for others, but are working at low levels of problem complexity are socially conscious, but can offer emerging solutions. If they *iterate* or repeat the problem-solving process, they may increase their abilities to

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deal with higher levels of complexity. This would move them toward "high empathy, high complexity" and innovation.

The ultimate goal is for our innovators to reach a level where they exhibit "high user empathy" and "high problem complexity." These innovators are creative and critical thinkers who are prepared for addressing or creating the many macro-opportunities in today's world.

As our students build their innovation skills, they need to engage in fulfilling, entertaining projects as a gateway to learning, connecting with others, and learning more complex subjects. They can begin with inventing.

INVENTING

While innovation is defined as "to renew or change into new," invention is described as "the act of creat[ing] or design[ing] something that has not existed before" (Oxford, 2015). Typically an invention is goal driven and must serve a purpose.

Jean Piaget, in his book, *To Understand Is to Invent* (1976), supported the invention process as an important part of education. He stated that educators should "lead the child to construct for himself the tools that will transform him from the inside – that is, in a real sense, and not just on the surface" (p. 121). He was defining the importance of students creating tools to perform tasks that are self-directed rather than teacher dictated.

While inventing has been around as long as humankind has roamed the Earth, it is considered a subset of a larger movement – the Maker Movement. The Maker Movement extends far beyond "formal learning structures, and encompasses not only the process of creating specific objects, but also the social and learning cultures surrounding their construction" (Sharples et al., 2013, p. 33). Voight describes the maker movement as an "umbrella term for independent inventors, designers and tinkerers" (2015). While "inventing" as we have described it in this chapter is part of the Maker Movement (Martinez & Stager, 2013), The movement goes beyond inventing new things in the typical sense. It isn't limited to 3-D printers or robots or metalworking. It is a complete culture that includes anything where you are "making" something. This can include arts, crafts, cooking, programming, filmmaking or any creative activity. The Maker culture supports innovative applications of technologies and the integration of seemingly disparate fields. Encouraging interdisciplinary thinking is the key to solving complex macroproblems. As learners engage in integrative problem solving, they are building a cognitive foundation for the transdisciplinary collaborative activities that stimulate innovation.

As an integral part of making, inventing is a process that will lead to innovation. It begins with identifying a need. This need is the recognition of a dent in our existing technology. Thomas Edison explained the next stage as "I find out what the world needs, then I proceed to invent." (as cited in Berglas, 2012, para. 5) Once the need has been identified, a series of solutions are generated. These solutions are not typically generated from the reaches of a single mind, but rather through conversation and

supposition between colleagues. These ideas are brought into the physical world with pictures, diagrams and ultimately prototypes. Using the prototypes, testing is done to find out how well they work and how they can be improved. This refinement process is repeated until it is considered ready for public consumption. At this point, the product is usually perfected to be manufactured in the most efficient and cost-effective manner.

Rube Goldberg inventions are quite the opposite of this standard invention paradigm. They are designed to involve a complex set of chain reactions to achieve a simple task. The elegance doesn't lie in achieving the task. The elegance exists in the complexity of the process used in completing a simple job. Developing this process is what unleashes an inventor's creativity.

Unleashing Creativity through Rube Goldberg Curricula

For many students, problem-based learning is uninviting because it is too serious, complicated, or they see the challenges as irrelevant to their lives. Solving problems doesn't have to be complicated. The task can be simple (e.g., turning off a light) and the procedure for achieving the task can involve various levels of complication. There is a name for this type problem solution – Rube Goldberg.

Rube Goldberg inventions are named after the renowned cartoon artist. Initially an engineer, Goldberg found his calling in drawing complicated contraption cartoons for the Sunday paper and other media. For 55 years (1915–1960), he devised inventions that worked in his head but he never tried them in real life. They were complicated and in a strange way seemed that they should work. The Rube Goldberg name became synonymous with "unnecessarily involved and complicated." In 1931, "Rube Goldberg" was adopted by the Merriam-Webster dictionary as an adjective defined as "accomplishing by complex means what seemingly could be done simply." Rube Goldberg Inc. expanded the definition to include the comedic sense found in every invention: "A comically-involved, complicated invention, laboriously contrived to perform a simple operation." (Rubegoldberg.com, 2015, para. 1) This aspect of fun can add another level of engagement to capture disengaged students.

While Rube Goldberg inventions are designed to achieve simple tasks. The enchantment lies in the process that the inventors pursue to get there. These inventions are designed to be entertaining and can lure students into learning more about physical science, being creative, and venturing into the innovation cycle. The Rube Goldberg model demands creativity. Goldberg contraptions integrate fun, being funny, and exploring physics in the process of accomplishing a simple task.

Rube Goldberg Inventions

An interesting aspect of Goldberg inventions is that they are contrary to regular problem-solving and engineering methods. Typical strategies direct the learner to find the most efficient and effective procedure for achieving the desired goal while

Goldberg challenges inventors to create extravagant and "contrived" solutions to accomplish their simple operations. The Goldberg method challenges inventors to use their imaginations to create their contraptions. It requires thinking beyond the norm. Instead of tripping a simple lever to turn off a light, a Rube Goldberg invention might engage 27 steps including rolling balls, spilling dominoes, racing cars or even popping balloons to flip the switch. Creating this complex series of steps is not a trivial process. It requires inventors to envision opportunities and then collaboratively explore how to make them a reality.

The increased complexity of creating a Rube Goldberg invention can add another level of creativity to the process. Imagine creating an invention to accomplish a simple operation and then being directed to rethink it to make it more complicated. You would need to expand it to make it funnier. You would need to reconsider your work through a more complex lens. The following case study will describe how the Rube Goldberg model can be used to engage students in the invention process. Please notice the increasing complexity of the challenges throughout the experience and how the control of the process of selecting these challenges was gradually moved from the teacher to the students.

Case study – 6th graders go Rube.   Our example of nurturing innovation through invention involves engaging 6th graders in STEM work in a Midwestern middle school; we will call it Applegate Middle School. The population is primarily composed of Caucasian students with a free and reduced lunch ratio of 21%. This school (grades 6–8) is a forward-looking school that has been running a 1-to-1 program for all students for 3 years. Each of the students has an iPad that they use 24/7 and they are fully integrated into the classroom activities.

It was near the end of the spring semester and it had been a successful year for the sixth-grade students and their teachers. The teachers wanted to provide a special learning experience so they presented the students from the four 6th grade classes with a number of unique opportunities to pursue their passions. One of the options was to engage in two weeks of Rube Goldberg activities where students could innovate and create while learning aspects of physics and problem solving. The students would work in 90-minute blocks of time on a daily basis. Twenty students signed up for our Rube Goldberg program. This was composed of 18 boys and 2 girls. (Unfortunately, the girls dropped from the groups after 3 days because they did not feel that it was following their areas of passion.)

This project was a unique opportunity to work in the STEM (science, technology, engineering, and mathematics) arenas. While students were aligning dominos and rolling marbles down chutes, they were engaging in an ongoing engineering process of building a solution to a given task. As scientists, these students learned about various forms of energy and explored Newton's 3rd law (For every action there is an equal and opposite reaction). Technology in a digital sense was only seen in the Lego robot used in one of the contraptions, but in a broader sense, they fulfilled Core Curriculum learning expectations by using "creative thinking in the design

and development of innovative technology projects and problem solving." (Iowa Core, 21.6-8.TL.1) Mathematics was not included in a formal sense, but this whole operation was based on physics principles and could be more intentionally integrated in future projects.

The full engagement of learners as they explore STEM topics in an authentic task provides an immersion into the content areas that is not possible in the book-driven high-stakes-testing curriculum of today. STEM's transdisciplinary nature provides the opportunity for learners to develop broad and deep proficiency in multiple subject areas. More importantly, experiencing such interdisciplinary innovation will prepare these learners to deal with more complex problems in the future.

Our strategy was to challenge these students to invent solutions to achieve various tasks. At first the tasks were defined by the teacher and later the students identified their own tasks and invented innovative ways to achieve them.

Phase one.   On the first day, the students entered the room and self-selected 3 groups of six or seven members each. Each group gathered around a table awaiting initial instructions from their teacher. The teacher held up a large marble and asked them how he might get this marble into a white bucket across the room. Several suggested throwing the ball. The teacher threw it and missed. Others proposed walking over and dropping it into the container. The teacher walked across the room but missed again. He then challenged the groups to brainstorm ideas for achieving the task and creating a list of options. The adventurers began rolling off typical ideas: "roll it off the table," "bounce it off a trampoline," and "make a ramp from you to the bucket." Then more innovative and creative ideas began to appear: "place a vacuum in the bucket and suck it in," "use a catapult", and, our favorite, "fly a remote controlled helicopter to grab the marble and then drop it into the bucket."

After about 5 minutes, one group of boys grew tired of listing their ideas and began lining up their chairs to see if they could create a ramp that they could use to actually roll the ball into their bucket. These were our kinesthetic learners.

After the groups had listed their ideas, the teacher challenged the students to actually invent a contraption that could carry a ball from one point in the room to the bucket. The standard construction resources in the room were intentionally scant because we were more interested in their imagination than their creation at that point. Ramps, marbles, and buckets were the only things that were provided for their inventions. An interesting aspect of their work over the next 40 minutes was what they used to improvise tools for moving marbles. Textbooks were stacked to create varying elevations. Chairs were arranged to provide guidance for ramps and balls. Some groups worked on the floor while others ran their ramps along bookshelves below the windows. All groups were successful in rolling their marbles into their buckets.

After the students left, their teacher took photos of their inventions and then put everything away. Today was only the first day of a series of days where these young engineers would be inventing innovative methods for achieving simple goals.

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Phase two. The next day, the students entered a room filled with tools for achieving their tasks. Their initial inventions were gone, but the supply table was filled with dominoes, ramps, duct tape, ping pong balls, miniature cars, cups, PVC piping, legos, blocks, balloons and other treasures found in the school's science closet. These items weren't found on a prescribed list of materials needed for learning, but each gem provided another avenue through which these thinkers could create solutions to their challenges.

The class began with discussing simple machines and watching YouTube videos of simple machines that can be combined to create Rube Goldberg inventions. Whether it was a rolling ping pong ball, cascading dominoes, or a vibrating cell phone, these students were tasked with the opportunity to combine a series of these machines to invent chain reactions to accomplish a simple task.

Once again, the groups were asked to review the collection of resources on the table and then brainstorm a number of simple machines that could be combined in a Rube Goldberg machine. Again, the teacher challenged the groups to invent a new and more complex way to drop a marble in a bucket. They were to plan their new invention by drawing it on their white-board table or on a white-board wall. This time, due to their increase in experience in watching videos and playing with hands-on gadgets, the students' selections of possible machines was greater and more varied.

After the students had imagined their inventions, they explained them to their teacher. Questions were asked, plans were challenged, and proposals for inventions were updated. Once the teacher gave them the "go ahead," the groups began bringing their inventions to life. One group ran water from a faucet through a hose to a balloon that, when inflated, released a marble to roll down a chute to topple Winnie the Pooh who began a domino chain reaction that pushed a cart that rolled a ball down a chute into a bucket.

This process took a couple of days of group work. Through experience and coaching from the teachers, the students learned about group work and collaboration. They experimented with making their plans come to life while learning about the interpersonal development process.

Along with the invention process, these activities provided a perfect stage for our explorers to learn about various forms of energy. Instead of having them memorize the definitions for bolded terms in a science book, they made a list of the various types of energy on the board and integrated them into their conversations. They began by reviewing each of the terms and then used them in our discussions as they watched more Rube Goldberg videos and discussed their inventions. The general categories of energy included kinetic and potential energy. To make these ideas more understandable, they identified the more specific types of energy in each form. Kinetic energy includes motion (this was the most prominent in our inventions), sound, thermal, radiant and electrical. Potential energy includes gravitational (another important energy in rolling marbles down ramps), mechanical, chemical

and nuclear. We even discussed how gravitational energy that causes a marble to roll down a ramp converts to motion energy.

It should be noted that these activities were designed to align with the Iowa Core Standards (2008) for 6th grade. It is obvious that building a Rube Goldberg solution easily addresses Science and Technology standards, but this was a cross-curricular project that incorporated Writing standards as well. Here are some examples of the standards that were addressed:

- *Science* – PS 2-1 Designs a solution to a problem involving Newton's 3rd Law.
- *Technology* – 21.6-8.TL.1 Demonstrate creative thinking in the design and development of innovative technology projects and problem solving.
- *Writing* – W.6.6 Use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others.

Engaging students in writing could have been accomplished through keeping a paper journal or writing papers for the teacher, but the inventors were challenged to share daily reflections through a blog, *Kidblog*. These reflections were opportunities to talk about their inventions, discuss their challenges and "awesomeness," and provide an overall impression of their creating. Kidblog has an iPad app so the students were able to easily include photos of their work with their reflections.

Sometimes their musings were surprisingly insightful. One 6th grade creator shared "Inventing is like writing a book. You get to have fun imagining new things, and when you're done you feel like you accomplished something. That is why I think inventing is cool beans."

Posting their thoughts online added a collaborative aspect where students would review each other's postings and leave comments. This brought about a greater sense of community. Having left written comments, students were heard discussing each other's postings after class. The teacher responded to each of the postings, but this writing activity was not to please the teacher. It was meant to share their ideas with classmates and receive feedback.

Phase three.   Having invented contraptions to fulfill goals set by their teacher, it was now time for our sixth graders to identify their own goals and fulfill them. This is the transition from *Teacher Led* instruction to *Student Driven* learning.

As noted earlier, a Rube Goldberg invention is defined as a "comically-involved, complicated invention, laboriously contrived to perform a simple operation." This simple operation might be as mundane as turning off a light, shining a shoe, turning a page in a book, or even opening a window. The three groups of inventors were charged to brainstorm lists of simple tasks. Some of their tasks were simple: Turning on a fan, popping a balloon, cutting a banana and closing a door. Other suggested tasks were a little more complex: making toast, preparing a smoothie, and even dipping a chip into salsa. Upon completing their lists, the groups were asked to select a single goal for their inventions. One group chose to pop a balloon – simple enough. The other two groups selected some more challenging tasks with one deciding to

prepare a smoothie drink and the other group planning to create a machine that would that dip a chip into salsa.

Having identified their goals, it was now time for our 6th graders to envision their inventions through drawings. A few requirements were set. Each invention needed to include 15 machines (this number was not enforced as things developed) and needed to use at least two forms of energy. Most of the students identified gravitational and kinetic energy, but some of the others included sound (vibrating cell phone), chemical (battery), electrical (turning on a powerbar) and mechanical (stretched rubber bands). This wasn't too difficult, but the important part was that they would be dialoging about the energy instead of identifying it on a multiple-choice test.

While each of the groups needed to have their plans reviewed by their teacher, it was evident that the innovation did not end in the planning stages. The students began creating their inventions using their plans but as creative muses struck or reality showed them that they would not be able to accomplish what they had planned, the inventors changed their plans along the way.

Mmmmmm – a smoothie.   The "smoothie makers" decided that they just needed to get the smoothie ingredients into a blender and turn on the blender. They began by trying to build towers around a blender from which they could drop the banana and milk and ice cream from different containers at different heights. This approach was too complex because the towers were too unstable. Looking toward the heavens for direction, they realized that there was an empty cupboard directly over their work area. They opened the doors to find that there were moveable shelves and multiple levels for rolling marbles, tipping dominoes and spilling bananas. They created a series of ramps for marbles so that they would fall through a hole in the table and cause a hinged cup in the cupboard containing a yogurt and a banana to spill its contents into a waiting blender under the cupboard. Once the contents were in the blender, it needed to be turned on. They accomplished this by placing a marble into a structure of zig-zag ramps on top of a closet. This marble rolled down a series of ramps until it slammed into the *on-switch* on a power bar that provided electricity to the blender that mixed its ingredients into a delicious smoothie.

Dip a chip in salsa.   The "salsa dippers" decided that they would use a complex trail of marbles, pipes, chutes, dominoes, and levers to initiate the process. The difficult part was to design something that would grab a chip, move it to the salsa bowl and then submerge the chip into the sauce. Toward the end of that day's session, the inventors began discussing using robotics to accomplish the task but class adjourned before any solutions could be considered. In service to his students, their teacher pursued resources for acquiring robotic arms. He went to the high school where they had a robotics lab, but it turned out that all of the robotic arms were being used for the rest of the month. He contacted the nearby university but their robots were all otherwise engaged. Interestingly upon returning to school the next day, he found that these industrious 11-year-olds had spoken with their middle school robotics teacher

from the previous semester and acquired a *Lego Mindstorms* programmable robot to transport their chips. They could program the robot to roll along a suspended track as needed and to open and close a robotic hand on a dangling arm attached to the rolling robot. This meant that they could move the robot to the chip, grab the chip and then move the chip to another point along the suspended track.

An innovation moment came when these Nikola Teslas realized that they needed to have a bending elbow if they were going to "dip" the chip in salsa. They had no such capability. Instead of lamenting this barrier, these inventors decided to bring the salsa to the chip. They created a seesaw lever where the salsa bowl was attached to one side while a basket receptacle was on the other. They coordinated their contraption so it would begin with placing a ball into a pvc pipe. This ball would roll down the pipe into a series of chutes, hit a large marble, which ran down additional chutes to the basket on the lever. During its decent, the robot would pick up the chip, move it to a point above the salsa bowl, and when the large marble dropped into the seesaw basket at the end of its course, it would bring the bowl of salsa up to the chip. Voila!!

Balloon poppers.   The simplest task was by no means boring. These innovators decided that the weapon du jour for popping the balloon would be a tennis ball with pins and needles protruding from its surface. This ball would be placed on a table above a wastebasket containing a balloon. They only needed to find a way to knock the treacherous ball off its precarious perch above the basket. Their solution to this challenge began atop some boxes at the other end of a couple of long tables. They had placed a 3" binder on top of the boxes with the incline sloping down towards the balloon. Based upon what they had seen in a video, they decided to place a flip phone at the beginning of their course on top of a slanted binder. The phone was set on vibrate. A marble waited at the bottom of the incline.

To begin their reaction, a student dialed the flip phone's number. The flip phone began vibrating. It slid down the binder and tapped the marble. The marble rolled down a ramp and set off a *Hot Wheels* car along a Super Loop, which toppled dominoes that knocked the treacherous ball into the basket and popped the balloon. It should be noted that these chain reactions didn't always follow the planned route or sequence of events. Sometimes the balls fell off the ramp or the dominoes didn't fall as intended. Sometimes the balloon didn't pop. These failures were acknowledged to be part of the process. With a series of 5 or 6 steps in a Rube Goldberg invention, there were many steps that succeeded leading up to the one misstep that caused the failure. Inventing is a series of trials and failures and refinements to achieve the desired outcome.

REFLECTIONS ON THE GOLDBERG EXPERIENCE

This 6th grade Rube Goldberg experience involved critical thinking, creativity and innovation, but it's success was based on successful collaboration. It required

effective intrapersonal and interpersonal skills that enabled learners to know their strengths and collaborate with others to invent. As such it seems to have some promise as a strategy for the development of 21st-century knowledge, skills, and dispositions.

Building Personal Interaction

One student was incredibly attracted to the Rube Goldberg creation process but he didn't want to work with people. He was a loner. At night he would create chain reactions using Minecraft and share it with us the next day, but during the day he generally sat on the sidelines. One day, after another teacher had nudged him a little, this student approached the lead teacher and said, "I want to work on these inventions but I don't want to be part of a group." The teacher looked into his earnest eyes and asked, "Have you ever heard of a consultant?" He hadn't, so the educator explained that a consultant was a person who could help groups to do special things. He introduced the inventor to the Balloon Popping group. They decided that his specialty would be creating the treacherous ball that would pop the balloon. He took to the challenge. He found needles and broke paper clips that he poked into the tennis ball. This consultant had achieved his goal but the story didn't stop there. After the ball was in place, our lone student began working with the group inventors to refine their contraption. The invention process took precedence over his social barriers. This innovative process had caused this inventor to go beyond worrying about interacting with people to direct his interest towards inventing.

Discovering Intrapersonal Strengths

At the beginning of the project, the teacher realized that this project could be a prime opportunity for students to recognize their interests and move independently to develop their strengths. He decided that the level of student buy-in would be apparent in the classroom but could be further indicated by two factors. The first factor would be seen in the students bringing materials to school to use in their inventions. This wasn't suggested by the teacher but he felt that it would be an indicator of personal interest. The only item brought into class was the *Mouse Trap* board game (Ideal, 1963) which was a useful Goldberg model but not useful in building contraptions The second indicator expected by the teacher was students creating these Rube Goldberg contraptions at home. Interestingly enough, this extra-curricular inventing occurred in two flavors: real and virtual. Three of the eighteen students created their own inventions at home and then used their iPads to video record them and share them with the class. These inventions ranged from a simple 4-step contraption to launch a ball towards a target to building a complex 12-step invention involving dominoes, marbles, Hot Wheels cars, springs and duck tape to turn out the lights. Three other students created Minecraft-ed Rube Goldberg inventions. These also

ranged in complexity but contraption interaction was all virtual. These students recognized their interests and strengths in working and inventing in a virtual world.

This invention process ended with an open house where the parents could come to school and enjoy their sons' and daughters' handiwork. It was an opportunity to celebrate their creations. Rolling marbles, falling dominoes, and dipping chips evidenced the creativity that flourished in this experience.

CONCLUSION

While invention may be one of the most important products of a person's creative brain, it is innovation, what we do with these creative ideas, that makes a difference in the world. The question is how we can scale up inventions to lead to innovations. Educators and school systems face two dynamically-opposed alternatives: (a) preparing students to seize macro-opportunities by developing their 21st-century abilities, which include networking, solving complex problems, leveraging new technologies, and thinking creatively, critically, and empathetically, or (b) ignoring these options and leaving our learners ill-equipped, facing shortages, and vulnerable to being crushed under a wave of macroproblems.

Throughout this chapter, we have explored the importance of developing innovation and how we can foster innovation and creativity through the invention process. The invention process provides a venue for experimentation. Using a constructivist process, learners built their own understanding of how devices can work together to achieve a designated goal. Failure was part of the process. Success involved building on those failures to create something that works.

In this chapter we assumed that learners possess a *growth mindset* because we believe it is possible to cultivate an aptitude for innovation. This involves studying and assuming traits of successful innovators, adopting an innovation mindset, and providing students with opportunities to enhance their empathetic thinking skills and receptiveness toward problem complexity. Students who consider problems from potential users' points-of-view (empathetic thinking) and complexity are in better position to innovate.

Innovation Age learning extends Information Age learning. Using a constructivist process, learners build their own understanding of core concepts and skills. Using this new knowledge to solve problems or create opportunity requires empathetic thinking and expectation of problem complexity. Innovation requires developing the interpersonal skills to work together to achieve a designated goal. Students who need to build empathetic thinking and collaboration skills can move toward innovation by being associated with others. Students who need to build their ability to solve complex problems, benefit from working through multiple iterations of solutions. Failure is part of the process. Success involves building on those failures to create something that works.

The Rube Goldberg invention provides a different perspective on inventing. While a simple operation is defined for the outcome, the elegance of the invention lies in the

multiple steps through which it is accomplished. It is not about building simplicity. Rube Goldberg inventing involves developing complicated and laboriously contrived systems along the way. The unique aspect of the Rube Goldberg approach is the opportunity for embellishment. Once an invention has been completed, creativity is nurtured by asking the inventor to expand on her device rather than making it more efficient. This process fosters creative and visual-spatial thinking skills to envision new ways to accomplish tasks.

The 6th grade case study provided an opportunity to see how the Rube Goldberg model works in an actual classroom. The participating learners spanned a range of skill and interest levels. Devising and implementing their solutions involved challenges in the areas of creativity and personal interaction. The level of student engagement was such that some of the students created their own contraptions at home and shared videos with the class.

The Rube Goldberg experience was a STEM experience. It was an interdisciplinary activity integrating science, technology and engineering into an authentic problem-solving project. The solution for this project was not as important as the process involved. Finding the solution required learners to use and develop their creating thinking skills to generate and adapt new ideas. They needed to use visual-spatial thinking to conceptualize the overall project and integrate appropriate solutions. As demonstrated, this project developed both interpersonal and intrapersonal skills as they collaborated to create a solution and discovered their own personal interests and strengths in the process.

The work that was shared in this chapter provides a foundation for integrating inventing into the classroom curriculum. It addressed a specific genre of invention–Rube Goldberg. This unique model was aligned with core standards in science, technology and English. Future research should expand the opportunity for creativity by challenging builders to make their creations more elaborate and absurd. The sky is the limit with these sort of inventions and learners should be encouraged to venture into the untested.

It should be remembered that Innovation is a creation process where inventions are applied to real-world solutions. While the Rube Goldberg inventions are glamorous and crazy, they won't be part of a real-world solution. These inventions would be used in the initiation phase of developing an innovation aptitude. The real innovation development process will occur when learners are challenged with real world problems of greater complexity than turning on a light.

The ability to innovate doesn't happen overnight. It can occur in individuals who naturally possess the Innovator's DNA or these traits can be cultivated through experimentation and exploration. It can flourish in those who have an innovation mindset. Teachers can engage students in the innovation process through activities that initiate and invite participation, iterate to resolve complex problems, and associate students with common goals. The Rube Goldberg case study is just one example of initiating students onto the path of cultivating innovation through invention.

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DOROTHY A. SISK

14. CREATIVITY AND LEADERSHIP DEVELOPMENT

Can They Co-Exist for Transformational Change in Education?

To create transformational change for the future, students will need both creativity and leadership. The question is can creativity and leadership development co-exist in the classroom? Otto Scharmer, the Director of the Presencing Institute at MIT said leadership development is not about filling a gap, but igniting a field of inspired connections and actions to address macro-problems with macro-opportunities. Igniting and inspiring connections and action calls for creativity and what Scharmer calls an open mind, open heart, and open will. This chapter examines the Theory U of Scharmer, which emphasizes tapping collective leadership to meet challenges in a more conscious, intentional, creative, and strategic way. Two individuals who manifested creative leadership in their lives are examined as creative leadership exemplars. The five movements of co-initiating, co-sensing, presencing, co-creating and co-evolving in Theory U are discussed and how they can inspire students to identify and address problems. Presencing is being able to connect to the source of inspiration and will, by going to the place of silence and allowing inner knowing to emerge. The seven Theory U leadership capacities are addressed along with ways they can maximize activities in the classroom with gifted students toward creative application to problem solving and learning by doing.

Education has the challenge that Don Ambrose addressed in the book's focus chapter of ensuring that students have the knowledge, skills and dispositions for dealing with macroproblems and capitalizing on the macro-opportunities. To create transformational change for the future, students will need both creativity and leadership. The question is, can creativity and leadership development co-exist in the classroom? And if so in what ways?

In a world of massive institutional failure, a world that presents leaders with phenomenal challenges, the call for creative leadership is staggeringly apparent. Min Basadur (2004), a pioneer and researcher of the Creative Problem solving Institute (CPSI) in Buffalo, New York, said defining creativity and creative leadership can be difficult because it depends on the content, the form of creativity and the leadership style. Sidney Parnes, one of the founders of the Creative Problem Solving Foundation said creativity is a state of mind in which all of our intelligences are working together, involving seeing, thinking, and innovating in which creative people question the assumptions they are given, and seek new connections. They

function as leaders and see the world differently, not as it is, but how it could be (Parnes, 2004). Another CPSI leader, Scott Isaksen (2012), said that if there were no universal definitions of either creativity or leadership, and if creativity were considered as the making and communication of meaningful new connections, and leadership as an influence process, then creative leadership would be the kind of influence process that results in meaningful new connections. More specifically, Isaksen defined creative leadership as an inclusive influence process in which the leader functions as a catalyst for navigating change.

HISTORY OF LEADERSHIP

Historically, the study of leadership involved a search for traits and characteristics of leaders that could be described as a single dimension approach. Thomas Carlyle and Francis Galton explored the trait theory at length. In *Heroes and Hero Worship*, Carlyle (1841) listed the talents, skills, and physical characteristics of men who had risen to power, and Galton in *Hereditary Genius,* said leadership was inherited and leaders were born, not developed. These views dominated the thinking about leadership for decades, and were followed by an examination of leadership as a blend of concern for people and tasks in a two-dimensional approach. McGregor (1960) identified two management tasks, theory X, with power viewed as stemming from position, and subordinates are considered lazy and unreliable, and theory Y that viewed leadership being given to the group and subordinates are considered self-directed and creative, if they were motivated. Tannenbaum, Weschler and Massarik (1961) described leadership as a continuum of boss-centered leadership and subordinate-centered leadership, and their work was a forerunner of the current approach to the study of leadership involving multi-dimensions in situational leadership.

Situational Leadership

In the theory of situational leadership, individuals are viewed as having leadership ability that emerges in specific situations. Hersey and Blanchard (l977) included task behavior, relationship behavior and effectiveness in their situational model. They used the dimensions of concern for task (productivity) and concern for relationships (people), and they introduced a central idea of task-relevant maturity. Later Blanchard and Johnson popularized their ideas about leadership in *One Minute Manager* (1982), *One Minute Mother* (Johnson, 1983), and *One Minute Father* (Johnson, 1983). They defined leader behavior in three steps: l) One minute goal setting, 2) One minute praise, and 3) One minute reprimand.

Still another view of leadership as a systems model of leadership is the WICS model of Sternberg (2004) in which leadership is a synthesis of wisdom, intelligence and creativity. According to Sternberg, leadership is in large part a decision making process on how to marshal and deploy the resources of wisdom, intelligence and

creativity. One needs creativity to generate ideas, academic (analytical) intelligence to evaluate whether the ideas are good, practical intelligence to implement the ideas and persuade others of their worth, and wisdom to balance the interests of all stakeholders and to ensure that the actions of the leader seek a common good. The WICS model incorporates elements of transformational as well as transactional leadership to identify highly effective leaders.

LEADERSHIP QUALITIES AND SKILLS NEEDED FOR THE FUTURE

The Center for Creative Leadership (CCL) in Greensboro, North Carolina surveyed 2,200 leaders from fifteen organizations in three countries to identify leadership skills needed in the future. These skills included: Leading employees, strategic planning, inspiring commitment and managing change (Leslie, 2009). Top leadership qualities of integrity, dedication, magnanimity, humility, openness, fairness, assertiveness, sense of humor, and creativity were identified by Hakala (2008). He said creative leaders are individuals who think outside the box and reward ingenuity and originality in their group members.

MANIFESTED CREATIVITY

Creative leaders see a problem and begin to think how it could be changed, then they fearlessly experiment, taking risks, and are comfortable with making mistakes. Creative leaders according to Lucas (2005) in *Discovering Your Hidden Talent* seize opportunities throughout their life to broaden their knowledge, skills and attitudes and to adapt to an increasingly changing, complex and interdependent world. Creative leaders provide the conditions, environment and opportunities for others to be creative. An examination of two individuals as exemplars who manifested creativity throughout their lives by thinking outside the box illustrates the importance of thinking and acting beyond the boundaries that limit effectiveness.

Exemplar: Sidney J. Parnes

Transforming is one of the characteristics of a creative leader whether transforming education or business, and it begins with transforming one's mind, and inner transformation starts with opening to – indeed welcoming – the inevitable bursts of creativity. Sidney J. Parnes, one of the world's leading experts on creative problem solving, innovation and creativity said, "I dream a dream, a vision great … my world will appreciate" (Parnes, 2004). Sid was a life-long researcher, author and world class educator who presented thousands of seminars and courses on creativity and creative problem-solving for leaders in business, education, and government on five continents. For over fifty years, Sid worked in the *living laboratory* of the Creative Problem Solving Institute (CPSI) in Buffalo, New York, sponsored by the Creative Education Foundation.

Sid first came to Buffalo as an Assistant Professor in the Retailing Department of the University of Buffalo. At that time, one course in creativity was being offered at the University, taught by account executives from the advertising company of Batten, Barton, Durstine & Osborn. Alex Osborn organized a conference on Creative Thinking and Creative Problem Solving in Buffalo, and Sid attended this conference, becoming so enthusiastic about the program that he said he realized his life's mission was to pioneer and nurture the vast untapped potential of everyone for creative behavior. Sid and Alex worked together for over ten years developing a comprehensive educational program for CPSI. They were able to bring together pioneers of the creative thinking movement including: Calvin Taylor, J.P. Guilford, E. Paul Torrance and Donald MacKinnon.

At the death of Alex Osborn, Sid assumed the leadership of the Creative Education Foundation (CEF). In l966, CEF sponsored the nation's first graduate course in Creative Studies at Buffalo State College, and in l967, CEF launched the *Journal of Creative Behavior*, a research publication devoted to the science of creativity. Parnes published the work of the CEF creative training programs in a *Creative Behavior Guidebook* and in a *Creative Behavior Workbook.* Reflecting on those years, Sid said, "Seeing the wonderful students I've mentored grow personally and develop even more effective programs than they were taught remains a source of pride and deep satisfaction" (Kuby, 2012).

As Director of an annual CPSI and regional Institutes, Sid initiated and sustained the unique and distinctive *soul and spirit* that characterized CPSI. He modified Alex Osborn's original seven stage CPS model (orientation, preparation, analysis, hypothesis, incubation, synthesis and evaluation), and after numerous adaptations, the Osborn-Parnes five stage CPS model was introduced. The stages of the model are: Fact-Finding (FF), Problem-finding (PF), Idea-Finding (IF), Solution-Finding (SF) and Acceptance-Finding (AF). It is depicted in Figure 1
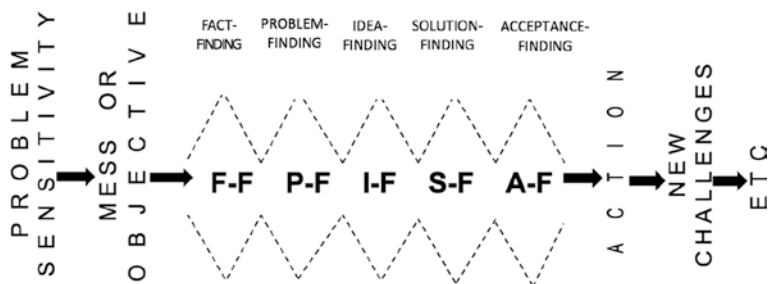
Figure 1. Five Stage CPS model (Parnes, 2004, p. 195) Source: Parnes, S. (2004). Visionizing: Innovating your opportunities. Buffalo, New York, NY: Creative Education Foundation Press

The Osborn-Parnes model illustrates the alternating processes of divergent and convergent thinking introduced by J. P. Guilford. Divergent and convergent thinking

take place in every stage of the model, and emphasize the dynamic nature of creative thinking. The five steps are merely a guide rather than a rigid formula for problem solving. A change of sequence may be introduced into the CPS process, and Parnes advocated leaving plenty of time for incubation. The main emphasis throughout each step is generating alternatives. Sid stressed that intellectualizing the creative processes is quite different from effectively internalizing them (Parnes, l997).

Sid taught graduate level creativity courses at Buffalo State College and designed and implemented an undergraduate and graduate program in Creative Studies in l975. Over the years, He established an eclectic approach to the development of a comprehensive program for nurturing creative behavior. Sid said,

> Inherent in this effort is the importance of developing a balance. A balance between the judgment and the imagination – between the open awareness of the environment through all of the senses and the deep self-searching into layer upon layer of data stored in the memory cells – between the logic and the emotion – between the deliberate creative effort and the incubation between the individual working with the group and alone. (Parnes, 2004, p. 340)

Creative problem solving and visionizing. In 2004, Sid designed a visionizing process to expand the front end of the CPS process of Fact Finding, (FF), Idea Finding (IF), Solution Finding (SF) by adding Opportunity Finding (OF), dreaming and visionizing. He said, "These dreams and visions can then be engineered into the *best reality* manageable" (Parnes, 2004, p. 8). The Visionizing Model starts with *desires* rather than *objectives* or *messes* and explicitly deals with imagery. The model is a more intuitive, imagery-driven approach and is overlaid on the more verbally-driven Osborne-Parnes CPS model. Parnes in *Visionizing: Innovating Your Opportunities* (2004) provided an overview and state of the art of CPS. He said CPS is the heart of visionizing and stressed the importance of imagery in CPS by saying: Deliberately applying imagery processes in the CPS steps may be analogous to adding electrical power to an effective hand operation, while at the same time providing increased illumination for the task (Parnes, l997, p. l52). The Visionizing Model is depicted in Figure 2.

In the Visionizing model, Parnes uses an oscillating process to allow deferred judgment at each step. The individual visualizes desires followed by (FF) Fact finding, then (OF) Opportunity finding, and (IF) Idea finding, leading to (SF) Solution finding and (AF) Acceptance finding. After each action, there can be further visualizing and the process continues. The broken lines in the model signify possible feedback or feedforward at all stages.

What makes an effective facilitator? Sid Parnes described an effective facilitator for creative problem solving as follows: "A facilitator of creative behavior is aware of the creative process and first understands it in himself/herself, and then is able to help others see and strengthen it in themselves" (Parnes, l997, p iii). Sid described
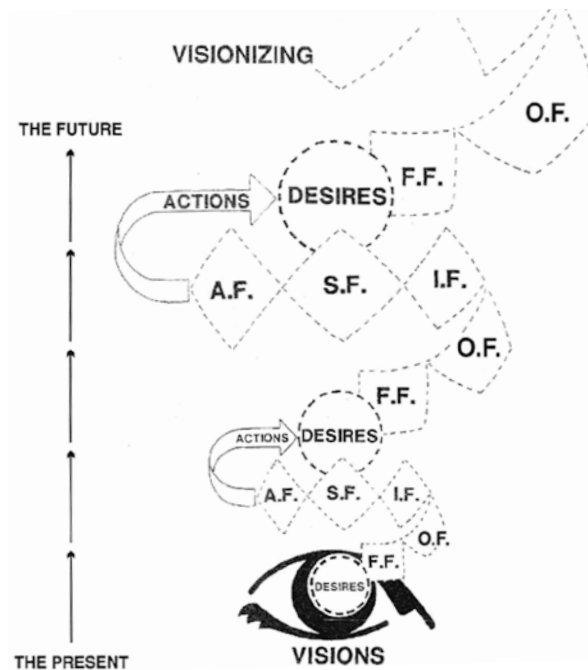
Figure 2. Visionizing model (from Parnes, 2004, p. 14)

the facilitator as enthusiastic, spontaneous, flexible, and able to invite ambiguity while, remaining on the sidelines. The facilitator is a hard worker, self-motivated, sincere, dedicated and confident that the creative process will carry one through, and be willing to take calculated risks. With this description, Sid aptly described himself as a creative leader.

Accolades and awards. Over the years, numerous organizations expressed appreciation to Sid for creative leadership including the Odyssey of the Mind organization and Buffalo State University College that gave him the President's Award for Excellence in Research, Scholarship and Fostering Creative Behavior. The Creative Education Foundation named Sid its first Colleague, and gave him its first Service Commitment Award for volunteer services spanning more than three decades. He was inducted into the CPSI Hall of Fame and the American Creativity Association Hall of Fame. In addition, Sid received the E. Paul Torrance Award for contribution to gifted education, and the Innovation Network of the National Association for Gifted Children presented him a Lifetime Achievement award.

Future efforts. Parnes at age 90 wanted to explore integrating the CPS principles and procedures within the self-healing processes. This process would involve

individuals effectively applying CPS to self-healing with the goal of high level wellness, not merely physical wellness, but psychological, sociological, political and spiritual wellness. Parnes described living his life with a creative attitude following Osborn's credo of a fair idea being put to use is better than a good idea kept on the polishing wheel. The creative leadership of Sid Parnes has enabled thousands of individuals to grow in adaptive and innovative directions and to balance these two strengths as needed.

Exemplar: Annemarie Roeper

A second example of a creative leader is Annemarie Roeper whose work in the field of gifted education is legendary. Kane (2003) said Annemarie could have been one of the five women Mary Catherine Bateson wrote about in her book *Composing a Life*. Bateson examined the creative potential of her subjects, and Kane noted that Annemarie's life story is a study in creativity. Annemarie said considering the academic, social and emotional well-being of children is essential and school-wide decisions at Roeper were made focusing on child-centered methods. In her book *Educating Children for Life*, Annemarie summarized the Roeper School philosophy as a philosophy of self-actualization and interdependence, with the primary goal of education being education for life, rather than achievement and college preparation. She described the essence of the Roeper School's philosophy:

> There is a goldmine of hidden creativity in each one of these children, which can blossom into spiritual, emotional, creative and scientific growth. We need to build bridges between the inner world of the individual and the outer world of society, so that knowledge, thoughts and emotions can flow freely between them. To contribute to the accomplishment of this great goal continues to drive my life passionately. (Kane, 2003, p.15)

Annemarie was born in Vienna to Max and Gertrud Bondy, and both parents were intellectually gifted. Her father had a doctorate in Art History and her mother, trained by Otto Rank, was one of the first women psychoanalysts with a medical doctorate. The Bondy couple established a residential school in Marienau on a 300-acre farm outside of Hamburg. Annemarie, her brother Heinz and sister Ursula attended the school, and one of the students George Roeper, later became Annemarie's husband.

As the Nazi influence increased in Germany, the curriculum and educational agenda of Marienau were changed to reflect their views, and the Bondy family being Jewish left Germany. Gertrud and Heinz went to Switzerland to begin a new school, Ursula was sent to England, and Annemarie stayed with her father, so she could graduate, and they could sell the school. Annemarie followed in the footsteps of her mother, and studied medicine in Vienna. Annemarie tells of being interviewed by Sigmund and Anna Freud, when she was admitted as the youngest student in the study of psychoanalysis. When the Nazis invaded Austria, Annemarie and the entire family came to the United States. Annemarie said:

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I survived because I had a mission. My task in life was to help children with their feelings, especially so that they wouldn't have a huge reservoir of anger that they needed to act out. It was up to me that groups like the Nazis would never rise up again. Most people fled Germany to flee, but I left so that I could help children to find goodness. (Kane, 2003, p. 15)

George Roeper and Annemarie were married shortly after arriving in the United States, and they started a summer camp, then established the Windsor Mountain School in Massachusetts. In l94l, they moved to Michigan, where Annemarie directed the Editha Sterba Nursery School and George began the Roeper Grade School in Highland Park, Michigan. The Roeper School relocated to Bloomfield Hills, Michigan where it is operational today.

The creative and innovative aspects of the Roeper philosophy of Self-actualization and Interdependence are described by Kane (2013) including aspects which at that time were considered controversial:

- Progressive education combined with psychoanalysis provides the basis for curriculum and instruction
- Non-graded education as students begin to exhibit asynchronous development
- Open classroom is implemented that creates more of an individual approach within the school 'community'; aligned to the Roeper Philosophy and child-centered, as goals are developed by the child and not by the institution.
- Racial integration of the school
- Focus on gifted education beginning in 1956
- Participatory democracy and the rights of teachers/students/staff are equally respected, non-hierarchical (Kane, 2003).

One passion of Annemarie was global awareness and she worked closely with Linda Silverman, a psychologist and Director of the Gifted Child Center in Denver, Colorado to establish a Global Awareness division, now known as a network in the National Association for Gifted Children. Annemarie said global awareness is the realization that we are all interconnected and interdependent with every facet of life around us (Kane, 2003).

Creative leadership is basically about connecting people, and in a sense creative leadership is a form of servant leadership in which the leader's task is to connect different people, ideas and ways of thinking. Leaders further develop the skills of their co-workers and co-create and co-sense problems of their organizations. Creative leadership comes from a deep-rooted passion, which was illustrated in the lives of Sid Parnes and Annemarie Roeper. Both responded to problems by acting and thinking differently, trying things out, making mistakes, but always keeping their focus on the potential and possibility of creativity at both the micro and macro level. They had a creative *mindset* that affected their leadership on a daily basis to develop and nurture a creative flow of energy in themselves and others. Their work

as well as that of others discussed in this chapter might be even more relevant today than it was in the mid-20th century.

Human Purpose and the Field of the Future: A Leadership Theory in the Making

Four very different individuals (Peter Senge, Otto Scharmer, Joseph Jaworski and Betty Sue Flowers) were drawn together on a journey to conceptualize a leadership theory about change and how it could be used to improve a globalized world that evolved into the book *Presence*: *Human Purpose and the Field of the Future* (2004). Senge, worked with organizations for over twenty-five years to collaborate in accomplishing change that could not be accomplished by individual effort; Otto Scharmer, a grassroots activist during the Cold War in Berlin established networks of relationships across the East-West divide in Europe; Joseph Jaworski, co-founded a major law firm, created the American Leadership Forum, a national network for developing servant leaders, and was responsible for scenario planning at the Royal Dutch/Shell Group of companies where he met Betty Sue Flowers. Betty Sue Flowers had a lifelong interest in the power of stories in shaping the reality that we experience, and became the fourth individual on the journey.

As they talked and shared stories with one another, they realized there were many individuals in diverse institutional settings with similar experiences of profound collective change. Yet, they noted contemporary theories of change were paradoxically neither narrow enough nor broad enough to address the change needed to participate in the future that was both deeply personal and inherently systemic. They emphasized the deeper dimensions of transformational change that represent unexplored territory in current management research, and in the understanding of leadership. Scharmer called this a *blind spot* and said, "This blind spot concerns not the what and how – not what leaders do and how they do it – but the who: Who we are and the inner place or source from which we operate both individually and collectively" (Senge, Scharmer, Jaworski & Flowers, 2004, p. 5).

The four of them held probing conversations over a year and a half exploring how profound transformational change arises, and the possibilities it offers an out-of-balance globalized world. They found many individuals stuck in older patterns of seeing and actions. Out of interviews with over 150 scientists, social leaders and entrepreneurs including: Brian Arthur, Rupert Sheldrake, and Buckminster Fuller, they identified the core capacity needed to access the field of the future as *presence*. Presencing is a blend of the words presence and sensing. It is deep listening, of being open beyond one's perception and traditional ways of making sense and letting go of old identities and the need to control. In the Introduction of the book *Presence: Human purpose and field of the future,* they said,

> Ultimately we came to see all the aspects of presence as leading to a state of 'letting come,' of consciously participating in a larger field for change. When

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this happens, the field shifts and the forces shaping a situation can move from re-creating the past to manifesting or realizing an emerging future. (Senge, Scharmer, Jaworski & Flowers, 2004, p. 14)

THE IMPORTANCE OF DEVELOPING CREATIVE LEADERSHIP

In September of 2009, the World Bank called a round-table meeting to discuss leadership development. The meeting began with the acknowledgment, as this chapter does, that we live in a world of massive institutional failure, and that the issues and problems present current and future leaders with unprecedented challenges. With the assistance of Scharmer, they discussed the need to co-sense problems and to co-create solutions using a social change model (Scharmer, 2009).

THE SOCIAL CHANGE MODEL OF LEADERSHIP DEVELOPMENT

The Social Change Model (SCM) of Leadership Development can be described as relational, transformative, process-oriented, learned and change-directed (Wagner, 2006). SCM is a values-based process based on principles of being purposeful and collaborative, resulting in positive social change. In the SCM, social responsibility and change for the good are achieved through the development of eight core values targeted toward enhancing the level of self-awareness of individuals and their ability to work with others. These eight values are grouped into three areas: Individual, group, and society/ community. The Individual core values include: Consciousness of Self, Congruence, and Commitment. The Group core values include: Collaboration, Common Purpose, and Controversy with Civility. The Core value of society and the community is Citizenship. The interaction between and across the seven core values facilitates social change for the common good, which is the eighth value. The SCM model is depicted in Figure 3.

Figure 3. Social Change Model (SCM) (from Higher Education Research Institute, 1996)

Developing the Seven Cs in the Social Change Model (MCM)

Individual values. Consciousness of Self can be developed and nurtured with opportunities to develop and practice interpersonal skills. One effective activity to build consciousness of self is *Cage Painting* (Remington, 2003). Cage Painting is a metaphor with the cage representing the perspective of the individual and the cage bars representing characteristics and details of cultural background (CB); life experience (LE), and current context (CC). Small group discussions focusing on the Cage can encourage participants to examine their beliefs, values, attitudes, and emotions. *Congruence* can be reinforced and developed through reflection in journals and discussions concerning socio-cultural issues. Participants can be encouraged to listen closely to others and to "step outside themselves" for an examination of congruency in their repertoire of values and beliefs. Reflecting on questions such as: Do I walk my talk? Can be helpful in examining congruence. *Commitment* entails making a significant investment in individual and group tasks. Discussion of how much commitment one usually makes to a task and the degree of perseverance and energy expended can encourage the participants to evaluate their task commitment.

Group values. Collaboration can be experienced as group members work together on developing creative solutions to problems or issues in which there is shared responsibility in the tasks. The power of the group can be increased if group members are selected to represent different genders, ethnicities and even ages. A *Common Purpose* is necessary for the SCM model to be effective in developing creative leadership. This includes the development of a shared vision and a group purpose. *Controversy with Civility* is essential, for as members of the group interact, there will be disagreements and the leader and members of the group need to listen to one another's point-of-view, and resist getting bogged down with personal attacks.

Community values. Citizenship is manifested in a group when all of the members have a sense of responsibility toward one another and value the interdependence of the group as they work together on tasks. The major goal of leadership in the SCM model is *Change* and engaging members in activities in which they work together can lead to positive social change.

Emerging Leaders for Innovation across Sectors (ELIAS): A Theory U-Inspired Model

Scharmer (2009) said the single-person-centric concept of leadership is outdated and emphasized that leadership takes place through collective, systemic and distributed action. In the ELIAS Theory-U model, named after the U-shaped journey depicted

in Figure 4, participants work through system change in several stages. Scharmer called the first stage *Downloading* and *Denial* in which members focus on the past. "This is the way we have always functioned," or "It is traditional in the way we work." The next stage is *Debate* in which the group discusses the problem, and they tend to place blame on others, as in: "No one ever told us what to expect or do" or "The task was not fully explained or articulated." This stage is followed by *Dialogue* in which the members discuss the issue or problem with multiple perspectives and identify each member's part in creating the issue or problem: "You could have been more observant in the process" or "That is where I should have modified the process." This stage leads to *Connection to Source* in which the members identify a common will, and there is a subtle shift from *me* to *we*. The next stage is *Envisioning* in which the vision is crystallized, and the group forms an intention. This stage is followed by *Enacting* in which the group links head, heart, and hand in practical applications or prototypes as they engage in learning by doing. The last stage is *Embodying* in which the *new* processes and practices are institutionalized.

Leading from the Future as It Emerges

Scharmer (2009) said the failure to address the myriad of problems we face is because we are blind to the deeper dimension of leadership and transformational change, and this *blind spot* exists in our collective leadership, and in our everyday social interactions. He said each of us has an inner place from which we operate. Scharmer stressed that two leaders under the same circumstances, doing the same thing can bring about very different outcomes, depending on the inner place from which each leader operates. This source dimension of leadership is often invisible and functions as a *blind spot* in the process of social reality formation and transformational change. The SCM model stresses the importance of attention, listening and becoming aware of how individuals and groups attend to and respond to a situation.

Levels of listening. Scharmer (2009) listed four levels of listening: (1) *Downloading* in which you listen by reconfirming what you already know; (2) *Factual listening* in which you pay attention to facts and to novel or dis-confirming data. In this type of listening, the inner voice of judgment (VOJ) is turned off. Instead, you listen to the voices in front of you, and focus on what is being said that is different from what you already know. The data talks to you, and you ask questions; (3) *Empathic listening* is when you engage in real dialogue, pay careful attention, and make connections with your own experiences that may have been similar. You move from looking at the objective world of things, figures and facts (the it world) to listening to the story of a living and evolving self (the you world). *Empathic listening* happens when you forget your agenda and see how the world appears through the eyes of someone else

with an open heart; (4) *Generative listening* goes beyond the current field and you listen from the emerging field of future possibility. This level of listening requires access to not only your heart, but to your open will (Scharmer, 2009, p. 39).

Deep Attention and Awareness. Deep states of attention and awareness are often found in athletes. Scharmer (2009) said that Bill Russell, a key player of the Boston Celtics described feeling his *play* rise to a new level, and how the game became more than a physical or even mental game, it was magical. Scharmer calls moving into that state a peak performance. In a peak performance, there is a slowing down of time, space widens, and there is a type of perception that is panoramic, with a collapse of boundaries between people. This is similar to *flow* as described by Csikszentmihalyi (1996).

STRUCTURES OF ATTENTION

The Structures of Attention and how attention determines the path of social emergence is described in an executive summary titled *Addressing the Blind Spot of Our Time* (Scharmer, 2007), and in the book *Theory U: Leading from the future as it emerges* (Scharmer, 2009); Table 1 depicts the field structures of attention. Theory U lists four field structures of attention:

- Field 1: Operating from the old *me-world*;
- Field 2: Operating from the current *it-world*;
- Field 3: Operating from the current *you-world*, and
- Field 4: Operating from the highest future possibility that is *wanting* to emerge.

These different fields greatly affect how you listen and communicate with others. The four columns of Table 1 depict the four fundamental meta-processes of attention that you usually take for granted: (l) Thinking (individual); (2) Conversing (group); (3) Structuring (institutions); and (4) Ecosystem coordination (global systems).

The challenge is how to address 21st century problems and issues from deeply generative sources across all four meta-processes and to move from Field l and Field 2 to Field 3 and 4. Scharmer (2009) called this process a U-shaped journey of five movements. The five movements are depicted in Figure 4.

Seven Leadership Capacities

Seven leadership capacities take place in the new social technology called presencing (Scharmer, 2009). Presencing represents a heightened state of attention that allows individuals and groups to shift to the inner place from which they function. When that shift occurs, people can begin to create from a future space of possibility that they feel "wants to emerge." Scharmer said in his executive summary that this is the essence of leadership.

Table 1. Structure of attention determines the path of social emergence (Scharmer, 2009, p. 4) Adapted from Theory U: Leading from the future by O Scharmer, San Francisco, CA: Berrett Koehler. Adapted with permission

Field *Structure of Attention*	**Micro:** *Thinking* (individual)	**Meso:** *Conversing* (group)	**Macro:** *Structuring* (institutions)	**Mundo:** *Ecosystem Coordination* (global systems)
Field 1: Operating from the old *me-world*	*Listening 1:* Downloading habits of thought	*Downloading:* Talking nice, politeness rule-reenacting	*Centralized:* Machine bureaucracy	*Hierarchy:* Central plan
Field 2: Operating from the current *it-world*	*Listening 2:* Factual, object-focused	*Debate:* Talking tough rule-revealing	*Decentralized:* Divisionalized	*Market:* Competition
Field 3: Operating from current *you-world*	*Listening 3:* Empathic listening	*Dialogue:* Inquiry rule-reflecting	*Networked:* Relational	*Dialogue:* Mutual adjustment
Field 4: Operating from the highest future possibility that is *wanting* to emerge	*Listening 4:* Generative listening	*Presencing:* Collective creativity, flow rule-generating	*Ecosystem:* Ba (the Japanese word for place)	*Collective Presence:* Seeing from the emerging Whole
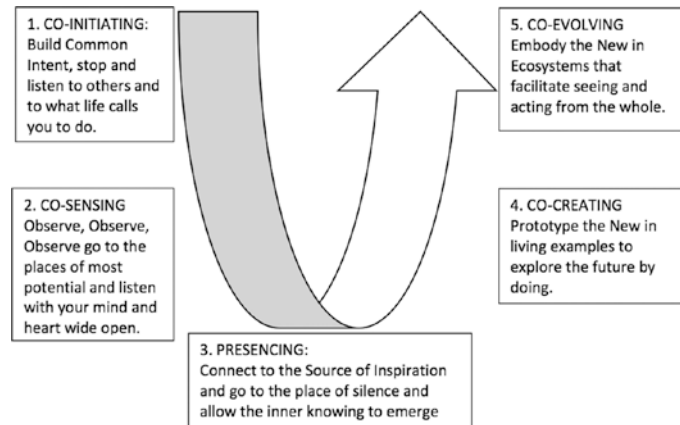
Figure 4. The U as one process with five movements (Adapted from Scharmer, 2009, p. 19)

The seven leadership capacities include:

1. Holding the space: Listen to what life calls you to do. This leadership capacity calls for the leader to "hold a space" that invites others in to participate. Whatever you are working on, it is important to leave considerable open space for others to make contributions. Theory U Leadership starts with the principle of incompleteness and possibility.

2. Observing: Attend with your mind wide open. This leadership capacity requires suspending the voice of judgment (VOJ), and shutting down the habit of judging based on past experiences. Suspending VOJ encourages an *opening up* to a new space of inquiry and wonder.

3. Sensing: Connect with your heart. Sensing calls for the implementation of an opening process, and the use of three mechanisms: the open mind, the open heart, and the open will. This leadership capacity can be developed by encouraging people to work on real projects that they care about, in real contexts,. They will need support with methods and tools that cultivate the open heart. Scharmer (2007) quoted the biologist Humberto Maturana in saying love is the only emotion that enhances intelligence.

4. Presencing: Connect to the deepest source of your self and will. Presencing calls for an *open heart* that provides opportunities to view a situation from the whole, and the *open will* enables one to begin to act from the emerging whole. An artist friend shared that while she is painting she feels connected to a power that allows her to intuitively paint as if her hand is being guided. She said perception widens to include everything, and it is a humbling experience of creating from the emerging whole.

5. Crystallizing: Access the power of intention. Crystallizing involves deep commitment to the purpose and outcome of a project, and going out into the world to create an energy field that begins to attract people, opportunities, and resources that make things happen. This will be addressed later in the chapter in the use of service projects with adolescents tapping into *crystallizing* and accessing their power of intentions.

6. Prototyping: Integrating head, heart and hand. In this leadership capacity there is an *intention* to integrate the intelligences of the head, the heart, and the hand in the context of practical applications. Scharmer (2009) said on the way up the U model, three old methods of functioning need to be overcome: Executing without improvisation and mindfulness (reactive action); endless reflection without a will to act (analysis paralysis); and talking without a connection to source and action

(blah-blah-blah). He stressed that instead of balancing the intelligence of the head, heart, and hand, one of the three may dominate – the will to mindless action, the head in endless reflection, and the heart in endless networking. He said one of the biggest mistakes in seeking creative solutions is focusing on the rational mind, breakthrough ideas come from learning to access the intelligence of the heart and the hand – not just the intelligence of the head.

7. Performing: Playing the macro violin. Using the metaphor of a musical instrument, this leadership capacity involves listening and playing from another place, from the periphery. Performing includes: (1) Convening players who are connected with one another through the same value chain, the *frontline* people, and (2) Using a social technology that encourages a multi-stakeholder gathering to shift from debating to co-creating the new (Scharmer, 2009).

Addressing Creative Leadership in the Classroom with Applications of Theory U

Students, particularly gifted students, are not only aware of the global problems and issues impacting the world, but they feel a heavy burden and responsibility along with heightened concern to make a difference. The research of Erickson (2009) indicated that gifted students are concerned about crime; global warming; terrorism; violence and safety; nuclear weapons; racism; biological warfare; HIV/AIDS and infectious diseases; child and animal abuse; hunger and homelessness; animal extinction; natural disasters; deforestation; depletion of natural resources; pollution; global warming; religious and gender discrimination; gang violence; loss of languages; endangered cultures; and ignorance. This research emphasizes the need for educators to use creative leadership to empower gifted students to be able to build and strengthen their global perspective. Students need to go beyond mere understanding of global issues and problems to creative productivity to address them.

Role of the Teacher in Addressing Creative Productivity

Swinarski and Breitborde (2003) stressed that teachers know and be actively involved in social and world issues and events; be open to new ideas and willing to share; and use critical thinking and creative problem solving. They identified twelve guiding principles: (1) global education is basic education; (2) lifelong learning; (3) cooperative learning; (4) inclusive of all; (5) education for social action; (6) economic education; (7) involves technology; (8) requires critical and creative thinking; (9) is multicultural; (10) is moral education; (11) supports a sustainable environment; and (12) enhances the spirit of teaching and learning. These principles are in harmony with Theory U, particularly with the Seven Cs in the Social Change Model.

SEVEN CS APPLICATION TO THE CLASSROOM

Individual Values

Consciousness of Self.   Providing gifted students opportunities to use and to develop intrapersonal skills will develop and nurture consciousness of self and discussions in which the students examine the beliefs, values, attitudes, emotions, and the impact of motivation on leaders of the present and past. These types of activities lead to an awareness of the *perceptual lens* of emotions as gifted students interact with others and with information that affects them both cognitively and affectively. Why do people do what they do? Why do I do what I do?

Congruence.   Gifted students can check for *congruency* between their actions and beliefs by stepping outside themselves and reflecting on the values and beliefs they consciously hold. One activity that is powerful in examining congruency is the *Value Auction* in which students discuss values that lead their lives and then identify their top l0 values. Each student is given a slip of paper representing $100, and a student/ auctioneer leads them on bidding on the ten values. This activity demonstrates the *push-pull* between the student's wish to hold on to their dollars and the wish to bid on values that are important to them and to manifest their altruism.

Commitment.   When gifted students have a significant investment in projects, their energy for the activities reflects increased intensity and perseverance. The following students represent kids making a difference and other examples of student leadership can be found on the website www.kidsmakingadifference.org. Six year old Ryan Hreljac was shocked to learn that children in Africa had to walk many kilometers every day just to fetch water. Ryan decided he needed to build a well for a village in Africa. By doing household chores and public speaking on clean water issues, Ryan's first well was built in 1999 at the Angolo Primary school in a northern Ugandan village. Ryan's determination led to him to establish Ryan's Well Foundation, which completed 667 projects in 16 countries, bringing access to clean water and sanitation to more than 714,000 people. Ryan's project represents Scharmer's emphasis on the importance of being committed, involving others and the emerging energy that evolves from collective commitment and action.

Another example of commitment is Rachel Wheeler who at age nine attended a meeting in which a representative of Food for the Poor described living conditions in Haiti. Rachel was overwhelmed to learn that children lived in cardboard boxes and ate cookies made of mud to stave off hunger. She immediately began raising money for Haiti, upping her efforts following the devastating earthquake in 2010. Last year, she used $250,000 that she had collected to build twenty-seven homes and a school for a town that was hit particularly hard by the earthquake. The recipients were so thankful that they named the area "Rachel's Village."

Group Values

Collaboration.   As gifted students work together on projects, collaboration can be encouraged and developed as they co-sense and co-create projects addressing problems that represent the real context of their lives. One example is a middle school group of students who identified hunger as the issue they wanted to address, and they volunteered to help distribute food at the local Food Bank. When they realized how important a bag of potatoes was to a family, they raised money with car washes and door-to-door solicitation with their parents (who were now aware of the problem) and donated $25,000 to the Food Bank for more potatoes.

Katie Stagliano from South Carolina brought a cabbage seedling home from school as part of a 4th grade plant project in 2008, which grew to 40 pounds. She collaborated with a local soup kitchen, donating her massive cabbage plant where it helped feed 275 people. Today Katie has her own non-profit called *Katie's Krops* that starts and maintains vegetable gardens that donate their harvests to those in need.

Common purpose.   In the SCM model gifted students can identify problems in their community and develop a shared vision and a common purpose to demonstrate creative leadership. A group of high school students in Beaumont, Texas identified the neglect of a nearby pre-school's front entrance area, with trash around the walkway and no shrubs and flowers, as a problem. They created a shared vision of a colorful flower garden, then asked local garden and florist companies for donations of flowers, and secured permission from the Beaumont Independent School District to create a garden. They cleared away the trash, prepared the ground, digging while simultaneously talking about their proposed garden. Then they planted red and yellow hibiscus in front of the school on the weekend. On Monday, the pre-school children came out to view the garden and they were elated. The high school students contacted the local television channels to come and share their project with the community. This stimulated other schools to plan similar group projects with their students, designing gardens and demonstrating creative leadership in action.

Controversy with civility.   Teachers can integrate group dynamics in their lessons, emphasizing deep listening and asking their students to reflect on the ability to withhold VOJ as they listen to different points of view. It is essential that teachers move students from *group think* with questions such as: Are there other ways of looking at this issue? Are there any more comments concerning our group vision? Teachers can also provide sentence stems such as "I see your point, but have you thought of …?" "That was an interesting point, and it makes me think of …" Students can learn to disagree with civility and not become bogged down with hurtful unproductive comments. This group activity represents moving away from the *blame* and *denial* phase in Scharmer's theory U model and is similar to the

jurisprudential teaching model in which students confront a controversial issue and carry out research to gain understanding of it (Arends & Kilcher, 2010).

Community values.   Citizenship can be encouraged and developed as gifted students co-sense and co-create with one another and recognize their interdependence. The students can sense the linking of one another and go from the *me* to the *we* focus that Scharmer and his colleagues advocate. The essential goal of leadership development in the Theory U model is *change* and service projects and action research can engage students in leading towards social change.

THEORY U: ONE PROCESS AND FIVE MOVEMENTS TOWARD CREATIVE LEADERSHIP

The five movements in the Theory U process can involve students and their teachers in finding their inner place, the source from which they operate. On one hand, Theory U is practical and on the other hand it is philosophical, as the goal is to experience the future as if it is *wanting to be born,* which Scharmer, Senge, Jaworski, and Flowers (2004) called presencing. Presencing carries with it ideas for meeting challenges and for bringing into being an otherwise impossible future. This was most aptly described in a Theory U Zambia project in which the prototyping activities included changing the attitude and values of the Zambian president toward HIV/AIDS (Scharmer & Kaufer, 2013).

The five movements are depicted in Figure 4. In *co-initiating,* students consciously stop and listen to others and begin to build a common shared intent to address a given problem or issue. They then *co-sense* by observing other students and themselves as they discuss with one another and identify the places of most potential. They listen with their open minds to facts and with their hearts being wide open. In *presencing* it is important that students have opportunities to reflect in silence and think about the problem and issues to encourage their inner knowing or intuition to emerge, and a nature walk might be helpful at this point in the process. In the next movement *co-creating,* students prototype the new approach with living examples that they can explore by *doing*, real hands-on activities with real problems. The last movement, *co-evolving,* being able to see and act from the bigger picture with conscious, intentional and strategic thinking and action can be a type of culmination. Creative productivity for gifted students can include planning, developing and implementing action research and service projects, to tap into their creative leadership.

EDUCATIONAL APPLICATION WITH FAILING SCHOOLS

With many schools in situations in which they have been unfairly and indiscriminately labeled as *failing schools,* the U process can have tremendous potential in addressing the problems faced by these schools. It would involve calling together the key stakeholders: the administrators, teachers, parents, students,

and community members including business, and city council leadership to co-initiate and co-sense the issues, identify the problem, and establish goals. Using the U process, selected members could take a *learning journey* to visit other school programs across the state and nation, and bring back ideas to the group. With open mind, open heart and open will this team could evolve from Field 1, the *me-world*, to Field 2 the current *it-world*, to Field 3 the current *you-world*, to Field 4 in which they would be operating at the highest future possibility that is *wanting to emerge* in which they would begin developing prototypes to be initiated in the schools. It would be important to include a retreat to provide time for the inner space of the stakeholders to emerge, flourish and build the cohesiveness of the group. The key to the U process is involvement, including training in the leadership skills of listening (factual, empathic and generative listening) and commitment as *change makers*. The U Process demonstrates creative leadership at its highest transformative function.

CREATIVITY AND LEADERSHIP DEVELOPMENT CAN COEXIST IN THE CLASSROOM

In summary, creativity and leadership development can coexist in the classroom and engage students and teachers in a transformation of the learning process. Creative leadership is basically about connecting people, often, and preferably with very different people. Creative leadership requires time, resources, opportunities, and space, but even more important it requires the commitment of teachers and administrators to engage students in mutual learning. The end result of creative leadership is seldom going to be a comfortable consensus or total agreement, for it includes disagreement, and sometimes heated dialogue and creative dissonance, as students and teachers move up and down the Theory U model. Creative leadership can be thought of as a form of *servant leadership* in which the major leadership task is to connect students, ideas and ways of thinking about creative solutions to make a difference in the lives of others.

Creative leadership is leadership without ego-systems and moving toward eco-systems (Scharmer & Kaufer, 2013). Creative leadership comes from a deep-rooted passion, that inner place, for the urge to act and think differently, to try things out, to make mistakes, and to see the potential and possibility of innovation at both the micro and macro level. This passion was manifested in the lives of the two exemplars of creative leadership (Sid Parnes and Annemarie Roeper). Applying the Theory U model to education can provide educators opportunities to encourage students to use their imagination, insight and originality as they co-initiate and co-sense problems and issues; develop different products, processes or outcomes as prototypes; and factor in the importance of ethics and value in their products or processes, operating with an open heart; to experience making a difference.

In essence, using Theory U as a model in education offers an opportunity to educate students toward a voyage of discovery. Gary Hunter (2014) in a thoughtful book entitled *Life Expects: Educating Students to Lead Fulfilling Lives* discussed the

need for balance of power in the classroom. The Theory U model calls for a sharing of power by the teacher and the students as they experience not only a deepening awareness of the socio-cultural reality shaping their lives, but also their capacities to transform themselves and to lead meaningful lives in shaping a collective reality that deals with macroproblems and capitalizes on macro-opportunities.

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SECTION V

CONCLUSION

ROBERT J. STERNBERG

15. WHAT'S WRONG AND HOW TO FIX IT

Balance of Abilities Matters More than Levels

Dinosaurs were, in a sense, the dominant species on the Earth for 135 million years. Home sapiens have about 200,000 years behind their belt, perhaps 100,000 years as some kind of dominant species. Cockroaches go back at least 320 million years and bacterial forms have been identified that are 3.5 billion years old, and bacteria are still around. So what exactly do we mean by dominant species? This may be a case where the species that laughs last, laughs best.

Given the problems cited in this book—human-induced climate change, terrorism, nuclear weapons, income disparity, poverty, perpetual wars, to name just a few—does anyone expect humans to be around for anything close to 135 million years? It would not take much to start a devastating World War III that would wipe out much of the Earth's human population. Humans have sown in so many different ways the seeds of their own ultimate destruction. Did anyone say anything about humans being the smartest species ever? They should enjoy their intelligence for the short duration they are likely to be around.

Humans are so much more creative than dinosaurs were. They are more creative than cockroaches and bacteria, which have been around for far longer than we have. So what's our problem? What's wrong?

WHAT'S WRONG?

There are many different explanations in this book for how so many things in the world have gone so awfully wrong and for what can be done to fix things. I have a rather simple explanation for what is wrong. I do not think there is any simple explanation for how to fix it.

Humans have abilities that are unimaginable in species other than *Homo sapiens*. But those abilities to create ideas and things are simultaneously the abilities to destroy ideas and things. The basic idea is that *humans flourish when abilities are roughly in balance or equilibrium, and wither when abilities go out of balance into disequilibrium.*

BALANCE OF ABILITIES

The augmented theory of successful intelligence (Sternberg, 2003) holds that four abilities underlie successful adaptive, shaping, and selection of environments—creative, analytical, practical, and wisdom. Our society places great emphasis on levels of abilities, especially (and in schools, almost exclusively) on analytical abilities. But balance of abilities matters at least as much as levels of abilities (Sternberg & Frensch, 1989). Lack of balance in abilities shows itself in many places, including on the public stage.

Imbalance of High Analytical Ability—the Robert McNamara Syndrome

The architects of the Vietnam War, Robert McNamara and colleagues, showed the dangers of high analytical abilities not accompanied by high levels of other abilities. Halberstam (1993) showed how extremely bright individuals could create policy disasters. Janis (1972) made a similar demonstration—of how brilliant individuals in government, placed in a group, made disastrous decisions as a result of their succumbing to groupthink.

There could be a variety of explanations as to how individuals who are analytically brilliant and who were educated in the best institutions of higher education in the country could create such fiascoes. One explanation is that of Stanovich (2010), who has argued that rationality is largely distinct as a psychological construct from intelligence as measured by intelligence tests. Stanovich even has coined a term, *dysrationalia,* to characterize the irrational thinking that often can be seen in very bright people. A second explanation is that the individuals were high in analytical intelligence but lacked practical intelligence (Sternberg et al., 2000): They were effective in academic settings but not in practical, everyday ones.

A long time ago, I wrote of the danger in our society of over-emphasizing analytical abilities (Sternberg, 1985). In particular, I argued that by over-emphasizing analytical abilities, we were encouraging students to develop these abilities at the expense of other abilities that might be more important in life, in particular, creative and practical abilities.

Imbalance of High Creative Ability—the Vincent Van Gogh Syndrome

People with high creative ability unaccompanied by other strengths are likely to end up frustrated. In the absence of sufficient practical skills, such individuals, from Mozart to Van Gogh, are likely to have much less success during their lives than after. Their problem is simply that full creative ability requires not only skill in generating new and exciting ideas, but also skill in persuading others of the value of these ideas (Sternberg & Lubart, 1995). People who do not have the practical skill to persuade others of the value of their ideas often end up frustrated and unable to

propagate their ideas, at least during their lifetimes. The lucky ones find someone else to do the selling of their ideas for them. The unlucky ones die poor and unhappy.

A problem for society is that the highest levels of creativity often are not appreciated (Sternberg & Lubart, 1995; Voosen, 2015). The kind of creativity that most is appreciated is "forward incrementation"—small steps forward within an existing paradigm (Sternberg, 1999; Sternberg, Kaufman, & Pretz, 2002). Large steps ("advance forward incrementation"), or steps that are lateral to the current direction ("redirection") in which a field is moving , tend to be frowned upon, dismissed, or even ridiculed (Kuhn, 1970). So when Ignaz Semmelweis suggested that doctors wash their hands after procedures, he was ridiculed, with disastrous results, both for him (he went mad) and for society (many more people died of sepsis).

High creative ability in the absence of high analytical ability tends to lead to pie-in-the-sky ideas. Howard Hughes's Spruce Goose, a plane that could not fly, was a marvelously creative idea that any decent engineer could have guaranteed would not work. High creative ability in the absence of high practical ability can lead to unsalable ideas. One of the reasons so many entrepreneurs with business start-ups fail is because, although they are creative, there is no demand for their products or services, nor are they able to generate the needed demand. High creative ability in the absence of high wisdom leads to, well, the atomic bomb—weapons of death that are ever more creative and ever more destructive.

Imbalance of High Practical Ability—the Vladimir Putin Syndrome

Vladimir Putin has proved to be a master of tactics. Under his leadership, Russia has punched far above its economic weight on the world stage. Putin is a master of surprise and gains part of his reputation as one to be feared by the unexpected moves he makes as a tactician. What is unclear is what else there is besides an uncanny ability to call attention to himself (and secondarily, to Russia). In general, when people like him have gone into politics, the results have been unfortunate, not only for their own countries, but for the rest of the world.

People who are high in practical ability but not as high in other abilities have products to offer that other people do not or should not want, but the people sell them anyway. Sometimes, they ram them down others' throats. Putin, at least, seems to have a respectable level of analytical ability or more. But then there are people like Nicolas Maduro in Venezuela, a pathetic dictator who stays in his job only through sheer force.

The worst of the lot are people who are high in practical ability but distinctly low in wisdom. Robert Mugabe in Zimbabwe has used what analytical ability he has for evil ends. Adolph Hitler, Osama Bin Laden, or Josef Stalin were others with high practical ability but extremely low wisdom (one might even say, were there such an expression, negative wisdom!). They are the ones who make the world ever so much worse of a place than it could be.

CREATIVE, ANALYTICAL, AND PRACTICAL ABILITIES
TEMPERED BY WISDOM

There is no category of high wisdom unaccompanied by other strengths because wisdom draws on all those strengths (Sternberg, 2009, 2013). A wise person inevitably must excel in analytical, creative, and practical abilities, because wisdom is in a sense the exquisite balance of high levels of all three. Nelson Mandela, Mother Teresa, Martin Luther King, and truly only a handful of leaders in recent times have shown truly distinguished levels of wisdom. The leaders who have best served their institutions and the world are the wise ones, because their abilities are in exquisite balance.

Analytical abilities increased dramatically during the 20th century (Flynn, 2012). But the increase in analytical abilities was not accompanied by an increase in wisdom, with the result that the analytical abilities often were used for purposes not conducive to species survival, such as the production of ever more sophisticated explosive devices, such has the hydrogen bomb.

We also today are seeing an explosion of creativity, such as in the culture of Silicon Valley. In the absence of an increase in wisdom, we have seen growing inequality of incomes, people losing their homes, and people deciding to commit suicide. As Lena Dunham, star of the show *Girls* stated, "I love the Internet because it has helped me discover everything that matters to me. But I also hate the Internet because every piece of true pain I've experienced as an adult—with the exception of death in the family and breakups—has come from it" (*Time,* November 2, 2015, p. 24).

Our society tends to view abilities in a linear fashion: More is better. At some level, probably this is true. But what is missing in our conception of abilities is the importance of balance (see Sternberg, 1998; Sternberg & Frensch, 1989). What contributes to individual survival and flourishing is much more the balance of abilities than excellence in any one of them. Yet none of our assessments measure balance. Whether it is the individual or humanity as a whole, balance or equilibrium is what is most important for survival and for an individual, collectivity, or species to flourish.

What is harder is to know how to fix it. By far the best way would be for schools to teach for wisdom (Gardner, Csikzentmihalyi, & Damon, 2001; Sternberg, 2001, Sternberg, Jarvin, & Grigorenko, 2009). Such teaching would ensure that creative abilities, as well as analytical and practical ones, were used for good ends. But schools cannot teach for wisdom if the teachers do not know how and the society does not seem to care. As a society, we have been ever so much more preoccupied with teaching to standardized tests that, whatever they may measure, certainly do not measure wisdom.

A second measure we could take, related to the first, is either greatly to deemphasize standardized tests or else change what the tests measure. As things stand, current tests measure shallow, convergent analytical thinking in the context of problems that largely do not matter to the test-taker or perhaps to anyone else

(Sternberg, 2003, 2010). Test-mania has driven out of our schools any even small semblance of teaching for wisdom.

A third measure we could take is to teach for *responsible* creativity. There are any number of programs to teach for creative thinking (e.g., Beghetto & Kaufman, 2014; De Bono, 2015; Gardner, 2011; Sternberg, 2010; Sternberg & Grigorenko, 2007). A program to teach for responsible creativity would be one that combined elements of creative thinking with elements of the wise use of this thinking.

None of these are magic bullets. None are likely to happen any time soon. But they need to happen, the sooner the better. Otherwise, humans will go the way of the dinosaurs not as a result of an extraterrestrial event, but rather as a result of our own foolishness. In his introductory essay to this volume, Ambrose (chapter 2, this volume) elucidates the enormous challenges facing contemporary society. Unless society meets these challenges, and fairly soon, the opportunity will be lost and it will be too late. Some future society will show reconstructed humans in their museums and wonder what in the world went wrong. Will they realize that we were what went wrong?

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