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Rethinking Giftedness and Gifted Education: A Proposed Direction Forward Based on Psychological Science

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Summary

For nearly a century, scholars have sought to understand, measure, and explain giftedness. Succeeding theories and empirical investigations have often built on earlier work, complementing or sometimes clashing over conceptions of talent or contesting the mechanisms of talent development. Some have even suggested that giftedness itself is a misnomer, mistaken for the results of endless practice or social advantage. In surveying the landscape of current knowledge about giftedness and gifted education, this monograph will advance a set of interrelated arguments: The abilities of individuals do matter, particularly their abilities in specific talent domains; different talent domains have different developmental trajectories that vary as to when they start, peak, and end; and opportunities provided by society are crucial at every point in the talent-development process. We argue that society must strive to promote these opportunities but that individuals with talent also have some responsibility for their own growth and development. Furthermore, the research knowledge base indicates that psychosocial variables are determining influences in the successful development of talent. Finally, outstanding achievement or eminence ought to be the chief goal of gifted education. We assert that aspiring to fulfill one's talents and abilities in the form of transcendent creative contributions will lead to high levels of personal satisfaction and self-actualization as well as produce yet unimaginable scientific, aesthetic, and practical benefits to society .

To frame our discussion, we propose a definition of giftedness that we intend to be comprehensive. Giftedness is the manifestation of performance that is clearly at the upper end of the distribution in a talent domain even relative to other high-functioning individuals in that domain. Further, giftedness can be viewed as developmental in that in the beginning stages, potential is the key variable; in later stages, achievement is the measure of giftedness; and in fully developed talents, eminence is the basis on which this label is granted. Psychosocial variables play an essential role in the manifestation of giftedness at every developmental stage. Both cognitive and psychosocial variables are malleable and need to be deliberately cultivated.

Our goal here is to provide a definition that is useful across all domains of endeavor and acknowledges several perspectives about giftedness on which there is a fairly broad scientific consensus. Giftedness (a) reflects the values of society; (b) is typically manifested in actual outcomes, especially in adulthood; (c) is specific to domains of endeavor; (d) is the result of the coalescing of biological, pedagogical, psychological, and psychosocial factors; and (e) is relative not just to the ordinary (e.g., a child with exceptional art ability compared to peers) but to the extraordinary (e.g., an artist who revolutionizes a field of art).

In this monograph, our goal is to review and summarize what we have learned about giftedness from the literature in psychological science and suggest some directions for the field of gifted education. We begin with a discussion of how giftedness is defined (see above). In the second section, we review the reasons why giftedness is often excluded from major conversations on educational policy, and then offer rebuttals to these arguments. In spite of concerns for the future of innovation in the United States, the education research and policy communities have been generally resistant to addressing academic giftedness in research, policy, and practice. The resistance is derived from the assumption that academically gifted children will be successful no matter what educational environment they are placed in, and because their families are believed to be more highly educated and hold above-average access to human capital wealth. These arguments run counter to psychological science indicating the need for all students to be challenged in their schoolwork and that effort and appropriate educational programing, training and support are required to develop a student's talents and abilities. In fact,

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high-ability students in the United States are not faring well on international comparisons. The scores of advanced students in the United States with at least one college-educated parent were lower than the scores of students in 16 other developed countries regardless of parental education level.

In the third section, we summarize areas of consensus and controversy in gifted education, using the extant psychological literature to evaluate these positions. Psychological science points to several variables associated with outstanding achievement. The most important of these include general and domain-specific ability, creativity, motivation and mindset, task commitment, passion, interest, opportunity, and chance. Consensus has not been achieved in the field however in four main areas: What are the most important factors that contribute to the acuities or propensities that can serve as signs of potential talent? What are potential barriers to acquiring the "gifted" label? What are the expected outcomes of gifted education? And how should gifted students be educated?

In the fourth section, we provide an overview of the major models of giftedness from the giftedness literature. Four models have served as the foundation for programs used in schools in the United States and in other countries. Most of the research associated with these models focuses on the precollegiate and early university years. Other talent-development models described are designed to explain the evolution of talent over time, going beyond the school years into adult eminence (but these have been applied only by out-of-school programs as the basis for educating gifted students).

In the fifth section we present methodological challenges to conducting research on gifted populations, including definitions of giftedness and talent that are not standardized, test ceilings that are too low to measure progress or growth, comparison groups that are hard to find for extraordinary individuals, and insufficient training in the use of statistical methods that can address some of these challenges.

In the sixth section, we propose a comprehensive model of trajectories of gifted performance from novice to eminence using examples from several domains. This model takes into account when a domain can first be expressed meaningfully—whether in childhood, adolescence, or adulthood. It also takes into account what we currently know about the acuities or propensities that can serve as signs of potential talent. Budding talents are usually recognized, developed, and supported by parents, teachers, and mentors. Those individuals may or may not offer guidance for the talented individual in the psychological strengths and social skills needed to move from one stage of development to the next. We developed the model with the following principles in mind: Abilities matter, domains of talent have varying developmental trajectories, opportunities need to be provided to young people and taken by them as well, psychosocial variables are determining factors in the successful development of talent, and eminence is the aspired outcome of gifted education.

In the seventh section, we outline a research agenda for the field. This agenda, presented in the form of research questions, focuses on two central variables associated with the development of talent—opportunity and motivation—and is organized according to the degree to which access to talent development is high or low and whether an individual is highly motivated or not.

Finally, in the eighth section, we summarize implications for the field in undertaking our proposed perspectives. These include a shift toward identification of talent within domains, the creation of identification processes based on the developmental trajectories of talent domains, the provision of opportunities along with monitoring for response and commitment on the part of participants, provision of coaching in psychosocial skills, and organization of programs around the tools needed to reach the highest possible levels of creative performance or productivity.

Introduction

There have always been individuals in our midst who inspire us with awe or envy based on their speed of learning, graceful performance, or innovative ideas. The appearance of effortlessness with which these individuals make outstanding contributions in their fields of endeavor continues to intrigue, and attempts to understand, develop, and support outstanding performers and producers are the pillars on which we propose the field of gifted education be based.

For nearly a century, scholars have sought to understand, measure, and explain giftedness. Succeeding theories and empirical investigations have often built on earlier work, complementing or sometimes clashing over conceptions of talent or contesting the mechanisms of talent development. Some have even suggested that "giftedness" itself is a misnomer for the result of endless practice and/or social advantage. In surveying the landscape of current knowledge about giftedness and gifted education, this monograph advances a set of interrelated arguments: Individual abilities are malleable, need to be deliberately cultivated, and do matter, particularly abilities in specific talent domains; different talent domains have different developmental trajectories, varying as to when they start, peak, and end; and opportunities provided by society are crucial at every point in the talent-development process. Society has a responsibility to promote these opportunities, but we argue that individuals with talent also have some responsibility for their own growth and development. Furthermore, it is clear from the research knowledge base that psychosocial variables are determining influences in the successful development of talent. And finally, outstanding achievement or eminence—with its attendant benefits to society and to the gifted individual—ought to be the chief goal of gifted education.

The first systematic American effort to explain the derivation of giftedness began in 1921 with Lewis Terman's *Genetic Studies of Genius* (Terman, 1922). Terman's (1925, 1954b; Terman & Oden, 1947, 1959) seminal research yielded many valuable insights about cognitive ability and its relationship to

academic, vocational, and psychosocial outcomes. This early work provided a direction for American researchers, mental health practitioners, and educators. Since its publication, many other conceptions of giftedness (cf. Sternberg & Davidson, 1986, 2005) have been developed. These can be categorized into several broad perspectives that currently frame how much of the field thinks about gifted children and the goals for their education.

Historically, the primary and still most concentrated attention to giftedness and gifted education is directed at high intellectual abilities. From this perspective, giftedness is seen as a generic, innate quality of an individual that needs to be recognized and revealed through some type of cognitive assessment or IQ test (N. M. Robinson, Zigler, & Gallagher, 2000). Further, gifted individuals are presumed to possess reasoning abilities that allow them to be successful across all academic domains and are presumed to remain gifted throughout their lives, *whether or not they actually achieve*.

Contrary to this view, many contend that outstanding academic achievement requires more than intellectual ability (see below; e.g., Dweck, in press; Freeman, 2005; Olszewski-Kubilius, 2000; Olszewski-Kubilius, Kulieke, & Krasney, 1988; Renzulli, 1977; Subotnik & Jarvin, 2005; Terman, 1954a; Winner, 1996; Worrell, 2010a), yet the conception of giftedness as primarily general intelligence (*g*)—which refers to the general mental-ability factor that is common to all tests of intelligence and ability—remains strongly entrenched in the minds of the public and the education profession. This belief is reflected in policies and practices in individual states and districts across the United States (Council of State Directors of Programs for the Gifted and the National Association for Gifted Children, CSDPG/NAGC, 2009).

A second and parallel conception of giftedness is clinical in nature, associated with concern for high-IQ children's presumed unique emotional fragility resulting from their innate sensitivities (Delisle & Galbraith, 2002; Pfeiffer, 2009; Subotnik, Kassan, Summers, & Wasser, 1993; Webb, 1993). Although Terman and his colleagues (e.g., Terman & Oden, 1947, 1959) found most of the participants in their longitudinal study of high-IQ individuals to be superior not only in intellectual functioning but also in volitional, emotional, and social functioning—a finding confirmed in many subsequent studies (e.g., Cross, Adams, Dixon, & Holland, 2004; Cross, Cassady, Dixon, & Adams, 2008; Deary, Whalley, & Starr, 2009)—many people nevertheless adhere to the notion that high-IQ gifted children are qualitatively different beings and are highly sensitive. Since their vulnerabilities are viewed as inherent to their giftedness, it is thought that gifted children need special programming, ongoing socioemotional support, and understanding (Callard-Szulgit, 2003; Fonseca, 2011; Sisk, 2009).

In 1977, Renzulli proposed a dichotomy between schoolhouse giftedness (manifested by high test scores) and creative-productive giftedness (manifested in recognized high level performance and innovative ideas). In this third conception of giftedness and gifted education, Renzulli argued that psychological characteristics such as task persistence, creativity, and motivation are as important to creative productivity as is intellectual or academic ability and that these characteristics should be sought out and cultivated in school programs. Renzulli's article ushered in a movement away from solely relying on measures of innate intellectual ability and toward recognizing the contributions of psychosocial variables to the manifestation of giftedness (cf. Benbow, Arjmand, & Walberg, 1991; A. W. Gottfried, Cook, Gottfried, & Morris, 2005). Renzulli's contribution represented an important conceptual alternative to existing ideas about what provisions should be made to potentially gifted children during the school years, although there was no special focus on the continued development of special talent into adulthood.

A fourth perspective is based on what has been learned from the study of gifted individuals in arenas outside academics and beyond the school years (i.e., into professional life). Gifted individuals in athletic and other competitive domains and the arts were and continue to be educated mainly outside of school, with private lessons from tutors or coaches and supported by dedicated practice. Initially, most of the knowledge base for this area was anecdotal, resulting from reports of strategies promoted by coaches, teachers, and elite performers themselves. In the past three decades, however, a growing body of scholarship has developed in these domains (e.g., B. J. Bloom, 1985a; B. S. Bloom, 1982a; Bruner, Munroe-Chandler, & Spink, 2008; Cote, 1999; Ericsson, 1996; Golomb, 1995; Gulbin, Oldenziel, Weissensteiner, & Gagné, 2010; Haroutounian, 2000; Huijgen, Elferink-Gemser, Post, & Visscher, 2010; Jarvin & Subotnik, 2010; Kay, 2003; Kay & Subotnik, 1994; Krampe, & Ericsson, 1996; Liu, 2008; Makris & Mullet, 2009; Martindale, Collins, & Abraham, 2007; Van Yperin, 2009; Wylleman & Reints, 2010; Yarrow, Brown, & Krakauer, 2009). Elite sport and performing-arts programs are exemplary in combining identification on the basis of demonstrated ability with the honing of talents through, for example, psychological strength training and coaching (Olszewski-Kubilius, 2000); such training is seldom discussed in the context of programs for academically gifted children and youth, even when arts and sports programs are also implemented in the same school settings (Worrell, 2010a).

A fifth viewpoint largely dismisses the role of ability, attributing outstanding performance instead to two environmental factors: practice and unequal access to opportunities (e.g., Colvin, 2008; Coyle, 2009; Ericsson, Prietula, & Cokely, 2007; Mighton, 2003; Shenk, 2010). In *Outliers: The Story of Success*, Gladwell (2008) highlighted the importance of 10,000 hours of practice in the development of expertise, citing the scientific literature (e.g., Ericsson, Krampe, & Tesch-Römer, 1993; Simon & Chase, 1973), historical figures, and contemporary success stories to support this thesis. Promoters of this perspective also argue for the importance of special advantageous chance factors, such as being the oldest

participants in an age cohort entering school or a sport activity (e.g., ice hockey) or being in the right place at the right time in history to capitalize on innovations and business opportunities (e.g., Andrew Carnegie, Bill Gates, Steve Jobs, John D. Rockefeller).

Using his own success in table tennis as an example, Syed (2010, p. 9) exemplifies the claim that special talent arises from unequal opportunities:

> We like to think that sport is a meritocracy—where achievement is driven by ability and hard work—but it is nothing of the sort. . . . Practically every man or woman who triumphs against the odds is, on closer inspection, a beneficiary of unusual circumstances. The delusion lies in focusing on the individuality of their triumph without perceiving—or bothering to look for—the powerful opportunities stacked in their favor.

Our responses to these five perspectives on giftedness (high IQ; emotional fragility; creative-productive giftedness; talent development in various domains; unequal opportunities; and practice, practice, practice) provide the context for this monograph. Drawing from scholarship in human development, expertise, creativity, motivation, and optimal performance, our focus here is on *giftedness as a developmental process* (Cross, 2011; Horowitz, Subotnik, & Matthews, 2009; Sosniak, 1985d; Whitehead, 1929) *that is domain specific and malleable* (B. J. Bloom, 1985b; Dweck, 2006; Feldhusen, 2005; Gladwell, 2008; Hassler, 1992; D. J. Matthews & Foster, 2009; Mayer, 2005; Sosniak & Gabelko, 2008; Subotnik, Robinson, Callahan, & Johnson, in press; Syed, 2010). Although the path to outstanding performance may begin with demonstrated potential (Simonton, 1994, 1999, 2010), *giftedness must be developed and sustained by way of training and interventions in domain-specific skills* (B. S. Bloom & Sosniak, 1981; Kalinowski, 1985; Lubinski, 2010a, 2010b; Park, Lubinski, & Benbow, 2007, 2008; Sloane & Sosniak, 1985; Sosniak, 1985a, 1985b; Winner, 1996), *the acquisition of the psychological and social skills needed to pursue difficult new paths* (Dweck, 2006, in press; Jarvin & Subotnik, 2010; Jonker, Elferink-Gemser, & Visscher, 2010; Sosniak, 1985c), *and the individual's conscious decision to engage fully in a domain* (Arnold, 1993; Ceci & Williams, 2010, Goldsmith, 2000; Sosniak, 1985b, 1985c). *The goal of this developmental process is to transform potential talent during youth into outstanding performance and innovation in adulthood* (Feldhusen, 2005; Subotnik & Rickoff, 2010).

Why is a new framework for the study of giftedness needed? The answer lies in our current inability to accurately identify who will be gifted *in the long term* (B. J. Bloom, 1985b; Freeman, 2010; Lohman & Korb, 2006). Although substantial numbers of children with outstanding academic or intellectual ability are identified and some resources are expended on services for them, few of these children become eminent in adulthood (Cross & Coleman, 2005; Dai, 2010; Davidson, 2009; Hollinger & Fleming, 1992; Simonton, 1998; Subotnik & Rickoff, 2010; VanTassel-Baska, 1989). Does this reflect on our methods of identification or the quality of instructional opportunities available in gifted programs? At the same time, there are numerous examples of eminent individuals whose abilities were not necessarily recognized in childhood (e.g., Freeman, 2010; Jordan & Vancil, 2006; Simonton, 1991; VanTassel-Baska, 1989). Again, does this reflect on our methods of identification? Does it reflect the fact that giftedness was less widely recognized as an educational phenomenon during the period of these people's childhoods? Or are our nonacademic colleagues (e.g., Gladwell, 2008; Syed, 2010) right when they suggest that outstanding achievement depends mainly on what opportunities individuals have to develop their talent.

The disconnect between gifted performance in childhood and adult eminence leads us to argue that the current system of identification and education should be replaced with one that provides the necessary resources for children and adults with talents in specific domains to become path-breaking scholars, artists, athletes, leaders, and professionals—should they so choose. Under such a policy, services would be available to high-ability individuals to help them pursue training and achievement in their domains of interest and ability. In addition, young people who may not be outstanding performers across the board but who demonstrate domain-specific talents and achievements would have a chance to experience an education tailored to eliciting optimal performance.

Psychological science can contribute to policy and practice related to domain-specific talent development at every point from childhood (when relevant) to adult manifestations of the talent. This process of talent development can be conceptualized as having two stages (Hohmann & Seidel, 2003). First is *talent identification*: continuous targeting of the precursors of domain-specific talent and the formal and informal processes by which the talent is recognized and identified. Second is *talent promotion*: how the person demonstrating talent is instructed, guided, and encouraged—a process too often left to chance rather than to strategic and targeted societal effort (Sosniak, 1995; Sosniak & Gabelko, 2008; VanTassel-Baska, 2007). This process also involves recognizing that domains of talent have different developmental trajectories and that transitions from one stage to another are influenced by effort; opportunity; and instruction in content, technical, and psychosocial skills.

Organization of the Article

In this monograph, our goal is to review and summarize what we have learned about giftedness from the literature in psychological science and suggest some directions for the field of gifted education. We begin in Section I with a discussion of how giftedness is defined. In Section II, we review the reasons why giftedness is often excluded from major conversations on educational policy, and then offer rebuttals to these arguments.

In Section III, we summarize the areas of consensus and controversy in gifted education, using the extant psychological literature to evaluate these positions. In Section IV, we provide an overview of the major models of giftedness from the literature on the subject. In Section V, we describe methodological challenges to conducting research on gifted populations. We follow this, in Section VI, with a proposed comprehensive model of the trajectories of gifted performance from novice to eminence, using examples from several domains. Section VII outlines a research agenda for the field. And in the last part, Section VIII, we summarize implications for the field in following our proposed agenda. Throughout the article, we wish to emphasize the following key points:

- Abilities matter, particularly abilities associated with specific domains of talent. They are malleable and need to be cultivated.
- Domains of talent have developmental trajectories that vary even within domains with regard to when they tend to start, peak, and end.
- At every stage in the talent-development process, opportunities need to be provided by the community (broadly defined to include school, neighborhood, local and regional community, society at large), *and* opportunities need to be taken advantage of and committed to by the talented individual.
- Psychosocial variables are determining factors in the successful development of talent.
- Eminence, which we characterize as contributing in a transcendent way to making societal life better and more beautiful, is the aspired outcome of gifted education.

I. Defining Giftedness

It is ironic that one of the most vexing questions in the field of gifted and talented education is how to define giftedness. It is often equated with IQ, which in many educational programs is the basis for classifying individuals as gifted (CSDPG/NAGC, 2009), but the issue is far from settled. Difficulty in coming to consensus does not result from a shortage of definitions, as in some fields, but rather from "a bewildering array" of them (L. Coleman & Cross, 2005, p. 5). Sternberg and Davidson (1986) edited a volume in which more than a dozen authors either put forward conceptions of giftedness or discussed different variables that they saw as important in gifted performance (e.g., insight, metamemory). In a second edition (Sternberg & Davidson, 2005), the conceptions of giftedness increased in number.

In addition to multiple definitions of giftedness, a number of terms are used in referring to outstanding performers (e.g., "brilliant," "eminent," "expert," "genius," "precocious," "prodigy," and "talented," to name a few). Some of these terms help highlight the assumption of giftedness as a developmental process. For example, children are seldom described as eminent, and adults are not described as precocious. In other words, giftedness does not manifest itself in the same way in children as it does in adults, and the nature of performance that results in the label "gifted" differs between childhood and adulthood (L. Coleman & Cross, 2005, Dai & Coleman, 2005a; Mayer, 2005; Olszewski-Kubilius, 2000). At the same time, many terms that are associated with success (e.g., "committed," "conscientious," "hard-working," "persistent") are not typically used to describe *gifted* individuals, as though the achievements of the latter occurred without effort, practice, or psychosocial support. Rather, those terms are more often reserved for those whose performance is just below that tier. Finally, it is important to distinguish between those whose talent is expressed by way of (a) creative *performance*, as exemplified by athletes, musicians, actors, and dancers, and (b) creative *producers*, such as playwrights, choreographers, historians, biologists, and psychological scientists.

Thus, to frame our discussion, we propose a definition of giftedness that we intend to be comprehensive.

> *Giftedness is the manifestation of performance or production that is clearly at the upper end of the distribution in a talent domain even relative to that of other high-functioning individuals in that domain. Further, giftedness can be viewed as developmental, in that in the beginning stages, potential is the key variable; in later stages, achievement is the measure of giftedness; and in fully developed talents, eminence is the basis on which this label is granted. Psychosocial variables play an essential role in the manifestation of giftedness at every developmental stage. Both cognitive and psychosocial variables are malleable and need to be deliberately cultivated.*

Our goal here is to provide a definition that is useful across all domains of endeavor and acknowledges several perspectives about giftedness on which there is a fairly broad scientific consensus: Giftedness (a) reflects the values of society; (b) is typically manifested in actual outcomes, especially in adulthood; (c) is domain specific; (d) is the result of the coalescing of biological, pedagogical, psychological, and psychosocial factors; and (e) is relative not just to the ordinary (e.g., a child with above-average art ability compared to peers) but to the extraordinary (e.g., an artist who revolutionizes a field of art).

There are several points that we wish to highlight here. First, ability is *necessary* for giftedness (Gobet & Campitelli, 2007; Howard, 2008; Simonton & Song, 2009) but not *sufficient* for the development of special talent (Sternberg & Davidson, 2005; Tannenbaum, 2003). Second, interest in and commitment to a domain are essential to becoming a gifted achiever and, ultimately, to attaining eminence (Ceci & Williams, 2010; Renzulli, 1978). Third, gifted achievement and eminence also depend on appropriate teaching or coaching of psychosocial skills that include persistence and exertion of effort (Cross & Coleman, 2005; Gagné, 2005b; Robertson, Smeets, Lubinski, & Benbow, 2010; Subotnik & Jarvin, 2005,

Syed, 2010; Worrell, 2010a); thus, the development of talent requires a substantial investment of time (Sosniak, 1990). Fourth, in every domain, the percentage of eminent adults is considerably smaller than the percentage of children with gifted potential. Fifth, the developmental periods in which potential and eminence are recognized differ across domains (Feldman, 1986; Simonton, 1997, 2007). Sixth, the transitions across stages—especially transitions through the later stages into adulthood (Subotnik & Jarvin, 2005)—are largely a function of developed psychosocial skills (Dweck, in press). Seventh, the emergence of new domains (e.g., snowboarding, programming applications for smart phones and tablet devices) creates additional opportunities for the manifestation and development of talent and eminence.

Disagreements in the field emerge about what the underlying causes of gifted performance are, where the line between gifted performance and performance that is not so labeled should be drawn, what the best way to turn childhood potential into outstanding accomplishments in adulthood should be, and whether the development of eminence should even be a goal of gifted education. To address these issues, we summarize the current state of knowledge in the field and provide a model of talent development, using examples from multiple domains. However, before addressing these issues, we describe the resistance to gifted education by policymakers and the public and articulate and address many of the arguments that buttress this resistance.

II. Why Are Educators, Scholars, and Policymakers Leery of Giftedness and Gifted Education?

Practitioners and researchers in the field of gifted education recognize that U.S. society is ambivalent, at best, about academic giftedness and gifted programming. This ambivalence is reflected in diametrically opposing societal attitudes and actions associated with outstanding academic achievement.

Some examples of pervasive attitudes include (a) beliefs that gifted children will make it on their own no matter what educational environment they are placed in, leading to inconsistent funding for gifted education at the state and federal levels (unlike other exceptionalities that also affect achievement, such as learning or physical disabilities); (b) beliefs that gifted programs identify children based on socioeconomic advantage, which lead to charges of *elitism* leveled at selective programs; (c) school cultures that recognize and revere achievements in athletics, leadership, and the performing arts while ignoring or downplaying the accomplishments of students whose talents are academic in nature; and (d) widespread acceptance of disparaging stereotypes of academically gifted individuals—such as "nerd" or "braniac"—in schools and popular culture.

On the other hand, there are ubiquitous complaints about the relatively low standing of American students on international academic tests and about America losing its pre-eminence to other countries in the areas of creativity and innovation, particularly in science and engineering (Augustine, 2005, 2007; Boe & Shin, 2005; Hanushek, Peterson, & Woessmann, 2010; Provasnik, Gonzales, & Miller, 2009).

In the United States, the goal of education is that all children be educated to the maximum of their potential. However, in practice, this aspiration conflicts with other profoundly held beliefs. One is that it is society's responsibility, in the form of government support, to buttress primarily the needs of the most vulnerable, those viewed as most likely to "fall through the cracks" without special attention. Children with disabilities, for example, are correctly protected under federal regulations requiring school districts to provide a free appropriate public education to them, no matter the nature or severity of the disabilities.

When it comes to research, program funding, policy, and K–12 teacher preparation, little to no attention is focused specifically on high-achieving students whose needs may also not be met in current classroom environments. According to Gallagher (in press), "The conflict between [excellence and equity] often lies in the reality that excellence becomes a long term goal, while equity, because of its immediate crisis character, is more often a short term goal."

Gifted children, regardless of the conditions under which they go to school or the economic status of their families, are not an educational priority and are assumed to be sufficiently capable of learning under most conditions, resulting in uneven distribution of services throughout the country. In fact, school-based gifted education receives very little state or federal funding (CSDPG/NAGC, 2009), and schools serving the largest numbers of low-socioeconomic-status (SES) and minority students continue to receive substantially less funding than other institutions, including funding that can support gifted programming. We present here some of the arguments that need to be addressed to make research, policy, and practice related to gifted students more salient to educators, scholars and policymakers.

"Gifted students will make it on their own"

The belief that giftedness equates to effortless, superior performance or creative production is widespread in our culture and society. This belief does not serve gifted students well in the long run, because the appearance of effortlessness masks the enormous commitment of time and dedication on the part of the gifted performer or producer. In the aftermath of Sputnik, Tannenbaum (1962) conducted a large-scale survey study of male public-high-school students exploring variables associated with popularity and high social status. His study subjects valued brilliance, athleticism, and nonstudiousness most highly, and average ability, nonathleticism, and studiousness least highly, in terms of popularity. These findings have been replicated with classroom teachers (Martin & Cramond, 1987),

who prefer high-achieving but nonstudious students as well. The message is "be smart but don't act like you have to work at it." Pupils who succeed in response to minimal challenge reinforce for teachers the idea that advanced learners are innately gifted and need minimal instruction and attention in order to be successful (Aronson & Juarez, in press).

Some members of the education and research community argue that no special services or programs are needed to serve children with academic gifts and talents. According to this view, since advanced learners require little effort or instruction to be successful, they should participate in inclusive, heterogeneous classrooms and receive differentiated instruction only when and if it seems reasonable to offer it. Starting in the late 1980s, a growing number of people in that community came to view tracking and, in some cases, ability grouping within classrooms as antidemocratic and elitist (Borland, 2005; Lockwood, 1996; Loveless, 1999; 2009; Lucas, 1999; Oakes, 1990, Sapon-Shevin, 1994; Slavin, 1987). The fact that only six states currently mandate services for gifted students and also fully fund those mandates (CSDPG/NAGC, 2009) suggests that there remains little commitment to these learners.

In reality, top students are not doing as well as they might, particularly in mathematics. According to Hanushek et al. (2010), outcomes from 30 of 56 countries participating in the most recent Program for International Student Assessment (PISA) study showed larger percentages of high-achieving students in mathematics than did the United States. In high-scoring countries such as Singapore, it is argued that with few natural resources, the talents of the nation's children must be developed (Mandelman, Tan, Aljughaiman, & Grigorenko, 2010). Even resource-rich countries such as New Zealand, Canada, and Australia have nurtured at least twice the proportion of mathematically advanced students as the United States has. Hanushek et al. demonstrated that the dearth of high achievers in mathematics is not due to the heterogeneity of the U.S. population, as the percentage of White students scoring at the advanced level was lower than 24 other countries, regardless of those countries' ethnic composition. Further, the scores of advanced students in the United States with at least one college-educated parent were were lower than the scores of students in 16 other countries regardless of those students' parental education level (Hanushek & Rivkin, 2006). Clearly, students perceived as most advantaged are not being instructed in such a way as to meet their potential. The findings support the theoretical perspective that giftedness requires external support structures to flourish.

High achievers were not always ignored in American education. When Sputnik took the world by storm, the Ford Foundation was several years into an early-college-entrance project for talented students including students enrolled early at historically Black colleges and universities. According to Evaluation Report Number 2 from the Fund for the Advancement of Education,

> There are those who argue that it is psychologically unsound and politically undemocratic for one child to proceed faster or to have richer academic diet than another. . . . But what is too often ignored is the greatest risk of all—the risk of adhering stubbornly to a clearly imperfect set of practices that are frustrating the development of young talent at a time in history when this nation urgently needs to develop its human resources to the fullest. A democracy, more than any other system, requires an abundant supply and wide diffusion of talent and leadership if it is to survive and prosper. . . . Greater attention to the educational needs of the ablest students is an effective way to improve education for all young people. The typical experience of a school or college that sets out to provide better opportunities for its ablest students is to discover far more submerged ability than was suspected and to upgrade the tone and performance of the entire institution. (Fund for the Advancement of Education, 1957, p. vii)

As a result of the infusion of attention and resources to talented and motivated adolescents and young adults through the National Defense Education Act, there was a boom of innovation and scientific productivity in the United States (Tannenbaum, 1983). More recently, the National Science Board, responding to what it views as a sense of complacency about investments in future innovation, recommended that opportunities for excellence be provided for the nation's most talented students (National Science Board, 2010; see also reports from the National Research Council [Augustine, 2005, 2007] and the President's Council of Advisors on Science and Technology, 2010).

"Gifted programs exist to advantage only a segment of society"

A common perception is that selection for gifted programs is relatively arbitrary. Gifted education typically enrolls greater percentages of higher- (but not the highest-) SES, European American, and Asian American students. Moreover, the benefits conferred by more sophisticated and complex curriculum, motivated peers, and sometimes specially trained teachers can certainly be viewed as an accumulation of advantage (characterized as the "Matthew effect" by Merton, 1968) that further advances those already meeting proficiency criteria for achievement and quality of life. Although a majority of currently identified gifted students appear to come from middle-class homes, there are important subpopulations of gifted students from homes with other demographic characteristics. In a study employing the Project Talent database, Lubinski and Humphreys (1992) identified two populations: the top 1% on cognitive ability (2.7 standard deviations above the norm) and the top 1% on measures of SES (2.4 standard deviations

above the norm). This categorization produced four groups: gifted boys, $n = 497$; gifted girls, $n = 508$; environmentally privileged boys, $n = 647$; and environmentally privileged girls, $n = 485$. Only 41 boys and 46 girls were members of both the privileged and gifted groups. Further, over one million of the approximately 20 million children who qualify for free or reduced lunch rank in the top 25% of students based on achievement in Grade 1, although only 56% of these students maintain their status as high achievers by Grade 5 (Wyner, Bridgeland, & Dilulio, 2009).

As addressed in a later section on barriers to developing giftedness, closing the achievement gap among demographic groups is not a simple task and is an ongoing challenge to educators, researchers, and policymakers. The difficulty lies in ensuring equal access for all children and youth while recognizing significant achievement differences among groups applying for admission to programs and courses of study. A large proportion of gifted-program participants, particularly at the secondary level, are made up of children of East Indian and Asian immigrants. These immigrant families seek to capitalize on opportunities in public education for their children. For example, according to Ceci and Williams (2010), when New York City offered special summer practice sessions for entrance examinations to selective public high schools, Asian American families enrolled in greater percentages than other groups. When comparing student profiles by ethnicity before and after the institution of these summer sessions, the Asian American student population in selective high schools increased from 40.8% to 60.6%. During the same time period, the percentage of African American students dropped from 11.8% to 4.8%. This outcome indicates a real hunger for such services in the wider community and at the same time raises the question of how to address the distribution of booster opportunities so as to increase the likelihood that they will be taken by all families for whom they were initially designed.

If all children were graduating from high school prepared to lead productive lives in higher education or in the job market, the achievement gap would be a smaller concern to policymakers. Yet we are far from achieving the stated goals of No Child Left Behind—all children reaching proficiency by 2014. According to Ceci and Papierno (2005) and Gagné (2005b), when special educational opportunities are made available to everyone rather than targeted to groups with a history of lower performance, achievement gaps actually widen. However, when opportunities have been designed specifically for lower performers, the latter have been less responsive to participation. In light of this conundrum, Ceci and Papierno argued that national policy should focus on removing impediments to individual progress rather than aiming to reduce the spread of individual differences. They argue, further, that it is incumbent on us to find the top 10% of the underrepresented segments of society and ensure that they get the resources that they need to develop their potential (Ceci & Papierno, 2005).

A contributing factor to the association of elitism with gifted education is the fact that placement of gifted children into programs at the school and district levels is made on the basis of *space available* rather than on *meeting criteria that define giftedness*. Instead of establishing criteria and then providing services to all those who meet the criteria (as in special education), gifted programs have to reject qualified students based solely on insufficient slots. Qualified students who are not admitted are denied services and may be incorrectly viewed as not gifted by the students themselves or by their schools (Louis, Subotnik, Breland, & Lewis, 2000). If curriculum standards were universally higher for all students, like in France or Singapore, gifted programs could be established for those students who meet and surpass a very high bar of achievement (e.g., see "A Chorus of Disapproval," 2010, for a discussion of the French *baccalaureate* system). Finally, if all school systems were able to provide better conditions for children in local public schools, gifted programs would not be viewed by parents as the only option for a safe and high-quality education.

Why is it important to integrate the study of giftedness into the psychology literature?

In the previous paragraphs, we have articulated many of the reasons that are used to deny support for gifted education. Now, we turn our attention to why gifted education is important for society and is a topic of interest for psychological scientists.

Addressing negative stereotypes. A broader conception of relevant research questions on gifted children and talent development is needed to deal with fallacies about elitism, privilege, and other stereotypes (Freeman, 2005). Many people outside the field of gifted education hold incorrect, negative, stereotyped views of gifted individuals, including that they are bookish, nerdy, socially inept, absentminded, emotionally dense, arrogant and unfriendly, and that they are loners. These negative stereotypes can affect the choices made by students—whether or not to pursue academics and strive for high achievement—especially on the part of some groups in our society—most notably, minority children and females. Alternatively, incorrect positive stereotypes, such as that gifted children are "naturals" and do not need to study or practice to reach higher levels of expertise and accomplishment, can result in children holding deleterious beliefs about the role of effort, which ultimately thwarts them from reaching their full potential (Dweck, 2006).

Some negative stereotypes are promoted by advocates of gifted education. Too often, behaviors like maladaptive perfectionism, feelings of being different, or extreme sensitivity and intensity have been put forward as defining characteristics of giftedness, whereas these behaviors may in fact be outcomes of the interaction between gifted children and their home, community, and school environments as a result of or independent of the "gifted" label (Freeman, 2010; Neihart, 1999; Worrell, 2010b). Research is needed to fully understand the characteristics that are true manifestations of giftedness versus those are often conflated with it but may result from

environmental factors and could be addressed through appropriate programs.

Addressing societal needs. One of the primary reasons to study giftedness and to understand how talent can be developed is society's need for future innovators to create products and services that will improve our lives; for creative thinkers to generate new ideas about and solutions to major social, economic, and environmental problems plaguing the world; for young leaders to tackle national priorities; and for creative performers to entertain, exhilarate, inspire, and soothe our souls. Rather than leaving this up to chance (Sosniak & Gabelko, 2008), we can resolve to craft programs and create environments that will increase the number of individuals who develop their talents to extraordinary levels for the betterment of all mankind. History, particularly the post-Sputnik era, teaches us that when there are pressing national priorities and we resolve to identify and educate gifted students to address them, we can accelerate the pace of innovation and technological development in needed areas. We now have tools to identify adolescents who are likely to pursue careers in science, technology, engineering, and mathematics (STEM) fields at multiple times the expected rate (Lubinski, Webb, Morelock, & Benbow, 2001; Tai, Liu, Maltese, & Fan, 2006), yet, as a society, we leave the identification and cultivation of talent to the preferences of individual schools and states and to the resources of individual families. If we believe that gifted children can be a source of our future national leaders, scientists, entrepreneurs, and innovators, we need to invest in understanding how we can deliberately cultivate their talents.

Addressing inequalities in opportunity. Every student in the United States is guaranteed a free and appropriate education, but too many academically gifted students spend their days in school *relearning* material they have already mastered, trapped in classes that are not challenging and too slow paced. Those gifted children whose parents are knowledgeable about special schools and programs, are savvy about negotiating the educational system, and have financial resources for supplemental programs do fare better. For example, after-school and summer Talent Search programs are self-supporting and currently have insufficient funds available to provide comprehensive access to lower-SES families (Olszewski-Kubilius, 1998). Consequently only a small percentage of children have experienced these opportunities and other out-of-school programs for the gifted (Lee, Matthews, & Olszewski-Kubilius, 2008; Sosniak, 2005; VanTassel-Baska, 2007). These limited opportunities—and the success of some families in navigating the system—foster the impression that gifted education reinforces social inequalities. Making gifted programs in schools more widely available and expanding funding (e.g., from corporations and foundations) for out-of-school programs could alleviate these inequities.

Understanding why some of our most talented students fail to achieve at high levels or enter specific fields can yield large benefits to society. For example, many of the most talented women fail to reach high levels in STEM fields, especially the physical sciences and engineering (Ceci & Williams, 2010; Halpern et al., 2007; Hill, Corbett, & St. Rose, 2010). Females are more likely to leave STEM career paths, in part because fewer females find or are recruited by appropriate mentors (Subotnik, Duschl, & Selmon, 1993; Subotnik, Stone, & Steiner, 2001). The most recent research suggests that salient reasons for differing outcomes by gender have to do with (a) preferences for nonmath vocations; (b) perceptions of greater flexibility in other fields to combine careers with parenting; (c) the fact that high-ability females tend to be equally strong in their math and verbal abilities, which affects attraction to a wider range of fields; and (d) preferences for people-centered careers (e.g., medicine and biology; Ceci & Williams, 2010). Interventions clearly need to be tailored to the psychological underpinnings of talented students' experiences and decisions.

Generalizing from findings with gifted populations. The study of giftedness can also contribute to our understanding of major psychological constructs and relationships between constructs that have been studied in more heterogeneous populations. Testing the validity of concepts such as mindsets, executive function, self-regulation, resilience, and stereotyping with gifted children will not only improve our understanding of their ubiquity as psychological constructs but, simultaneously, advance our understanding of critical psychosocial components of achievement and motivation (Aronson & Juarez, in press; Diamond, in press; Dweck, in press; Good, in press; Worrell, 2009, 2010b, in press).

Studying gifted individuals can also deepen our knowledge about important educational variables and challenge previously held assumptions. For example, research conducted by Lubinski and colleagues (Park et al., 2007; Robertson et al., 2010; Wai, Lubinski, & Benbow, 2005) contests the notion that higher amounts of ability do not matter in terms of creative outcomes. Other research has shown that some curricula designed for advanced learners and instructional strategies (e.g., classroom clustering) chosen to meet the needs of high-ability students have measurable benefits in terms of achievement for students of all levels (Gentry & Owen, 1999; Reis et al., 2007; A. Robinson, Shore, & Enersen, 2007; Shore & Delcourt, 1996; VanTassel-Baska, Bracken, Feng, & Brown, 2009).

Because what is considered exceptional performance today may not be viewed as exceptional in a few years, we need to understand the processes by which levels of performance are both determined and achieved, a goal that can only be ascertained with the study of outliers, such as exceptionally gifted children. One has only to review Olympic performances to realize that the bar for outstanding performances has been raised through the years. Take, for example, the 100-meter

freestyle swim. According to Lehman, Sloboda, and Woody (2007), Johnny Weissmuller broke the 60-second record in 1924, yet now high-school or college amateurs can meet that standard, demonstrating the seemingly limitless extent of human performance possibilities.

Albert (1969) noted that the study of giftedness in American psychology began with a focus on genius. Over the years, however, research has shifted away from studying human exceptionality. Lederberg (2005) pointed out that the exploration of outliers in the world of microorganisms has been institutionalized in the International Society of Extremophiles, a community of scientists who view research on extreme cases as providing a better understanding of nature's diversity and opening up a broad range of industrial applications ("About ISE," n.d.). Likewise, Gardner's (1983) studies of human extremes—savants and highly gifted subjects—helped expand our conceptions of giftedness by focusing beyond the academic/intellectual domains. Based on his study of child prodigies, Feldman (1994) made the case for developmental theories taking into account outliers from the normal curve. More recently, prominent developmental psychologists have begun to consider the inclusion of gifted subjects to expand their theoretical and empirical ideas (Columbo, Shaddy, Blaga, Anderson, & Kannass, 2009; Graham, 2009; Horowitz, 2009; Horowitz et al., 2009; Liben, 2009).

Addressing major educational issues. The study of how talent develops within domains and over time, and what experiences promote that development, can provide needed insight into solutions for major, persistent, perplexing educational issues currently facing our society. These questions include why minority children underperform compared to nonminority children at all levels of schooling and at all levels of SES (the achievement gap); why school does not increase opportunities nor advance upward mobility for certain segments of our society; and why certain groups, such as women and minorities, are significantly underrepresented in some fields, notably the physical sciences. A talent-development approach that emphasizes the contribution of and interplay between multiple contexts (e.g., home, school, community) and multiple variables (e.g., aptitude, interest, motivation, mind-set, stage of development) can help us understand why a factor such as low SES can be either an obstacle to success or the impetus for high achievement.

The perspective offered in this article is that abilities, motivation, and other psychosocial variables related to achievement are malleable and/or teachable. They can be significantly and positively affected by programs and interventions that are simultaneously domain specific and developmentally appropriate. Keeping this perspective in mind, it will be possible to offer viable and novel approaches to raising the achievement of all groups currently not served well by schools and society. Finally, a better understanding of the talent-development process within different talent domains can result in the identification and successful nurturing of the abilities of more students, such as students who are gifted and learning disabled, students who are gifted and low income, and students who are gifted and minority.

Insights into academic-talent development from understanding performance trajectories. Research aimed at producing an understanding of the developmental trajectories of talent within various domains; the role of different kinds of educational experiences; and the importance of effort, motivation, perseverance, and commitment to high levels of achievement will do much to place academic talent on the same plane as musical or athletic ability in terms of respect, reward, and public recognition. Our schools have cabinets and hallways with athletic and cheerleading trophies, yet similar levels of academic achievement are rarely publicly acknowledged for fear of discouraging less able students. This decision may stem from the antiquated and incorrect belief that giftedness is, in fact, a gift—genetically endowed and not earned—thereby advantaging some over others by virtue of birth and parentage. If young students understand that studying hard to get good grades and high test scores contributes to earning entrance into rigorous programs and becoming a respected physicist, historian, philosopher, linguist, or psychological scientist, they are more likely to venture onto the arduous path of developing their talent to the fullest.

Summary

This section presented the most commonly stated causes for resistance to promoting giftedness education and research. The next section lays out areas of agreement and disagreement in the literature that can pave the way for a new framework to address these concerns and reframe the field.

III. Consensus and Controversy: What Do We Know From Psychological Science?

Like any field, the study of giftedness is fraught with controversial and polarizing issues. These exist at the most fundamental conceptual level and at the level of practice. Typically, contentiousness flows from differences in beliefs about conceptions of giftedness that may not even be explicitly recognized. However, there are areas where there is common ground and shared beliefs because of strong research evidence. It is important to explicate these areas of consensus as well as controversies because they provide the basis upon which a more coherent and psychologically oriented perspective on talented children and their development can be built. Thus, in this section, we turn our attention to issues in the extant literature on giftedness and talent about which researchers have agreed and the ones about which we have not yet achieved consensus. Four questions are used to frame the discussion. First, what factors contribute to giftedness? Second, what are potential barriers to attaining the gifted label? Third, what are the expected outcomes of gifted education? Fourth, how should gifted students be educated?

Contributors to giftedness

Several variables in the literature are associated with outstanding achievement. The most important of these include general and domain-specific ability, creativity, motivation and mind-set, task commitment, passion, interest, opportunity, and chance. Each of these is discussed in greater detail in this section. Our goal is not to provide a comprehensive review of these literatures; rather, we provide a summary of the existing evidence and highlight areas of agreement and contention.

Ability. The role of ability in giftedness is one of the most contested issues although it is also one of the areas in which there is a considerable body of evidence. The notion of giftedness as hereditary came into prominence with the work of Galton (1869). This view is linked to the construct of intelligence, which is a traditional indicator of giftedness in the academic domains (Herrnstein & Murray, 1994). Two questions that generate heated debates are (a) is high ability necessary for outstanding accomplishments and (b) is ability innate? Other important questions focus on the specific abilities associated with music, dance, sport, and other performance domains and on which of those specific abilities contribute to outstanding performance.

Is high ability necessary for outstanding performance? Asking if ability is related to outstanding performance may seem simplistic, as the recognition of individual differences is one of the pillars of psychology as a discipline. There is no doubt in the research community that individual differences in ability exist in children (Neisser et al., 1996) and that ability, especially operationalized as IQ and other standardized measures, can validly predict many important outcomes including school achievement (N. Brody, 1997; Ceci & Williams, 1997; Gottfredson, 1997a, 1997b; Kanevsky, 1990; Kuncel & Hezlett, 2007a, 2010; Kuncel, Hezlett, & Ones, 2001, 2004; Kuncel, Wee, Serafin, & Hezlett, 2010; Simonton & Song, 2009). There is disagreement, however, about whether initial differences in ability are *causally* related to outstanding performance in the future (Howe, Davidson, & Sloboda, 1998; Simonton, 2001) and whether differences in ability are innate. Books with titles such as *The Myth of Ability* (Mighton, 2003) and *The Genius in All of Us* (Shenk, 2010) highlight the views of those who see high ability as unnecessary for and unrelated to strong performance. We begin with a review of the correlational evidence and then turn to the question of causation and biological inheritance.

For a large part of its history, the field of gifted education has been dominated by a focus on IQ or intellectual ability as the main determinant of giftedness. This is due in large part to Terman's seminal longitudinal study of high-IQ children begun in the 1920s. Terman's (1925) sample of over 1,000 individuals was chosen on the basis of Stanford-Binet test scores of 130 and above, representing approximately the top 2% of the IQ distribution. In their 35-year follow-up, Terman and Oden (1959, p. 16) reported that their participants were above average in almost all spheres:

> The proportion of gifted subjects rated superior to unselected children of corresponding age averaged 89 percent for 4 intellectual traits, 82 percent for 4 volitional traits, 67 percent for 3 emotional traits, 65 percent for 2 aesthetic traits, 64 percent for 4 moral traits, 51 percent for 2 physical traits, and 57 percent for 5 social traits.

Terman's conclusion was that, with relatively few exceptions, superior children became superior adults.

Subotnik, Karp, and Morgan (1989) sought to compare outcomes of Terman's high-IQ group at midlife (Terman & Oden, 1959) with a contemporary cohort (same age, same general SES level of family of origin, same mean childhood IQ) of study participants. Subotnik et al.'s investigation found much overlap between the two groups, with one exception: High-IQ women at middle age in the late 1980s had far more opportunities available to them than were available to the Terman women, who faced the inherent sexism of the period. Both the Terman and the more recent high-IQ cohort evolved into highly productive professionals with relatively good mental and physical health and stable relationships. Neither group, however, produced substantial numbers of *eminent* individuals—that is, those who made a significant contribution to improving or enhancing the human condition.

Gottfried and colleagues (A. E. Gottfried & Gottfried, 1996; A. W. Gottfried, Gottfried, Bathurst, & Guerin, 1994) recruited 130 one-year-olds and their families and followed them until middle childhood. Data were collected in 6-month periods from age 1 to 3.5 years, and then every year beginning at age 5 until age 8. At age 8, 20 participants were classified as gifted on the basis of IQ-test scores above 130. Looking back at the data collected in advance of the classification as gifted, A. W. Gottfried et al. (1994) reported that differences within the study sample of 130 favored the gifted group, which had higher receptive language skills at age 1 and higher performance on measures of intellectual performance at age 1.5 than the nongifted group. The gifted group attended kindergarten at an earlier age and had higher academic achievement and psychosocial functioning (e.g., curiosity, intrinsic motivation, persistence) than did the nongifted group, but the groups did not differ on measures of behavioral adjustment or social functioning.

All three study samples came from families with above-average incomes and had enriched environments. Indeed, A. W. Gottfried et al. (1994) noted that their high-IQ study sample had more enriched environments from their earliest years and long before the children were identified as gifted.

So how can we disentangle environment from ability or argue that the ability has a causal relationship with achievement? In science, causal relationships are inferred from the results of theoretically grounded experimental studies.

Although intelligence, like many other variables, cannot be manipulated in an experimental setting, one can use theory to predict the role of intelligence in different circumstances (e.g., measuring intelligence in two groups and assigning the same novel task to those with low and high intelligence scores) and infer a causal relationship based on the preponderance of evidence (Kuncel & Hezlett, 2007b). In practice, schools rely on ability tests to identify children as gifted and to place them in special programs. Moreover, even beyond identifying gifted students, the widespread use of ability-test scores for educational and vocational selection is an indication that many view these scores as having a causal relationship with outcomes. In conclusion, *general ability is necessary but not sufficient to explain optimal performance or creative productivity. It remains a component of talent development along with domain specific abilities, psychosocial skills, motivation, and opportunity.*

Is ability innate? This question has important biological, psychological, and public policy implications and is often framed in terms of mutually exclusive options. Does biology contribute to a fundamental psychological characteristic? Are children's future contributions determined in advance by dint of genetic inheritance? The literature shows that abilities are derived from both genetic and environmental components and are also modifiable. The nature/nurture debate is one of the oldest in psychology, and its manifestations in the literature on giftedness have also been centered on the construct of IQ. The issue of ability as innate is challenged in the scholarly literature (e.g., Ericsson, 1996; Howe et al., 1998) and the popular press (e.g., Coyle, 2009; Gladwell, 2008). For example, Howe et al. (1998, p. 400) argued that for talent or ability to be innate, it must meet five criteria: be genetically transmitted, be evident in some way early in development, be useful in predicting the probability of excelling later on, be present in only a minority of the population, and be "relatively domain-specific."

In responding to Howe et al. (1998) and arguing for a genetic basis to ability, other researchers have put forward compelling accounts of nature–nurture interactions in the development of talent (see Dai & Coleman, 2005a, 2005b; Lohman, 2005, Papierno, Ceci, Makel, & Williams, 2005; Sternberg, 1998). Simonton (1999, 2001) argued that current understandings of talent as innate may be overly simplistic. He contended that talent is best understood in terms of emergenic and epigenetic inheritance. An emergenic-inheritance perspective suggests that "most talent domains are not contingent on the inheritance of a single trait" (Simonton, 2001, p. 39; cf. Stanovich, 2010), that different traits are related to different aspects of learning (e.g., acquiring information, using learned skills), and that the traits operate "in a multiplicative, rather than additive, manner" (Simonton, 2001, p. 40). Simonton (2001, p. 39) also pointed out that traits related to a talent domain will include "physical, physiological, cognitive, and dispositional traits that facilitate the manifestation of superior expertise." The epigenetic perspective suggests that different traits will manifest at different times over the course of development. Finally, Simonton (2001, 2005) noted that there is support for the emergenic/epigenetic model of inheritance in the creativity and leadership talent domains (see Lykken, McGue, Tellegen, & Bouchard, 1992; Waller, Bouchard, Lykken, Tellegen, & Blacker, 1993). In sum, Simonton argues for a more complicated understanding of innateness.

These perspectives refute Howe et al.'s (1998) objections by highlighting how genetics can contribute to giftedness without meeting the criteria specified by Howe et al. and the extreme environmentalist positions. They also provide some insight into the Terman (1925; Terman & Oden, 1959), Gottfried et al. (1994), and Subotnik et al. (1989) outcomes. See Papierno et al. (2005) for an explication of the range of outcomes possible when nature and nurture interact to facilitate talent development. The resolution of the nature/nurture debate is further complicated when we consider the range of domains in which outstanding talent is manifested.

What are the specific abilities associated with music, dance, sport, and other performance domains? Gardner (1983) identified several categories of intelligence—including musical intelligence and bodily–kinesthetic intelligence. In contrast to the global-intelligence perspective, Gardner's work focused on abilities specific to domains. Specific ability is most often discussed in association with music and art, offering promising and exciting directions for future research (Stollery & McPhee, 2002; Winner, 1996, 2009). For example, Gagné (1999) reanalyzed data from Sloboda and Howe (1991) and concluded that musical aptitude was an important causal factor in outstanding achievement in music.

How important are domain-specific abilities to outstanding performance? There is not yet general agreement on the exact nature of specific abilities (e.g., whether these can be taught), nor their importance in predicting eminence and creative accomplishments. Some experts (e.g., Gottfredson, 2003) conclude from their reviews of the literature that measures of specific abilities such as verbal or mathematical ability add little to the prediction of achievement beyond *g* or IQ and are related to achievement only because of this general ability factor. Others argue that the literature provides support for the importance of both general cognitive and domain-specific abilities (e.g., Dai, 2010).

There are some domains in which this question has been addressed extensively and many domains in which it has not been addressed at all. For example, there is a substantial literature on the contributions of phonological skills to reading achievement in the elementary grades (e.g., Badian, 2001; Cormier & Dea, 1997; Margolese & Kline, 1999; Shatil & Share, 2003; Zifcak, 1981), although reading comprehension in adolescence may be better predicted by *g* (Hulslander, Olson, Willcutt, & Wadsworth, 2010). Lubinski and colleagues (e.g., Lubinski, Benbow, Webb, & Bleske-Rechek, 2006; Wai et al., 2005) have found that specific mathematics and verbal abilities measured around age 13 in high-achieving students are valuable for predicting important educational and occupational outcomes. Wai et al. (2005) showed that a select group

of almost 2,000 students scoring within the top 1% of ability in mathematics compared to same-age peers did very well academically and that their rank *within* the top 1% of ability in mathematics, as measured by standardized tests, predicted differential academic success. A greater percentage of participants in the highest quartile of the top 1% (a) obtained more doctorates, (b) earned more income, (c) produced more patents, and (d) were more likely to be awarded tenure at a top university than participants in the lowest quartile of the top 1%. As with the Terman group, however, only a small percentage of this elite group had outstanding accomplishments (e.g., Fortune 500 patents) 20 and 25 years after they were identified (Park et al., 2008; Wai et al., 2005), and these researchers have not removed the effect of *g* in their prediction models.

The Study for Mathematically Precocious Youth (SMPY) on which these results are based also yielded more nuanced findings related to domain-specific scores. These studies have shown that verbal versus quantitative tilt in abilities predicts differences in domains of accomplishment, with verbal tilt increasing the probability of accomplishments (degrees, publications) in the humanities and quantitative tilt increasing the probability of accomplishments (e.g., degrees, patents) in STEM fields (Park et al., 2007; Wai et al., 2005).

The nature and importance of domain-specific talents may also differ by discipline. In another study of mathematical talent, Krutetskii (1976) identified mathematical cast of mind as a basic ability. Choreographer Eliot Feld, based on years of experience building dance troupes and educating novice dance stars, identifies potential dancers around the age of 8. In his auditions he seeks indicators of flexibility, body proportion, and physical memory (Subotnik, 2002). In field hockey, researchers (e.g., Elferink-Gemser, Kannekens, Lyons, Tromp, & Visscher, 2010; Elferink-Gemser, Visscher, Lemmink, & Mulder, 2007) found that elite and sub-elite players (i.e., just below elite status) had better technical and tactical skills than non-elite players and also that elite players had better procedural skills than sub-elite players. A few domain-specific characteristics, including pitch perception (Freeman, 2000) and audiation (Ruthsatz, Detterman, Griscom, & Cirullo, 2008), have also been associated with musical performance in several studies, and in response to a survey, voice teachers identified intonation, timbre, musicality, and ability to control pitch as important factors related to singing talent (Watts, Barnes-Burroughs, Andrianopoulos, & Carr, 2003).

Summary. General ability or *g* is derived from both genes and environment. Both are modifiable. Both general and domain-specific abilities play a role in outstanding achievement (Kuncel et al., 2001), although the importance of general ability probably varies by domain (Simonton & Song, 2009; Sternberg, 1998; Tannenbaum, 1983). There is also some evidence to suggest that general and domain-specific ability may mediate the effect of practice, enabling individuals with higher levels of ability to profit more from guided practice and instruction (Howard, 2008; Ceci & Papierno, 2005; Gagné, 2005b; Gobet & Campitelli, 2007).

Creativity. Creativity, the ability to come up with novel and useful ideas or ways of doing things, has a long historical association with giftedness (Csikszentmihalyi, 1988; Csikszentmihalyi & Wolfe, 2000; Renzulli, 1978). Amabile (1996) argued that creativity consists of three components: (a) domain-relevant skills and knowledge; (b) task motivation; and (c) creativity-relevant processes, which include the capacity to use heuristics for generating novel ideas such as metaphorical thinking, tolerance for complexity, and flexibility in using mental sets during problem solving. Sternberg and Lubart (1995) maintained that creativity includes intellectual skills to define and represent problems in new ways, analytical skills to evaluate ideas and select the best ones, practical intelligence to sell the value of the new idea to others, and divergent-thinking abilities to generate many diverse ideas.

Simonton (2000b) pointed out that creativity is, in fact, dependent on cognitive processes (e.g., insightful problem solving, expertise acquisition), personal characteristics (e.g., intelligence, personality), life-span development, and the social context (e.g., interpersonal, sociocultural, and disciplinary). We consider several questions with regard to creativity. What is the relationship between creativity, general intellectual ability, practice, and expertise? Second, how do creativity and expertise differ? Third, does creativity predict eminence? Fourth, does creativity differ between children and adults and are these different types or stages of creativity?

Creativity, ability, practice, and expertise. There are those who argue that creativity and general ability in a domain are related but distinct phenomena (Renzulli, 1977), and who claim that both creativity and ability are necessary for eminent levels of achievement (e.g., Renzulli, 1977). Some subscribe to the ability-threshold/creativity hypothesis, which postulates that the likelihood of producing something creative increases with intelligence up to about an IQ of 120, beyond which further increments in IQ do not significantly augment one's chances for creative accomplishment (Dai, 2010; Lubart, 2003). There are several research findings that refute the ability-threshold/creativity hypothesis. In a series of studies, Lubinski and colleagues (Park et al., 2007, 2008; Robertson et al., 2010; Wai et al., 2005) showed that creative accomplishments in academic (degrees obtained) vocational (careers) and scientific (patents) arenas are predicted by differences in ability. These researchers argue that previous studies have not found a relationship between cognitive ability and creative accomplishments for several reasons. First, measures of ability and outcome criteria did not have high enough ceilings to capture variation in the upper tail of the distribution; and second, the time frame was not long enough to detect indices of more matured talent, such as the acquisition of a patent (Park et al., 2007).

Another debate in the field of gifted education is whether creativity is a generalized trait or a domain-specific capacity (see Kauffman & Baer, 2004; Plucker & Beghetto, 2004). The lack of agreement stems, in part, from the distinction between childhood creativity, which is often conceptualized as a

person-centered trait, and adult creativity, which is generally thought of in terms of a process related to a particular product or domain in a specific time and place. Within the field, there is general consensus on a distinction between *little-c* and *big-C* creativity (Csikszentmihalyi, 1990). Little-*c* creativity refers to accomplishments that are unique to a classroom or office or to the person—that is, creativity that is exhibited in narrower social contexts and does not usually entail the creation of novel products or new information (Kaufman & Beghetto, 2009; Plucker & Beghetto, 2004). Big-*C* creativity, on the other hand, refers to groundbreaking, field- and culture- altering products and knowledge, which occur in the broadest social context and involve eminent levels of creative productivity (Kaufman & Beghetto, 2009; Plucker & Beghetto, 2004; Simonton, 2010).

Research (e.g., Cox, 1926; Raskin, 1936; Simonton, 1991, 1992b) suggests that eminent performers and producers across a variety of domains spend less time engaged in training and practice before beginning to make notable contributions. Although these findings do not disentangle the contributions of ability from creativity, they do call into the question the notion that *amount* of sustained practice (Ericsson, 1996; Gobet & Campitelli, 2007; Howard, 2008; Syed, 2010; Walberg, Williams, & Zeiser, 2003) is the most important factor in attaining eminence. Two studies in sport provide some guidance here with regard to performers. In the first study, Memmert (2006) found that intellectually gifted students (IQ > 130) became more creative in the use of sports tactics after a 6-month training program than a group of non-gifted students who were in the same training program. A follow-up study suggested that the difference between the groups was due to the speed of automating thought processes, allowing for quicker access to relevant knowledge (Memmert, 2006).

In a retrospective study, Memmert, Baker, and Bertsch (2010) had trainers identify players on their elite professional teams (basketball, soccer, handball, field hockey) who were the *most* and the *least* creative. Creativity was operationally defined for the coaches as "(a) unusualness, innovativeness, statistical rareness or even uniqueness of tactical solutions to a game related task; and (b) varying and flexible tactical solutions over different complex game situations" (Memmert et al., 2010, p. 6), and the nominated players were then rated by expert trainers in the various sports who were familiar with the players. Interrater reliability within each sport was high—above .80. These players were asked to report on an array of variables. More creative players did not differ from their less creative counterparts on the age at which they started training, the number of years they were involved in the sport, the number of other sports they were involved in, or the number of hours of training. Differences with medium effect sizes favoring creative athletes were found in the number of total hours spent, the total number of hours of unstructured play in the sport, and the total number of hours of unstructured play before age 14. It has also been shown that substantial unstructured engagement in an activity may increase creative performance (Milgram & Hong, 1999).

Creativity versus expertise. Some scholars (e.g., Gagné, 2005a; N. M. Robinson, 2005; Sternberg, 2005; Tannenbaum, 1986) distinguish between experts and creative producers. Experts are those who have high levels of discipline-specific knowledge and experience and perform at high levels in their fields or occupations, without necessarily transforming current thinking or standards. They master the existing paradigms of a discipline or domain or what others before them have discovered and developed. Creative producers, on the other hand, generate new knowledge or art forms and significantly alter a field with their work. They advance new paradigms or revolutionize existing ones (Simonton, 1996). How dependent is creative productivity on expertise in a field? Do you have to be an expert in order to produce creative work in a field? Is creative productivity a stage or level beyond expertise, as some theorists suggest (Subotnik, 2000, 2004; Subotnik & Jarvin, 2005; Walberg et al., 2003), or are exceptional creators in a different category (Simonton, 2000a)?

Plucker and Beghetto (2004) argued that being too deeply entrenched in the current knowledge and concepts of a field can result in being less open to outside perspectives or alternative ways of approaching problems, thereby producing functional fixedness, with negative effects on creativity. Simonton (2000a) distinguished between the expertise necessary to give consistently similar, outstanding technical performances and the creativity necessary to generate high-quality, original work. "Mere repetition of previous work is necessarily disqualified as creative" (Simonton, 2000a, p. 286) even though the work may be outstanding or meet world-class standards in some fields. Alternatively, having deep expertise does not limit one to facile, stereotypical, and superficial approaches to complex problems that ultimately thwart creativity. Flexible thinking, or the ability to apply information from a different area to a new problem when needed, may be the key to creative productivity in general and to being creative in multiple domains (Plucker & Beghetto, 2004). It is also possible that technical precision, skill automaticity, and large stores of knowledge are more important at certain stages of talent development than at others (Dai, 2010).

Creativity and eminence. Research indicates that creativity is clearly related to outstanding performance. In 1977, Simonton postulated that eminence was a function of creative productivity (i.e., number of creative or notable compositions), which in turn was a function of creative longevity (i.e., length of time that one produced creative work). He tested a series of equations trying to establish the relationship between eminence and creativity in composers and found that both creative productivity and creative longevity were indeed direct predictors of eminence in that domain.

Historical analyses and biographical studies show that each domain establishes traditions of taste, which can vary within a culture and historical period in response to creative contributions (Csikszentmihalyi, 1988; Freeman, 2005), thereby affecting the attribution of eminence to any given individual. Gatekeepers (e.g., artistic directors, critics, journal editors, foundation heads), who serve as the arbiters of taste in each

field, distinguish contributions deemed as creative from those that are not (Csikszentmihalyi, 1988; Runco & Albert, 2005). According to Csikszentmihalyi, it is far more difficult to recognize enhancements or original input to fields in which gatekeepers such as K–12 teachers are not as widely held in respect, compared with high-status fields such as classical music.

Creativity in childhood versus adulthood. Do childhood differences in openness to ideas and willingness to entertain alternative views and perspectives predict creative productivity in adulthood? In other words, do creative children or little-*c* producers have a greater likelihood of becoming big-*C* producers as adults? Certainly, many school programs for gifted and talented students are built upon this belief or hope, but there is only limited empirical research on this issue. Studies conducted by Cramond, Matthews-Morgan, Bandalos, and Zuo (2005) and Plucker (1999) shed some light on the continuity between childhood and adulthood creativity. These authors reported on a multi-decade follow-up of students identified as creative with the Torrance Tests of Creative Thinking (TTCT; Torrance, 1974) while they were in elementary school. TTCT scores from childhood, which largely measure divergent thinking, predicted the quantity and quality of publicly recognized creative accomplishments in adulthood, accounting for 23% of the variance, and, according to Plucker (1999), divergent thinking contributed three times more than IQ.

There is also some empirical support for continuity in creative processes across disparate domains, suggesting the contribution of general rather than domain-specific creative ability, at least in terms of some processes or skills. Root-Bernstein and Root-Bernstein (2004) found a high preponderance of polymaths, or individuals who were able to work creatively in several disparate fields. They refer to noted actress Hedy Lamarr and composer George Antheil, who together invented frequency hopping, a mechanism used in torpedo guidance (Braun, 1997). According to Root-Bernstein and Root-Bernstein, learning how to manipulate the creative process in one discipline appears to train the mind to understand the creative process in any discipline. In other words, creative people tend to be generally creative, in the sense of being able to make personal contributions to disparate fields.

The question remains whether those creative roots begin in childhood and undergird adult creativity. Thus, there may be some aspects of creativity—notably creative processes as well as personality dispositions—that are domain general and begin in childhood, and other aspects (e.g., those used by gatekeepers in the field to judge the creativeness of products or contributions) that are domain specific (Plucker & Beghetto, 2004). Although it is likely that creative work in one field can catalyze work in another field, it is not known at what points in talent development explorations in another domain can be most fruitful.

Motivation. Several researchers argue that motivation, drive, or grit are at the center of eminent levels of achievement (e.g., Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2010; Gagné, 2005a, 2005b, 2010; D. J. Matthews & Foster, 2009; Nokelainen, Tirri, Campbell, & Walberg, 2007) and credit motivation with determining an individual's ability to garner, respond to, and capitalize on talent-development opportunities. In 1985, Csikszentmihalyi wrote,

> the unifying similarity among geniuses and innovators is not cognitive or affective but motivational. What is common among them is the unwillingness or inability to strive for goals everyone else accepts—their refusal to live by a presented life theme. (p. 114)

A decade later, Winner (1996) made a similar point, as did Ochse (1990, p. 133): "It is consistently recognized that the creator's most salient characteristic is persistent motivation." Some eminent creators eventually have the chance to publicize how their detractors were wrong. Nobel laureate Rosalyn Yalow's results met with resistance to the point that scientific journals refused to publish her work. When Yalow was awarded the Nobel Prize, she made sure to include a key rejection letter as an exhibit in her acceptance lecture materials (Gellene, 2011).

There are a wide variety of achievement-motivation models (Alexander & Schnick, 2008; Graham & Weiner, 1996), including self-determination theory (Deci & Ryan, 2000), ability self-perceptions and subjective task values (Eccles, O'Neill, & Wigfield, 2005) , goal-orientation theory (Dweck, 1986), self-efficacy theory (Bandura, 1997), conceptions of ability (Dweck, 2006), attribution theory (Weiner, 1974, 2010), self-worth theory (Covington, 1984, 1992), and intrinsic and extrinsic motivation (Lepper & Henderlong, 2000), among others, and D. J. Matthews and Foster (2009) provided practical suggestions about how some of the literature on motivation can be incorporated into gifted education. To date, much of the research on gifted students has focused on (a) the relationship between motivation and achievement, (b) comparing gifted and non-gifted students on one or more motivational constructs, or (c) looking at gender differences within gifted samples. Here we review research related to motivation constructs that have been most often linked to high levels of achievement and performance.

Intrinsic and extrinsic motivation. One motivational construct that has a long association with giftedness is intrinsic motivation. Intrinsic motivation refers to engaging in a task for the sake of learning, and extrinsic motivation refers to engaging in tasks for external factors like rewards or instrumentality (i.e., practical utility). Despite the generally held belief that gifted students are only intrinsically motivated, Covington and Dray (2002) showed that many high academic achievers are motivated both by valuing learning (intrinsic) and by proving their ability through accomplishment (extrinsic). In another study, Kover and Worrell (2010) reported that a group of academically talented students had *similar* levels of intrinsic and extrinsic motivation but also found that instrumentality beliefs (i.e., a concern with the future *utility* of grades) *strongly*

predicted extrinsic motivation but did not predict intrinsic motivation. More research is needed to understand the interrelationships of these variables in gifted students and their contributions to outstanding performance (Dai, Moon, & Feldhusen, 1998).

Achievement motivation. Dweck (2006) coined the term *mindset* to describe assumptions held by children and youth about intelligence and achievement that affect the way that they respond to challenge, reward, feedback, and setbacks. These assumptions, in turn, can affect goals and aspirations held by talented young people in school, in studios, and on the playing field. As an outgrowth of her work on attributions and self-theory (Dweck, 1999; Good & Dweck, 2006; Mueller & Dweck, 1998), Dweck has demonstrated the positive impacts of viewing intelligence as malleable and subject to modification. Those who hold a fixed mindset seek validation and reinforcement from others, constantly having to prove themselves worthy of a high ability label. In contrast, holding a growth mindset frees individuals to face obstacles and recognition as part of a trajectory of growth toward higher goals.

Several researchers (Eccles, 2006; Eccles et al., 2005; Graham, 2004) have presented a dual-level view of motivation, which can be succinctly framed as "Can I, and do I want to?" According to this theory of achievement motivation, children and adolescents assess tasks on two levels. First they consider whether they have the skills to complete the task. Concurrently, they gauge the task by virtue of how important doing well or poorly at it might be for them, how much they enjoy it, and what role it might play in their future goals. If the answer to both "can I" and "do I want to" is "yes," then it is likely that they will engage in the task.

Task commitment. In 1977, Renzulli challenged the established conceptualization of giftedness as IQ by introducing a three-factor definition of giftedness: above-average but not necessarily superior ability, task commitment, and creativity. But what is task commitment? Renzulli (1986, p. 69) defined task commitment as

> a refined or focused form of motivation. . . . Whereas motivation is usually defined in terms of a general energizing process that triggers responses in organisms, task commitment represents energy brought to bear on a particular problem (task) or specific performance area. The terms that are most frequently used to describe task commitment are perseverance, endurance, hard work, dedicated practice, self-confidence, and a belief in one's ability to carry out important work.

Task commitment is best thought of as the constellation of psychosocial variables that translates ability and potential into outstanding performance (Ruthsatz et al., 2008; Worrell, 2010a).

There are several studies showing that task commitment contributes to outstanding performance. In a study predicting third-grade enrollment in gifted programs based on kindergarten social-competence levels, Curby, Rudasill, Rimm-Kaufman, and Konold (2008) demonstrated that those kindergarten pupils most likely to be identified as gifted in third grade exhibited not only high cognitive ability but early task orientation as well. Benbow and Arjmand (1990) used a statistical method called discriminant function analysis to identify variables that distinguished between high and low academic achievers in mathematics. Participants consisted of 356 students in the first cohort of SMPY and had been identified based on their scores on the SAT taken before age 13. Students attending medical school or graduate school for mathematics or science degrees were classified as high achievers, and students who did not complete high school, did not attend college, did not complete college, or completed college with a GPA in the bottom fifth of their graduating class were classified as low achievers. The discriminant function correctly classified 83% of the high and low achievers; independent of test score, the strongest predictor was the number of mathematics and science examinations the students had sat for—a variable that reflects a *commitment* to the discipline, as these were optional examinations rather than requirements.

Task commitment came to the fore in the research of Ericsson and his colleagues (e.g., Ericsson, 1996; Ericsson et al., 1993; Ericsson, Nandagopal, & Roring, 2005) with their focus on deliberate practice. Ericsson et al. (1993) conducted seminal work showing how the amount of deliberate practice differentiated among three tiers of talented violin players. This study's findings highlight the importance of task commitment. There are two important points to make about this research. First, Ericsson et al. contended that deliberate practice is not enjoyable but is engaged in because it is instrumental. This hypothesis suggests that those who engage in the amount of practice that results in elite performance are higher than their peers in another aspect of task commitment, self-regulation. However, given other studies on how the gifted experience their craft (e.g., flow, passion), it is also probable that the mastery that comes from extended deliberate practice also has intrinsic value for elite performers (Csikszentmihalyi, 1990; A. W. Gottfried et al., 1994).

Second, it is worth noting that deliberate practice *aimed at technical proficiency* is more relevant to some aspects of a domain than to others. Expertise from deliberate practice is more likely to result in technically flawless performance or production, but not necessarily in original or elegant performance or creative productivity. It will therefore be important to learn how domain-specific ability (e.g., musicality) interacts with deliberate practice to result in creative performance beyond mastery of high-level technique (cf. Ruthsatz et al., 2008).

Personality. Many prominent researchers who study talent development also agree that personality is related to high levels of achievement and creative productivity (Csikszentmihalyi, 1985; Kuncel & Hezlett, 2010; MacKinnon, 1968; Ochse, 1990; Piirto, 1998; Roe, 1953; Simonton, 1984a, 1984b,

1992a). Winner (1996, p. 283) wrote, "after a certain point, levels of ability play a less important role than personality and motivational factors," a claim substantiated with regard to motivation in the studies mentioned in the previous subsection. Personality traits show interesting patterns of association with achievement and creative productivity (e.g., Busse & Mansfield, 1984).

In one of the few meta-analyses looking at achievement and personality (Feist, 1998), scientists were much higher on Conscientiousness than were non-scientists and much lower on Non-Conscientiousness (direct expression of needs, psychopathic deviancy), whereas artists and non-artists had an inverse pattern on these constructs. Feist (1998) found no differences between less creative and more creative scientists and between scientists and non-scientists on Neuroticism. Perhaps this finding speaks to the inaccuracy of some popular stereotypes about gifted individuals.

Artists did report higher scores than non-artists on Neuroticism, as well as on Sensitivity, Imagination, Radicalism, and Self-Sufficiency. However, research is not yet able to ascertain how differences in personality characteristics contribute to promoting eminence and creative productivity (Simonton, 2008). In a longitudinal study of creative artists, Getzels and Csikszentmihalyi (1976) speculated on the types of social skills needed to draw attention to one's work, noting the importance of such skills in achieving recognition at the highest level yet that such skills remain tremendously understudied.

Emotional trauma. Many eminent individuals experienced family tragedies early in life (e.g., death of a parent or sibling, loss of family home), or lived in dysfunctional, chaotic, and challenging family situations (e.g., alcoholic or mentally ill parents; Albert, 1978; Goertzel & Goertzel, 2004). It has been suggested that these environments facilitate creative productivity by engendering characteristics that help individuals meet the demands of creative careers or jobs that involve tackling ill-defined, unstructured, and complex problems. These characteristics include early psychological independence, self-sufficiency (Albert, 1994), an ability to cope with high levels of stress, resiliency, emotional strength, a tolerance for ambiguity, intellectual risk taking, and a preference for challenge (Ochse, 1990; Olszewski-Kubilius, 2000, 2008a; Simonton, 1994). Difficult childhoods, childhood trauma, or experiences of marginalization may also create compelling psychological needs that are ameliorated or compensated for through creative productivity in adulthood (Csikszentmihalyi, 1993; Ochse, 1990; Piirto, 1992; Simonton, 1994; VanTassel-Baska, 1996). It is also clear that some eminent individuals did not grow up in dysfunctional environments and that many individuals from such environments never become eminent. We need to understand more clearly whether these environments serve as catalysts for individuals with tremendous potential in a domain, and if so, why and how.

Parents. Goertzel and Goertzel (1962) used the biographies of eminent 20th-century politicians, reformers, musicians, and artists to explore the special role of parents in their children's long-term achievements. One consistent theme found by the Goertzels was the great importance these parents placed on intellectual or creative excellence and recognition. This drive was channeled into their children's talent development, often at the expense of the parents' own personal fulfillment. Syntheses of retrospective studies on eminent individuals' early lives by Ochse (1990) and Simonton (1997) highlighted the ample encouragement and intellectual stimulation parents offered to their talented offspring. However, encouragement and stimulation were not necessarily accompanied by emotional support. Despite this, and to the extent that outstanding achievement was the goal, the parents seemed to have contributed to their children's attainment of eminence.

Interest. The role of interests in outstanding performance is an emerging theme in the literature on outstanding performance (Maltese & Tai, 2010; Milgram & Hong, 1999; Tai et al., 2006). In 2010, Ceci and Williams published a volume of work in which they examined the reasons for female underrepresentation in math-intensive fields. They concluded that "one of the most robust findings has been that women at all levels of math aptitude do not *prefer* [emphasis added] math-intensive careers in anywhere near the numbers that men do" (Ceci & Williams, 2010, p. 190). These findings are important in the context of giftedness because Ceci and Williams examined data related specifically to pursuing graduate degrees and faculty positions at research-intensive institutions in mathematics and related fields, the domain of individuals who are outstanding achievers in mathematics. Ceci and Williams's (2010) findings are supported by Su, Rounds, and Armstrong (2009), who conducted a meta-analysis of sex differences in interests on a sample of over 500,000 individuals. They found several differences with large effect sizes and concluded that "interests may play a critical role in gendered occupational choices" (Su et al., 2009, p. 859; cf. Robertson et al., 2010).

Differences in interests play a critical role in many gifted students' options and choices, and we need to understand more deeply what sparks and enhances those interests. Individuals who show tremendous potential in athletics and other performing domains are typically encouraged to pursue those domains. Often these individuals have potential in several areas and need to make a choice about which one they are going to pursue in early- to mid-adolescence (Sosniak, 1985d). Interests also play a role in academic domains. Tai et al. (2006) examined the impact of eighth graders' interest in science—assessed as expectation to be in a science-related career by age 30—on the probability of earning a life-science degree versus a non-science-related degree or a physical sciences/engineering degree versus a non-science-related degree by the year 2000. According to Tai et al., "an average math achiever with a science-related career expectation (or interest) has a higher

probability of earning a baccalaureate degree in the physical sciences or engineering than a high mathematics achiever with a non-science career expectation, 34% versus 19%" (p. 1144).

Interests also play a crucial role in channeling students into particular domains (Milgram & Hong, 1999). Although the connection between giftedness and interest is clear in talent domains such as sport and the arts (Csikszentmihalyi, Rathunde, Whalen, & Wong, 1997), it is less clear in academic domains, and it depends on the curriculum being offered in particular subjects and when students are exposed to them (e.g., disciplines like philosophy, astronomy, or sociology are not typically taught until after high school). Tai et al.'s (2006) findings suggest that even in gifted programs, if students have been identified based on general ability and there is no clear sense of a given child's talent domain and interests, it is probable that the child will not develop as much as he or she would were interests taken into account. The topic of interests—how they are nurtured, developed, maintained, or lost—is one that should elicit further research in understanding giftedness.

Passion. The notion of passion is an interesting one in gifted-and-talented education because it is often mentioned but seldom studied. Piirto (1998) refers to the "thorn" or call that drives the creatively productive person to pursue explorations in a domain. Ochse (1990) claimed that single-minded drive can lead to great intellectual or creative gains or to emotional disorders, and that many great artists, leaders, and scholars avoided pain, loneliness, and self-awareness by engaging deeply in their work. Nevertheless, we often fail to recognize that passion is directed toward a domain, rather than existing as a general characterization of the person.

A recent study in *Gifted Child Quarterly* illustrates this concern. Fredricks, Alfeld, and Eccles (2010) used data from a longitudinal study to examine passion in academic and nonacademic domains for a sample of high-school and college students who in childhood had been identified as either academically gifted or gifted in sports or the arts. They reported that students in sports and the arts were passionate about their involvement in these domains (e.g., "I love the game. . . . I want to play all the time"; "I love to play. . . . When I want to be alone I play my violin. When I'm feeling depressed, I play my violin. Even when I'm . . . feeling really happy I'll play my violin and I'll feel happier"; Fredricks et al., 2010, p. 23). However, this passion was not present in the academically gifted youth ("Well, I don't get all excited or anything, I mean, it's schoolwork"; Fredricks et al., 2010, p. 24). The authors concluded that passion is more apt to be present in nonacademic than in academic domains. However, Fredricks and colleagues interviewed athletically and artistically gifted youth about violin, baseball, or dance, yet they asked the academically talented youth about school in general (instead of specific subjects like physics or history), missing out on the opportunity to examine the relationship of passion to performance in specific academic domains of interest to the students.

Opportunity. Outstanding performance depends, in large part, on the opportunity to develop the talent that one has (Barnett & Durden, 1993; Tannenbaum, 1983). Opportunity provides a context for talent to be nurtured, sometimes even before it is recognized (A. W. Gottfried et al., 1994; Syed, 2010). This means that talents are more often developed in households with adequate financial and other resources (Collins & Buller, 2003). This suggests the need for greater access by talented individuals to high-quality talent-development programs. In discussing the concert pianists in the B. J. Bloom (1985a) study, Sosniak (1985a, pp. 417–418) commented,

> Parents began to consider what other activities they could allow their child to engage in without the possibility of harming his or her music making. Parents began making large sacrifices of time and money to get the child to a better teacher, buy a better piano, and travel to competitions. . . . The teachers found themselves working with students who could, perhaps become fine musicians. . . . the students found themselves working with teachers who were dedicated to music and who appreciated ability and commitment.

Of course, the person to whom the opportunity is offered must choose to accept it and commit to it (Noble, Subotnik, & Arnold, 1996; see discussion of task commitment above). Wai, Lubinski, Benbow, and Steiger (2010) examined the relationship between participation in precollege educational activities such as competitions and academic clubs, as well as in advanced and accelerated classes, and found that students with a richer density of these—what they called a "higher STEM dose" (p. 860)—had a higher rate of notable STEM accomplishments as adults, indicating that opportunity matters.

The ultimate marker of eminence in many academic domains is receiving a Nobel Prize. In 1977, Zuckerman reported on a study of 92 Americans who won a Nobel Prize in a science domain between 1901 and 1972. She based her theoretical framework on Merton's (1968) concept of accumulation of advantage. Her interviews traced the ways in which her study participants were labeled early in their careers as "comers," able to capitalize on opportunities for outstanding education and mentorship. According to Zuckerman, more professional advantage was derived from their choice of postsecondary education than from their social origins. Over half the laureates had studied or collaborated with previous laureates. These mentors inducted their protégés into the culture of the discipline and helped them develop a feel for important problems and elegant solutions. The mentors also mobilized resources, such as access to grants, fellowships, jobs, and publications, on behalf of their protégées. In sum, giftedness must be nurtured appropriately and pursued vigorously. Although it is not always clear whether the nurturing will pay off, it is abundantly clear that without the appropriate environmental conditions, the gift will never mature into what it could be (Worrell, 2010a).

Chance. Not all opportunities are calculated. Serendipity also plays a role (L. J. Coleman, 1995, 2005). In 2004, *60 Minutes* ran a piece on low-income adolescents of color from Harlem, four of whom were representing the United States at the Olympics in fencing that year. How did students from low-income backgrounds living in an inner city neighborhood get involved in such an esoteric sport? As chance would have it, a former Black fencing champion had retired to Harlem and began giving lessons 15 years earlier. His work provided the opportunity for many youngsters who may never have held a sword in their hands to discover that they had a talent for the sport. Along with their newly discovered talent, these youngsters also exhibited the interest, passion, and commitment to pursue the gift; and of course, they had a teacher to help them hone the gift appropriately (Haensly, Reynolds, & Nash, 1986).

Austin (1978) classified chance into four types. Type 1 is associated with luck. The individual plays absolutely no role in the outcome. Type 2 chance is a function of exploratory behavior and involves willingness to take advantage of opportunities that fortunately happen to exist in one's particular circumstances. The decision of the youth in Harlem to join the fencing team is an example of this type of chance. If these individuals had not chosen to use the opportunity that chance provided, they would not have achieved as they did.

According to Austin (1978), Type 3 chance only happens if one is already steeped in a domain, and thus able to benefit from a random remark or article. In other words, one's preparation allows for making opportune connections, as perhaps happened with the Nobel laureates in Zuckerman's (1977) study. Finally, Type 4 chance results from serendipitous action unique to the individual, such as a hunter chasing his dog into an unknown cave found to have magnificent cave paintings. Chance plays an important role in providing opportunities for talent development, and successful individuals learn how to prepare themselves to capitalize on Types 2 and 3 chance factors.

Cultural factors affect the expression of giftedness and talent. Researchers who study talent development recognize that all achievements exist and are valued within a sociocultural context (Csikszentmihalyi, 1988; Freeman, 2005; Simonton, 1994; Sternberg, 2005; Tannenbaum, 1986). Actions or outcomes are defined as achievements depending upon cultural values. For example, Sternberg (2004) noted that in a tribal culture, being exceptional at gathering food, hunting, or understanding the medicinal properties of herbs will be highly prized and may define giftedness. In societies that emphasize oral rather than written traditions, exceptional, expressive storytelling may be considered a hallmark of giftedness. In other words, domains of giftedness and definitions of talent differ across cultures.

Sociocultural environments affect talent development in other ways as well. Cultures that value certain fields and domains and make them more available to children via access to instruction and programs (e.g., chess, violin) will produce more prodigies and champions in those fields (Feldman, 1986; Gardner, 1983). Based on perceived national needs, societies may promote and value giftedness in particular areas at particular times—for example, the current emphasis on STEM talent that has been reignited in the United States. Broad ideologies also provide a framework for the purposes and goals of talent development—to honor the family in collectivist cultures, assist the state in communist societies, and maximize wealth in capitalist societies (Mandelman et al., 2010). Historical events focus attention on certain problems—for example, the current need for more environmentally friendly, renewable energy sources to reduce U.S. dependence on foreign oil—that result in fiscal resources and other forms of support being channeled into specific kinds of creative work that capitalize on specific talents.

Summary. There are those who contend that giftedness is an ability trait that separates those who are gifted from the rest of us, arguing that those who are gifted are qualitatively different from those who are not. Others contend there is no such thing as giftedness and that outstanding achievement is merely the outcome of appropriate opportunity and sufficient practice. The data support neither of these two extreme claims. General and domain-specific abilities, task commitment, and opportunity in the form of access to teaching and appropriate resources contribute to outstanding performance and to the development of eminence. Some important personality variables are common across domains of achievement, but others may be more closely associated with scientific accomplishments or more related to artistic endeavors. Creativity is also an important part of the equation, although it is not always clear if creativity is a predictor of giftedness, part of the outcome that allows us to identify giftedness, or both. If the claim is that gifted individuals are different by virtue of their combination of intensity, persistence, and ability that results in eminent productivity, we would agree. The distinguishing feature of those who are gifted is the commitment and sacrifice they are willing to make in pursuit of their creative productivity.

Barriers to developing giftedness

For more than a quarter century, gifted education has been criticized for the underrepresentation of children of color and those from low socioeconomic backgrounds (Baldwin, 1985; Ford, 1995, 1998; Maker, 1996; Melesky, 1985; Worrell, 2003, 2009), with blame being cast on identification procedures and societal racism. Many of these scholars compare the percentage of low-income and minority students in a school district with the percentage of students in its gifted program to determine underrepresentation. For example, based on data from the 2006 Elementary and Secondary School Civil Rights Survey (2006), Ford, Grantham, and Whiting (2008b) noted that

African American students are underrepresented by about 51% and Hispanic students by about 42% in gifted programs, relative to their proportion in the nation's schools.

However, most of these researchers fail to connect underrepresentation in gifted and talented programs to the larger issue of the achievement gap. African Americans, Latinos, and Native Americans are severely underrepresented among the top 1%, 5%, and 10% on almost every achievement measure, including grades, GPA, class rank, and standardized test scores—and at every level of education from kindergarten through professional school (Miller, 2004). Using data from the National Assessment of Educational Progress (NAEP) and state achievement tests, Plucker, Burroughs, and Song (2010) documented the underrepresentation of lower-income students, English-language learners, and historically underrepresented minorities at the highest levels of achievement—what the authors refer to as pervasive "excellence gaps." Without intervention, the achievement gap between high-ability European American and ethnic-minority students increases between Grades 5 and 8 (Clotfelter, Ladd, & Vigdor, 2007; Plucker et al., 2010; Wyner et al., 2009). Indeed, any analysis of the academic performance of students by ethnic and racial group provides a cogent explanation for the discrepancy between the proportions of groups of students in gifted programs and the general school population (Aud, Fox, & KewalRamani, 2010).

The reasons and causes for the achievement gap are many and varied. They include a host of factors that could be labeled educational malnourishment (L. J. Coleman, 2005). Among them are lack of access to supplemental educational programs and other educational tools including technology; poor quality schools with underprepared teachers; lower teacher expectations; low levels of parental education and parental involvement; cultural and language differences; negative peer influences; geographic mobility; academic declines over the summer months; and lack of tacit knowledge about higher education (Arnold, 1995; Darling-Hammond, 2001; Ferguson, 2008; Jussim & Harber, 2005; Sampson, 2002; Sosniak, 2005). The most potent of these is poverty, which is related to many of the other variables listed.

Several psychosocial factors have also been posited (Aronson & Steele, 2005; Beilock, 2010; Dweck, 2006; Mickelson, 1990; Ogbu, 2003; Steele, 1997; Steele & Aronson, 1995), with many of these focusing on the intersection of students' personal and social identities (Worrell, 2009, 2010b). Cultural ecological theory (Ogbu, 2003) suggests that African American students may actively resist doing well, because achieving academically is perceived as giving up one's Black identity and acting White. This hypothesis has been supported by several studies. For example, Ford, Grantham, and Whiting (2008a) found that high-achieving African Americans reported that doing well in school and taking honors and advanced classes were associated with acting White, whereas underachieving and pretending not be smart were associated with acting Black. On the other hand, Steele (1997) and colleagues suggest that stereotype threat undermines the performance of African Americans with particularly potent effects on the performance of those who care the most about doing well. According to Aronson, Fried, and Good (2002), stereotype threat derives much of its power to create anxiety from a fixed mindset (Dweck, 2006), as it feeds the individual's apprehension that he or she is unalterably limited. A number of social psychologists are now arguing that "unidentified or unremedied psychological threats" consistently undermine the academic performance of minority students (Walton & Spencer, 2009, p. 1137).

These theoretical formulations suggest that high-ability or high-achieving students from low-income or ethnically and racially marginalized backgrounds may experience psychosocial stress reconciling their social identity with their academic or achievement identities. This may have the effect of decreasing their sense of belonging in and willingness to participate in gifted programs or advanced classes (Good, in press; Worrell, 2010b). However, there is a debate about how well these effects generalize to different school settings with different school populations (Fuller-Rowell & Doan, 2010) or beyond the laboratory to the real world (e.g., Aronson & Juarez, in press; Cullen, Waters, & Sackett, 2006). In summary, although there are several theories explaining the disparities in achievement in our society that contribute to the underrepresentation of low-income and minority students in gifted education, these issues are manifested in unique and different ways that have been understudied and need further attention by scholars.

Expected outcomes of gifted education

If one accepts the view of giftedness as a hereditary characteristic, it follows that the field simply needs to learn how to reliably identify it. A contrasting view associates giftedness with accomplishment (Subotnik, 2003). From this perspective, what determines whether individuals are gifted or not is not *who they are* but *what they do*. From this point of view, it really does not matter how high an individual's IQ is if that person never makes a substantive and substantial contribution to some field of endeavor. Given that most contributions are made by adults and there is a growing literature on the importance of talent development, one can argue that giftedness in children is probably best described as *potential*. This suggests that to maintain the label of "gifted" in adolescence and adulthood requires turning potential into outstanding accomplishments (L. E. Brody, 2006; L. J. Coleman, 1995). This debate can be formulated in terms of at least two rival views of what gifted education should lead to: self-actualization versus eminence.

Self-actualization. The Roeper School is an example of gifted education with self-actualization as a goal (Roeper, 1996). Designated as a school for the gifted in 1956, the Roeper School is concerned with creating a "safe, joyful community of learning where each child can become their best self" (p. 18). Annamarie Roeper argued that gifted education

has focused on developing the cognitive abilities of children; from her point of view, gifted education should be concerned with "the growth of the individual as well as his/her responsible membership in the world community" (p. 18). These ideas are reflected in the mission and philosophy of the school (see www.roeper.org/) Annamarie Roeper and her husband founded. The Roepers' primary concern about talent development was not about contributions to science, philosophy, or art; as Annamarie Roeper put it,

> It is my belief that the gifted child is emotionally different from others. The Self of the gifted child is structured differently. The depth of their awareness is different. The center of their inner life is different. Their view of the world is more complex in a fundamental way. That is why one cannot say the child is "partially gifted" in certain areas only and not in others. (Roeper, 1996, p. 18)

Success, from this perspective, is based on gifted children maximizing the development of this emotionally different psyche. Although this view of giftedness is still prevalent in many quarters, there is little empirical support for viewing gifted people as qualitatively different.

Development of eminence. In 2003, Subotnik commented on the surprise she had felt a decade before at realizing that graduates of an elite program for high-IQ children had not made unique contributions to society beyond what might be expected from their family SES and the high-quality education they received (see Subotnik, Kassan, et al., 1993), and posed the following question to readers: "Can gifted children grown up claim to be gifted adults without displaying markers of distinction associated with their abilities?" (Subotnik, 2003, p. 14). Several years later, Subotnik and Rickoff (2010) contended that the answer is no: (a) Gifted children need to become eminent producers to be labeled gifted as adults, and (b) society has a right to expect outcomes from its investment in developing children's gifts. To accomplish the goal of producing eminent adults, society will actually have to invest in developing children's gifts by studying talent in various domains, assessing the benefits and costs of early specialization, ensuring apprenticeships and mentorships, and supporting psychosocial-skill development. The premise here is that gifted education should have a specific goal. In this case, the goal is to develop the talents of children and youth at the upper ends of the distribution in all fields of endeavor to maximize those individuals' lifetime contributions to society. The talent-development goal does not mean that self-actualization is not important; rather, the suggestion is that self-actualization should not be the explicit goal of gifted-education programs. In any case, longitudinal studies (e.g., A. W. Gottfried et al., 1994; Terman & Oden, 1959; cf. Subotnik & Arnold, 1994) make it clear that outstanding accomplishment in the domain of their talent is an important part of the self-actualization of gifted adults.

Educating gifted students

Given aspirations for preparing young people to be outstanding contributors, are there pedagogical practices that are appropriate only for gifted children (Karnes & Bean, 2009)? This question has generated some debate in gifted-education circles. Is gifted education just effective teaching or does it involve strategies that work only for gifted learners. Several researchers have concluded that some strategies employed in gifted education are useful with all children while others are not (e.g., A. Robinson et al., 2007; N. M. Robinson et al., 2000; Shore & Delcourt, 1996; VanTassel-Baska et al., 2009). Such strategies include inquiry, interdisciplinary explorations, and problem-based learning. If true, this strand of evidence reinforces our policy perspective decrying the zero-sum-game approach to investments in gifted and general education.

Two approaches, enrichment and acceleration, are the most frequent strategies employed in gifted education, and we discuss these in a bit more detail. We also discuss psychosocial coaching and selective institutions for elite performers, less common educational offerings for gifted students that have elicited interest and research as well.

Enrichment. Enrichment is a term used to describe a set of programming options that extend and supplement the regular curriculum and often include topics that are not typically covered in the curriculum (Adams & Pierce, 2008; L. Coleman & Cross, 2005; Gavin & Adelson, 2008; Olszewski-Kubilius, Lee, Ngoi, & Ngoi, 2004; Reis, 1995, 2008; Reis & Renzulli, 2010). Visits to Web sites of well-known summer programs for the gifted yield a range of topics for children and youth that are not typically available in the regular-education classroom (e.g., Human Anatomy for fourth graders; Robotics for middle schoolers). These classes are not accelerated in that they are not being taught at the level of sophistication at which they would be offered in high school or college, although enrichment can lead to accelerated placement.

The distinction between enrichment and acceleration can be fuzzy, because enrichment offers access to topics that these students would typically not study in their regular school offerings. The goal of enrichment classes is to allow students to engage with a subject in more depth than they would in a traditional classroom. Although enrichment is perhaps the most frequent programming option for gifted students (especially in regular-education settings), with rare exceptions (Olszewski-Kubilius & Lee, 2004), the literature reports almost no formal evaluations of the effects of these programs. Moreover, it is probable that enrichment strategies are useful for all students (A. Robinson et al., 2007; N. M. Robinson et al., 2000).

Acceleration. Acceleration is based on at least two premises. The first is that academically gifted students can acquire and process information more rapidly than their peers. Second, by

virtue of their speed and depth of knowledge acquisition, gifted students often have mastered advanced levels of content in subject areas, thereby necessitating above-grade-level placements. Acceleration encompasses a variety of strategies, including those that allow students *earlier* access to courses and content than their same-aged peers. Examples include early entrance to any level of schooling, grade skipping, placement in a higher grade level for instruction in a single subject (subject-area acceleration), and Advanced Placement courses (early access to college courses). These options can also include accelerating the pace of instruction within courses (e.g., self-paced classes, fast-paced classes, telescoped or compressed classes), so that two years of material are covered in one academic year. There is general consensus in the field, supported by the extant literature, that acceleration is a uniquely appropriate instructional strategy for gifted learners (Argys, Rees, & Brewer, 1996; Colangelo, Assouline, & Gross, 2004).

Research evidence about the efficacy of acceleration is overwhelmingly positive. Kulik (2004) conducted several meta-analyses of research studies on acceleration with elementary and secondary students. When compared to students of the same age and ability who were not accelerated, accelerated students demonstrated superior levels of achievement, with a large median effect size, and their achievement was comparable to older, non-accelerated students. Kulik (2004) also found that acceleration had a positive influence on educational aspirations, particularly plans to pursue higher education beyond the bachelor's degree. Kulik's findings replicated results from previous meta-analyses (e.g., Kent, 1992; Kulik & Kulik, 1984; Rogers, 1992). Rogers (2004) computed the amount of additional growth for accelerated students placed in various types of programs and found that growth ranged from 1.9 months in multigrade classrooms to 3/5th of a year for students in telescoped classrooms (designed so that students cover several years of content within a given academic year). Support for acceleration also comes from recent work indicating that accomplishments in STEM fields are related to the amount of "advanced pre-collegiate educational opportunities in STEM" (Wai et al., 2010, p. 860) that are taken.

In a study of 60 gifted individuals in Australia, Gross (1993, 2004, 2006) reported similar findings about the benefits of acceleration. Participants in this study were chosen on the basis of IQ scores greater than 160 when they were between 5 and 13 years old. Seventeen of the participants were radically accelerated, allowing them to graduate from high school three years early. In a 20-year follow-up study, Gross (2006, p. 416) reported that the 17 students who were radically accelerated were "characterized by a passionate love of learning;" they all "graduated with extremely high grades and in most cases, university prizes for exemplary achievement . . . and almost all have gone on to obtain their PhD." Gross also pointed out that participants who were accelerated two years also generally did well but not as well as the radically accelerated group. She also found that participants who were accelerated only one year or not accelerated were less satisfied with their education, and the latter group had students who dropped out and experienced problems with psychological well-being. This study is unique in finding that students who were not accelerated experienced adjustment difficulties. These results suggest that acceleration may be especially important and effective for the exceptionally gifted, as other studies have not always found adjustment differences between students who were accelerated and those who were not (e.g., Benbow, 1990). It is also possible that students who appeared poorly adjusted were less likely to be recommended for acceleration.

Few studies find negative social or affective consequences associated with acceleration for groups of students, although negative effects have been observed for individuals (Freeman, 2010; Neihart, 2007) There is empirical evidence of decreases in academic self-concept or academic self-esteem on the part of students in accelerated or otherwise selective programs (N. M. Robinson, 2008b). Marsh and colleagues (Marsh, Chessor, Craven, & Roche, 1995; Marsh & Hau, 2003; Seaton, Marsh, & Craven, 2009) call this phenomenon the big-fish-little-pond effect (BFLPE) and have found compelling cross-cultural evidence that students who attend selective schools (including accelerated programs) may develop less positive perceptions about their academic abilities once they have left behind being a top student in a less competitive environment. We think these findings support the argument we make later for the importance of psychosocial coaching for academically gifted students.

Although Marsh et al. (1995) see this decline as a concern, researchers in the gifted field question whether an unrealistically high self-concept or even one that is lowered upon entrance into a selective school or program is detrimental to long-term achievement or to social and psychological adjustment (Plucker et al., 2004). It is unknown whether the BFLPE occurs for other forms of acceleration such as grade skipping or subject acceleration, as these have not been specifically studied, although there is some evidence that the BFLPE does not occur in supplemental, outside-of-school gifted programs (Makel, Lee, Olszewski-Kubilius, & Putallaz, 2010). Also, it is not clear how other characteristics, such as resilience or coping skills, moderate potential negative impacts of a selective academic environment on self-esteem and whether interventions employing skills training might neutralize BFLPE effects.

Acceleration strategies for gifted students are not used frequently in schools, in part due to the difficulties of scheduling, especially across levels of schooling, requiring students to leave the building to acquire needed services (e.g., elementary-school-aged students attending a middle school for mathematics instruction; Colangelo et al., 2004). Many outside-of-school summer programs for the gifted provide the opportunity for students to accelerate their learning by offering semester- or year-long courses compressed into a few weeks of intensive instruction (Olszewski-Kubilius, 2008b). With some important exceptions, research studies have generally reported few negative effects on the adjustment of children who enter school early (N. M. Robinson, 2008a). Problems are more likely to occur with very young children in the early primary years. And

there is some evidence that grade skipping during the K–12 grades or early entrance to college can result in adjustment difficulties, particularly if students are not appropriately assessed for readiness or are placed with teachers who have negative attitudes toward acceleration or unrealistic expectations for performance and maturity (L. E. Brody, Muratori, & Stanley, 2004; Freeman, 2010)

Psychosocial coaching. As noted previously in this monograph, the process of achieving eminence requires psychosocial strength (Simonton, 2000a; Subotnik & Jarvin, 2005). In a study of successful elite coaches from 13 different sports, Martindale et al. (2007) found that key aspects of talent development included preparing athletes for and supporting them through key transitions. Sport psychology has developed a number of techniques for coaching that are ripe for further empirical study such as goal setting, imagery, relaxation, concentration, and self-talk (Burton & Raedeke, 2008; Hanton, Thomas, & Mellalieu, 2009; Kornspan, 2009; Lehman et al., 2007; MacNamara & Collins, 2009; MacNamara, Holmes, & Collins, 2008; Weinberg & Comar, 1994; Williams & Krane, 2005) in sport and other domains.

Taking a developmental perspective, Jarvin and Subotnik (2010) suggested that the type and relative importance of various psychosocial skills required for transformation of abilities into competencies, competencies into expertise, and expertise into eminence differ, and that one of the functions of a good teacher is to offer appropriate psychological strength training in addition to information specific to the talent domain. Academically talented students, who also live and work in competitive and occasionally stressful environments (Preuss & Dubow, 2004; Shaunessy & Suldo, 2010; Suldo, Shaunessy, Michalowski, & Shaffer, 2008), only rarely have access to psychological coaching. This omission is especially glaring before graduate school, as academic talent during the school years and even in college is pursued mostly in classroom settings, as opposed to working with an individual teacher, mentor, or coach. It is also the case that school and college teachers receive no systematic training in this dimension of differentiated instruction.

Selective institutions. The most intensive educational option for developing talent is found in elite training centers, conservatories, and special schools (L. J. Coleman, 2005). These institutions offer psychological scientists opportunities to study optimal performance and the psychosocial dimensions of talent development. The results of studies regarding the most powerful components of these environments might be generalizable to schools and out-of-school environments serving gifted young people without access to elite institutions.

Academic institutions. Some special schools target a limited number of academic domains, and some focus on more general academic-talent development. The most intensive special schools existed in the Soviet bloc countries. According to Donoghue, Karp, and Vogeli (2000), Chubarikov and Pyryt (1993), and Grigorenko and Clinkenbeard (1994), the impetus for specialized science schools came in the late 1950s from distinguished scientists advocating for educational opportunities to develop future generations of scientists. In order to increase the geographical reach of the schools, several included boarding facilities. Admission to the schools was based on stringent criteria, including having already competed well in regional competitions. The faculty of these schools included pedagogically talented educators (Karp, 2010), and students had the opportunity to work with renowned professors as well. An example of one of these specialized institutions is the residential Kolmogorov School (Chubarikove & Pyryt, 1993), which enrolls 200 students per year from Russia, Belarus, and beyond. Selection was and continues to be based on a record of success in regional Olympiads. Professors from the prestigious Moscow State University serve as the faculty, the coursework is heavy and intense, and students are expected to conduct independent projects on topics of interest to them.

Grigorenko and Clinkenbeard (1994) reported that students attending Soviet special schools were uncharacteristically (for the Soviet Union) encouraged to be intellectually aggressive and competitive. They added that the curriculum in these schools shortchanged the humanities and social sciences, focusing overwhelmingly on excellence in mathematics and science. Although the schools were often denigrated by Soviet educators and psychologists, who argued that outstanding achievement was achieved exclusively from hard work and commitment, these arguments were countered by famous scientific advocates (Donoghue et al., 2000). The schools, which continue to exist in some form today, have graduates on the faculties of the most prestigious institutions in Russia. However, many graduates of these schools are also found in the academic ranks of Western universities, leading Russian policy makers to question the value of further investment.

The United States created its first specialized technical high school—Stuyvesant High School—in New York City in 1904, and this was followed by Brooklyn Technical High School in 1922 (Thomas & Williams, 2010). Although both originated as boys' vocational schools, they transformed into powerhouses in science and engineering and were joined by the Bronx High School of Science in 1938. The first state residential high school in the United States, the North Carolina School of Science and Mathematics, was established in 1980. In the mid 1980s, most likely in response to *A Nation at Risk* (National Commission on Excellence in Education, 1983), public support led to the establishment of a number of other selective schools around the country designed to serve students talented and interested in STEM. Among them were residential schools (e.g., the Illinois Mathematics and Science Academy and the Arkansas School for Mathematics, Sciences and the Arts), part-time programs (e.g., the Central Virginia Governors School and the Kalamazoo Area Mathematics and Science Center), schools within schools (e.g., Montgomery Blair Science, Mathematics, and Computer Science magnet), and other technical schools based on the New York City

model (e.g., Thomas Jefferson High School for Science and Technology).

The White House, the U.S. Department of Education (National Research Center on Gifted and Talented, in press), and the National Science Foundation have recently promoted studies looking at the impact and effectiveness of these programs. One large-scale study currently underway will compare graduates of such schools with a group of equally able and interested peers who did not enroll in specialized schools. A focus of the study is relative rates of completion of STEM majors (Subotnik, Tai, Rickoff, & Almarode, 2010). This and other outcomes will be analyzed with the aim of teasing out the variables most associated with maintaining and enhancing the U.S. pipeline of scientific innovators.

Other U.S. schools have been created to serve the needs of academically able students, without a special focus on any particular domain. Examples of such institutions include Hunter College Campus Schools and University of Illinois Laboratory High School. These highly competitive environments were designed to prepare future leaders, scholars, and creative thinkers (e.g., Hildreth, Brumbaugh, & Wilson, 1952). Early promoters of programs for intellectually gifted children identified the importance of appropriate psychosocial-skills preparation (Hildreth et al., 1952; Witty & Lehman, 1928), but those proposals were not institutionalized in the schools, at least after the early years. The small number of such schools makes it difficult to conduct large-scale investigations of their effectiveness and impact, although some promising qualitative studies are underway (Chester Finn, personal communication, July, 22, 2010).

Athletic training. In the performance arenas of athletics and the arts, training institutions are closely tied to the gatekeepers and agents associated with attaining success in a field. Sport selection and training are based on what is considered best practice as well as scientific studies of mental- and physical-skill enhancement. According to the International Olympic Committee (Mountjoy et al., 2008), elite child athletes have distinct physical, social, and emotional needs that vary with developmental level. Explicit attention is focused on creating a healthy motivational climate through mental-skills training in goal setting and behavioral, cognitive, and emotional control. Training centers for sport are urged to create an atmosphere for young athletes that is free of harassment and inappropriate pressure from adults, so that they can focus on meeting and exceeding performance goals.

The U.S. Olympic Committee sponsored a study (Gould, Dieffenbach, & Moffett, 2001) to investigate the development of psychological strength in U.S. Olympic champions. According to Gould et al., in order to become a champion, individuals need to master both physical- and mental-skills in training. The study delineated the following characteristics of successful Olympic athletes: ability to focus, mental toughness, goal-setting ability, coping ability, competitiveness, confidence, coachability, drive, intrinsic motivation, optimism, adaptive perfectionism, automaticity, and emotional control. Coaches who work with young Olympic athletes promote hard work and discipline, teach mental skills, provide encouragement, and elicit trust.

Musical training. Music conservatories for Western classical music are interesting environments in which to study talent. They are rich in traditions that span decades, if not centuries, and share common programs around the globe. One of the first studies conducted in a music conservatory was by Kingsbury in 1988. Kingbury's goal was to describe the cultural system that supported the development of musical talent and performance. He argued that the cultural mores of the conservatory were similar to those in a seminary, with music as the source of devotion for the students. Another distinguishing feature of the conservatory is the studio (i.e., instrumental) teacher, who provides individualized and highly focused lessons to their talented charges (see also Olmstead, 1999). A majority of studio teachers also have their own performance careers.

Subotnik (2000, 2004) described the implicit and explicit curriculum of the Juilliard School's precollege and conservatory programs. More implicit components include inculcating beliefs and values, such as deep devotion to one's art and to one's teachers, that are associated with successful negotiation of the conservatory years. Specific courses that focus explicitly on some of the same mental-skills training used in sport institutes have been added in recent years to directly address variations in outcome from "star" to underachiever. The skills are taught by music coaches and agents and are offered in each instrument department at elite institutions like Juilliard (Olmstead, 1999) and the Royal College of Music (Williamon, 2004). Subotnik (2004) recommended that the following components of the conservatory be considered for appropriate adaptation in academic domains far before the dissertation stage:

- Employ audition (e.g., paper presentation) for purposes of admission
- View each student as a unique challenge with his or her own profile of skills, talents, personality, and interests
- Provide regular opportunities for public demonstration of skills and creative work
- Encourage students to apply to advanced programs based on the talents and creative productivity of the faculty, as is currently the case in pursuit of the PhD, rather than on the general reputation of the institution
- Provide psychosocial-skills training designed to enhance opportunities for success in a highly competitive environment

Throughout their history, institutions for the development of elite talent have struggled with diversity and inclusion. In athletics, the degree of diversity by race and ethnicity varies by sport, and financial resources for female athletes remains a point of contention. These highly focused organizations serve a special role in preparing the most competitive candidates, and the zero-sum game of admission looms heavily on both the candidates and the admissions directors each year.

IV. Talent-Development Models

Talent-development models have emerged from scholars' desire to organize empirical literature and retrospective studies of highly accomplished learners, creators, and performers in ways that might be useful for research and practice (Olszewski-Kubilius, 2000; Sternberg & Davidson, 2005). The models aim to delineate the pathways from childhood precocity to adult accomplishment in specific domains while seeking to be economical, understandable, and generative of further empirical work (Davidson, 2009). Although families set the stage for the development of elite talent, most of the models focus on variables associated with expert teachers or mentors, individual abilities, and psychosocial factors. Two models (Gagné, 2005a; Tannenbaum, 1983, 2003) feature the role of chance. All of the models recognize general and specific ability as factors, as well as the role of expert instruction and mentoring in developing optimal performers and producers. All of them acknowledge the central role of personal commitment to hard work (Ericsson, 1996; Simonton, 1997) and a drive to excel, whether derived from intrinsic or extrinsic sources (Ochse, 1990; Simonton, 1997).

We present here a sampling of models that represent this body of literature. Four models have served as the foundation for programs used in schools in the United States and in other countries. These include the developmental model of giftedness and talent (DMGT; Gagné, 2005a); the enrichment-triad model (Renzulli, 2005); talent search (Stanley 1976, 1985); and the wisdom, intelligence, creativity, synthesized model (WICS; Sternberg, 2003, 2005, 2009). The talent-search model—perhaps the best known—has been the basis for numerous outside-of-school programs as well as some in-school programming. Most of the work associated with these models focuses on the school and early university years. Other talent-development models (e.g., B. J. Bloom, 1985a; Feldman, 1986; Piirto, 1998; Subotnik & Jarvin, 2005; Tannenbaum 1986, 2003) we will describe are designed to explain the evolution of talent over time, going beyond the school years into adult eminence, but do not have networks of school programs associated with them. Two of these models (B. J. Bloom, 1985a; Subotnik & Jarvin, 2005) are derived from interviews and observations of talented people in various domains.

Models based on variables associated with talent development from childhood to adulthood

Three of the models represent efforts to identify variables associated with transforming potential into notable accomplishment. These models do not place the components into a trajectory but provide a framework for indicating how each variable on its own is necessary but not sufficient to maximize potential.

Tannenbaum's talent-development model. One of the first scholars to present a theory explicating the talent-development process from childhood to adulthood was Tannenbaum (1983, 2003). He defined giftedness in the following way:

> Keeping in mind that developed talent exists only in adults, a proposed definition of giftedness in children is that it denotes their potential for becoming critically acclaimed performers or exemplary producers of ideas in spheres of activity that enhance the moral, physical, emotional, social, intellectual, or aesthetic life of humanity. (1986, p. 33)

The Tannenbaum model consists of five components, all of which must be in place to transform early potential into exceptional contributions in adulthood. The components include general ability, special or domain-specific ability, psychosocial abilities, external support, and chance. Tannenbaum argued that the amount of *g* needed varies by domain. If sufficient *g* exists for succeeding in a domain, it must be accompanied by foundational abilities or propensities associated with that domain, such as musicality or a mathematical cast of mind (Krutetskii, 1976).

In addition to *g* and special abilities, a person needs interpersonal skills, motivation, and perseverance to overcome impediments to their talent-development trajectory. The more revolutionary the idea or performance, the more psychological strength is needed. Furthermore, at least one person in the individual's life must also provide encouragement to appreciate the joys and persist through the challenges of the talent-development process. Finally, Tannenbaum (1983, 2003) reminded us that it is impossible to remove the role of chance in the fulfillment of potential. Chance factors can be as basic as the genes one inherits, the circumstances of the family that one is born into, or the geographic setting in which one grows up (e.g., a city with many nearby opportunities to pursue activities of interest vs. a rural area with fewer such opportunities but more community ties and individual attention). More important, chance factors offer random matches or mismatches between gifts and the values of a society at a given moment in time and in an individual's proximal environments.

Wisdom, Intelligence, Creativity Synthesized (WICS). According to Sternberg and his colleagues (e.g., Sternberg, 1998, 2001, 2003; Sternberg, Jarvin, & Grigorenko, 2011), giftedness is the development of expertise, is associated with excellence relative to peers, and is rare within a given context. For example, among academically talented young adults, becoming a graduate student is not a sufficiently rare phenomenon to warrant the label "gifted" (unless this person emerges from extremely difficult circumstances). Giftedness also requires demonstration of productivity in valued domains.

Sternberg (2005) joined Tannenbaum (1983, 2003) in stressing that outcomes of talent development should serve the common good. In his WICS model, Sternberg explicated how determining the common good involves balancing intrapersonal, interpersonal, and extrapersonal needs and interests. In order to meet this challenge successfully, one needs intrinsic motivation and courage. WICS and all of Sternberg's work supporting this talent-development model highlight the role of intelligence, creativity, and practical knowledge. Practical or implicit knowledge helps to ensure that the investments made in developing talent connect with an audience and are therefore fully realized. According to Sternberg, practical intelligence promotes capitalizing on one's developed strengths to achieve desired, culturally relevant goals while shoring up weaknesses. Practical intelligence (Wagner 1994; Wagner & Sternberg, 1985) also allows talented individuals to gain access to gatekeepers and to domain-specific insider knowledge.

Co-incidence model. Feldman's (1986) co-incidence model is designed to explain why prodigies emerge in some domains and not others. Prodigies are individuals who perform at extremely high levels within a specific field at a young age (Feldman, 1986). The model does not address adult eminence. Components of the co-incidence model include biological proclivity toward a domain, access to master teachers, family recognition and support, and deep passion for the domain. Although not mentioned explicitly in the model, the role played by chance is reflected in another dimension explicated by Feldman: the fact that only some domains are within the physical and conceptual reach of children. These are domains in which prodigies excel, such as chess, music performance, or some subsets of mathematics. Chance also plays a role in the convergence of all of the supporting factors that lead to prodigious outcomes.

Models featuring talent trajectories

A second set of models takes components of talent development and places them into a sequence, although the sequence is not framed specifically as a developmental process.

Enrichment triad model. Like Feldman's (1986) co-incidence model, Renzulli's (1977, 2005) enrichment-triad model focuses mostly on developing talent in childhood and youth. In the enrichment-triad model, the variables that provide the basis for developing giftedness are above-average cognitive ability, creative ability, and task commitment. Renzulli argued that the talent pool for developing giftedness consists of individuals in the top 15% to 20% on these three constructs, and he suggested that the development of talent is related to an appropriate sequence of educational experiences conducted in schools. He divided the educational experiences into three stages: enriched activities in a number of domains (Stage 1), specific and advanced instruction in domains of interest (Stage 2), and experiences that foster creative productivity that may lead to adult career contributions to benefit society (Stage 3).

Pyramid model. Piirto's (1998) pyramid model also begins with a foundation of abilities that come from genetic contributions and develop through training of psychological and cognitive skills. The direction of development is influenced by the values held by families, schools, communities, and cultures. These influences can afford or disallow opportunities to pursue talents and interests. According to Piirto, psychological attributes such as insight, passion, persistence, and creativity outweigh intelligence in determining the likelihood that one will gain recognition by one's peers for making something valuable and new.

DMGT. Gagné (2005a) employed a similar set of variables as Tannenbaum (1983), but he placed them in a sequence framed in the transformation of natural gifts into high-level mastery or expertise (although not necessarily eminence) in a domain. In the Gagné model, intellectual, creative, socio-affective, and sensorimotor abilities serve as a foundation for the talent-development process when those gifts are displayed at a very high level. Gagné also incorporates learning and practice into the mechanisms that drive talent development, with environmental and intrapersonal catalysts (such as temperament) serving as facilitators or inhibitors of the process. Gagné gives chance a prominent role in his model, as it affects the availability of learning opportunities and environmental supports, as well as whether one exhibits psychological traits conducive to motivation and persistence. The successful transformation of potential gifts to actualized talent is indicated for Gagné by a level of accomplishment above the 90th percentile of same-age peers with similar levels of investment in the field.

Talent search. The talent-search model was developed by Julian Stanley (cf. Stanley, 1976) based on his interest in extreme precocity in mathematical-reasoning ability. An important component of the model is domain-specific testing in key cognitive areas such as verbal, mathematical, and spatial reasoning using above-grade-level instruments that have sufficient ceiling to accurately measure the abilities of gifted children.

Another component of the model is achieving an optimal match between tested ability and the level of educational programs provided, which include in-school and outside-of-school programs. This optimal match is obtained by accelerating students as necessary and by adjusting and tailoring the pacing of material to the abilities of the students. The talent-search model hypothesizes that motivation, task commitment, and perseverance are facilitated and engendered by the appropriate levels of challenge achieved through this optimal match. An appropriate match also involves student interests, passions and values. Because these factors change, and since abilities develop over time, the nature of optimal programming and career paths for individual students can also

change over time (N. M. Robinson, 2008b; N. M. Robinson & Robinson, 1982). As we cited in other parts of this monograph, there is a great deal of empirical support for the predictive validity of the domain-specific identification system involved in talent search (Olszewski-Kubilius, 2004) and for the efficacy of educational programs built on domain-specific talent identification for developing high levels of talent in mathematics and science domains (e.g., Benbow, 1992; Lubinski et al., 2001; Park et al., 2007, 2008; Robertson et al., 2010; Wai et al., 2005, 2010).

Models that feature developmental changes over time

The second group of models we described suggests a trajectory for talent-development variables. The variables in the next set of models we present change in importance according to developmental stages.

Bloom's model. The model developed by B. S. Bloom (1982b; B. J. Bloom, 1985a; B. J. Bloom, 1985b) and his colleagues (e.g., Kalinowski, 1985; Sloane & Sosniak, 1985; Sosniak, 1985a, 1985d) addresses the contributions made by teachers to the evolution of outstanding talent. At each stage of the model, teachers play a central role unique to that stage. The first stage is exemplified by playful engagement with a topic or domain of interest that elicits rapid progress on the part of the child and is reinforced by parents and teachers. Over time, playful interaction is insufficient for a child whose interests are deep and who seeks other peers exploring similar pursuits. Parents search for the best possible teachers or coaches to provide instruction in technique, content, and rules associated with that domain in Stage 2. Should talented young people persist in their interest and commitment to the extent that they wish to make the domain a life choice (Stage 3), then a third type of teacher guides them to develop a personal niche for their creative work.

The scholarly productivity/artistry (SP/A) model. The SP/A model (Subotnik & Jarvin, 2005) builds directly on B. J. Bloom's (1985a) work as well as on Sternberg's (1998) conception of transforming abilities into competencies and competencies into expertise. Inspired by Bloom and Sternberg's approaches, Subotnik and Jarvin reformulated Bloom's three stages to apply to the musical and mathematical domains.

In the SP/A model, psychosocial skills serve as the catalysts of movement from one stage to another. Some psychosocial variables remain constant and others change. The age at which the first stage begins depends on the instrument or domain of talent. As development progresses, three variables remain constant: musicality (or in the case of mathematics, mathematical cast of mind; Krutetskii, 1976), intrinsic motivation, and persistence. The first stage of SP/A is the transformation of abilities into competencies, a process mediated by parental support or pressure, the young person's willingness to learn, and sufficient extrinsic rewards. The second stage involves the transformation of competencies into expertise, with the following variables as mediators: parental support (not pressure), differentiation from one's teachers, recognition and opportunities to perform, and social skills such as collegiality.

Two psychosocial variables are particularly important in Stage 2: self-promotion and learning how to "play the game." Additionally, many young people experience a loss of self-confidence at this stage when encountering other highly talented individuals for the first time and need assistance in restoring their self-confidence in order to proceed. The third stage of the model involves the transition from expertise to scholarly productivity and artistry. At this point, the talented individual focuses more exclusively on his or her strengths, is promoted through an agent or mentor, takes strategic professional risks, and according to gatekeepers interviewed by Subotnik and Jarvin, relies increasingly on psychosocial/political skills and charisma over technical skills.

Summary

Sternberg and Davidson's (2005) edited volume contains descriptions of many of the talent-development models. Davidson (2009) and Mayer (2005) provide analyses of several of them. These resources show that current models share common variables and attempt to explain the movement from potential to accomplishment. Although several of the models describe systems that are in use, only a few (e.g. talent search, the enrichment-triad model, WICS) have been translated into systematic educational programs. To date, however, there have been no comparisons of models using experimental studies that would enable researchers to determine their relative effectiveness for developing talent in specific domains. Nevertheless, the models establish frameworks that can guide future research.

V. A Proposed Talent-Development Mega-Model

In this section, we propose a mega-model of talent development—that is, a model integrating the most compelling components of already-established models, intended to apply to all domains of endeavor. A comprehensive model of talent development should take into account when a domain can first be expressed meaningfully—whether in childhood, adolescence, or adulthood. The point of departure could be based on physical factors (e.g., muscle mass or puberty) in sport, music, or dance; depth of experience in areas such as diplomacy or public policy; or exposure to anthropology or sociology, as courses in these fields are not typically offered until college.

The trajectory of elite talent evokes images of beginning with a relatively small base of talented individuals and ending with a tiny cadre of eminent adults. However, the disconnect between childhood giftedness and adult eminence (Cross & Coleman, 2005; Dai, 2010; Davidson, 2009; Freeman, 2010;

Hollinger & Fleming, 1992; Simonton, 1991, 1998; Subotnik & Rickoff, 2010; VanTassel-Baska, 1989), as well as the outcomes of individuals who receive unexpected opportunities (Gladwell, 2008; Syed, 2010), suggest that there is a much larger base of talent than is currently being tapped. Additionally, previously nonexistent fields like newly recognized Olympic sports or applications for phones and other electronic devices are coming into being, with opportunities for different groups of individuals to achieve recognition for innovation in yet-to-be conceptualized arenas. If more systematic translations of research on talent domains were available, we could develop the talents of a wider range of young people and be better prepared to promote talents in newly developed fields of endeavor.

A comprehensive model should also take into account the acuities or propensities that can serve as signs of potential talent. These can include, for example, deep interest (Tai et al., 2006), musicality (Subotnik & Jarvin, 2005), or mathematical cast of mind (Krutetskii, 1976). Some of these propensities or interests are developed exclusively outside of school, and some can be accelerated and enriched in school, but none is developed exclusively in school to a level sufficient for elite-talent development (B. J. Bloom, 1985a; Olszewski-Kubilius, 2010a). Budding talents are usually recognized, developed, and supported by parents, teachers, and mentors. These same individuals may or may not offer guidance for the talented individual in the psychological strengths and social skills needed to move from one stage of development to the next.

We developed the model with the following principles in mind: (a) Abilities, both general and special, matter and can be developed; (b) domains of talent have varying developmental trajectories; (c) opportunities need to be provided to young people *and* taken by them; (d) psychosocial variables are determining factors in the successful development of talent; (e) and eminence is the intended outcome of gifted education. In introducing the model, we first distinguish between the development of performers and producers. Then we use these two categories to illustrate within-domain differences in trajectories. We close this section with a figure and description of our model.

Performers and producers

Exemplars of the performer category include singers, instrumentalists, dancers, actors, and athletes. The producer category includes composers, choreographers, writers, and scholars/scientists/academics. As indicated in Figure 1, the two groups are similar in some ways and different in others. Empirical research and expert opinion indicate that both outstanding performers and outstanding producers have high levels of knowledge in the content of their domain and in the content of domains related to the projects they are working on (e.g., a playwright or choreographer's study of an historical period; a vocalist's study of dramatic arts; an economist or psychologist's knowledge of research design or statistical methods). Both have also developed expertise in the skill sets required to perform or produce in their domain. This expertise is developed by way of mentored guidance, through a challenging regimen of practice or intensive study, and with a commitment to excellence, as budding "stars" are being inculcated into the values of the domain.

Psychosocial skills are important for success in all domains. In the performance domains, and perhaps most explicitly in sport, instruction and coaching in mental skills are an integral part of training and talent development (Martindale et al., 2007). These skills include handling setbacks, adjusting anxiety levels for optimal performance, and imagining success, among others. Although their importance has always been recognized, music conservatories have given more systematic attention to these skills in recent years (Jarvin & Subotnik, 2010). Academic domains have been the least likely to explicitly convey the importance of this type of psychological strength training, even though there is a tacit understanding that handling adversity and success productively and with grace and demonstrating good social skills are helpful to engaging others with one's ideas. As an example, learning how to recover productively from a refereed journal rejection has an impact on career development and optimal productivity in an academic domain. Our point is that this highly relevant skill for success and eminence is not taught explicitly in academic domains, whereas parallel skills are routinely a part of coaching in the arts and in athletics.

There are also differences between how elite performers and producers are evaluated as they develop (see Figure 1). Substantial investments have been made in developing practice benchmarks for outstanding performers related to incremental skill development, improvement of technique and expressive communication (cf. Canadian Sport for Life, n.d.; Mac, 2011). Although there are individual differences in *how* skills are developed in performers, there is consensus on what the appropriate skills are. Producers' learning tasks are not so clearly defined and are more likely to be determined by the individual mentor in the area of specialization. Widely accepted benchmarks do not yet exist in the academic domains. Concurrently, standards for excellence are more explicit in performance domains and the paths to achieving excellence in those domains are clearer (Hamilton & Robson, 2006)

Physical skill plays a central role in the development of performers. This reliance on the physical also sets some limits on the length of performers' careers—that is, when they begin, peak, and end. These physical limitations result in fewer opportunities for late bloomers to enter a performance field, so the talent-development trajectory increasingly winnows out participants over time. Consider the relatively small number of openings in the NBA or the NFL every year. By contrast, there is often room in a field for producers who are late bloomers (and have high levels of talent, motivation, perseverance, and other traits required of elite performers), especially in domains that are of substantial importance to society. Elite performers are also appreciated by the general public whereas elite

	Performers	Producers
Similarities	Must master the content within the domain	
	Need guided and deliberate practice and/or study	
	Must have commitment and motivation	
	Domain values are inculcated by mentors	
	Psychosocial variables limit or enhance success	
Differences	What you need to practice is more clearly defined—results of practice seen more easily	Tasks are more diffuse, long term, and multi-component
	Judgments of experts are trusted throughout the process	Judgments for selection in academic disciplines, at least at the pre collegiate level, are not trusted, and objective tests serve as a stand-in
		Judgments of experts are trusted in fields such as composition, playwriting, and visual arts
	Physical abilities are important—you do not have them forever, which constrains the arc of talent development	Physical abilities do not serve as central constraints to the arc of talent development
	Greater winnowing and fewer opportunities over time	Room for a greater number of producers, particularly in domains designated to target societal need
	More current focus on psychosocial-skills training	Little current focus on psychosocial-skills training
	The outcome of excellence and creativity is clearer—better sense of knowing the path and where you are going	Outcome of excellence is clear only in some areas—e.g., academic publications, grants, awards
	Domain is appreciated more widely by the public	Domain is mainly appreciated by insiders

Fig. 1. Similarities and differences between performers and producers.

producers, especially in specialized academic domains (e.g., mathematics, theoretical physics) tend to be most appreciated by individuals who are also members of that field.

Judgments made by gatekeepers in performance domains and artistic- and athletic-production domains such as choreography or musical composition, tend to be made on the demonstration of specific talents in ways that closely mirror actual demands made in those fields (e.g., auditions or portfolios of work). In many academic production domains, however, we rely first on indicators of potential because production is often years away and

involves a more varied set of skills and competencies. For example, admission to special programs for academically talented children is very rarely based *exclusively* on demonstrated achievement. It relies heavily on standardized testing to provide what are expected to be objective measures of potential. Without such measures, programs can face claims of bias, with litigation or investigations into the process of selection. K–12 teachers' judgments regarding potential talent tend not to be trusted, due to legitimate inability to distinguish talent, lack of understanding of what children are capable of doing, or unfair assessment of teachers' judgment on the part of the public and policymakers. Thus, we find different levels of trust put in educators of talent across different domains, as well as imbalance between public appreciation for giftedness expressed in the performance domains and in the production domains.

Developmental trajectories in three domains

Figure 2 highlights differences in performance trajectories among and within domains, in terms of beginnings, peaks, and endings across the life span. Although there are often exceptions to general principles, especially in psychology, the purpose of this figure is to depict how the process of talent development varies by type of field. Whether a trajectory begins in early childhood or in adolescence, for example, depends on when the skills and abilities in the talent area emerge and coalesce. This is affected by physical maturation in fields such as music and sports, and it also depends on when talent can be recognized by systematic identification procedures (e.g., school programs) or by knowledgeable adults (e.g., parents).

For example, boy sopranos can begin to perform in the early elementary grades (see Fig. 2), but adult singing voices do not develop until after puberty. Similarly, precocity in mathematics can be recognized as early as the preschool years (and certainly in the elementary grades) whereas outstanding contributions in psychology do not typically occur until several years after completing an advanced degree. In the athletic domain, outstanding performance in some sports begins in childhood (e.g., gymnastics). For other sports (e.g., American football; Malina, 2010), adult size and speed are important contributors; these are not attained until late adolescence, even if one has been training from a younger age.

End points of developmental trajectories also vary widely. Some trajectories are short: Puberty will truncate further development for boy sopranos. For most academic fields and some musical fields, these developmental arcs are virtually lifelong. Fields in which outstanding performance peaks in late adolescence or early adulthood, such as gymnastics, diving, and figure skating, are typically those involving particular physical skills or body type. They are affected substantially by physical changes that occur with aging. These fields also typically have short peak-to-end intervals. For many other fields, especially academic ones, individuals can remain involved and active well into late adulthood, with almost no limits on productivity. Intervals between starts and peaks also vary greatly, with some fields requiring long periods of preparation (e.g., most academic fields). Simonton (1977, 1984a, 1991, 1992a, 1992b, 1997, 1998, 2007) is a substantial contributor to the research on trajectories.

The developmental course of domain trajectories is affected by training and education, which is tied to our schooling system in many academic areas. For example, the serious study of some academic subjects, such as the social sciences, is not introduced until high school or college. Therefore, specialization can typically get underway only in college. Peaks are also affected by the amount of training and education needed to reach high levels of expertise (the 10,000-hour rule). Some domains, such as psychology, religion, or literature, require the accumulation of maturity and experience to generate important contributions.

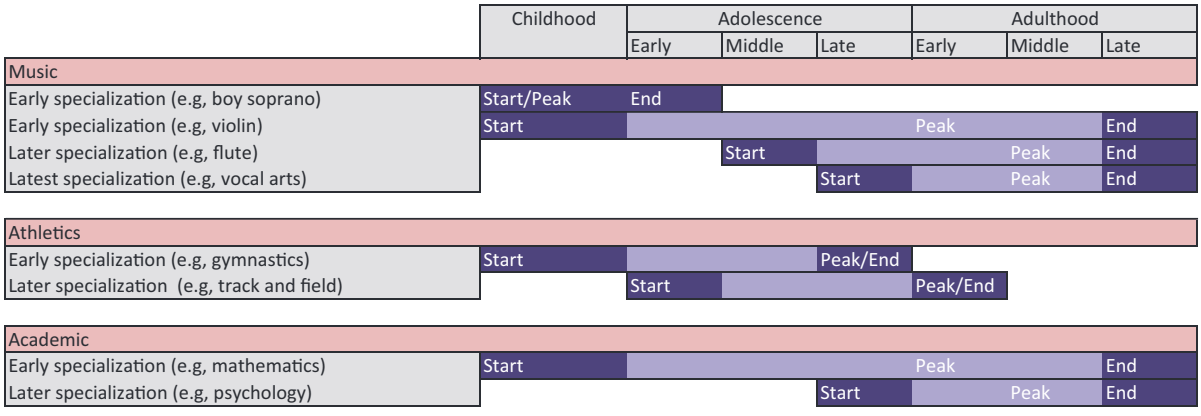

Fig. 2. Early and later trajectories in music, athletics, and academics, within and across domains.

From ability to eminence

In the first six rows of Figure 3, we combine several of the threads previously discussed with regard to giftedness. First, domains have developmental trajectories with different start, peak, and end times for outstanding performance. Second, giftedness is evaluated in relationship to others. At the earliest stages, it is determined and largely defined by potential, whereas at the middle stages it is determined by demonstrated achievement. By full adulthood, eminent levels of achievement define giftedness. Third, the talent-development process involves several transitions whereby abilities are developed into competencies, competencies into expertise, and expertise into eminence.

The type of creativity an individual manifests is one of the features that distinguishes ability from competence, competence from expertise, and expertise from eminence. Precursors of adult creativity may present initially in independent thinking, a willingness to entertain different perspectives and views, and the creation of projects and products that are novel when compared to those of same-aged peers. Creative thinking and skills such as metaphorical thinking, divergent thinking, and creative problem solving can be deliberately and systematically developed during middle childhood and adolescence (Pyryt, 1999). Transitioning to eminent levels of achievement requires a substantial shift: Creative products are judged not just in relation to others at similar levels in the field but also by how they move the field forward (Simonton, 1977, 2000a).

Although we recognize that the generation of creative performances or ideas requires person, process, and product, it is also the case that the relative emphasis on these factors shifts over time. For example, it is important that young children develop a creative approach and attitude (person), that older children acquire skills (process), and that the acquisition of these mindsets and process skills are then coupled with deep multidisciplinary content knowledge and are applied to the creation of intellectual, aesthetic, or practical products or performances (product).

As with creativity, there may be different levels and kinds of motivation associated with eminent levels of achievement. What we call "little-*m*" motivation refers to the motivation involved in smaller achievement-related tasks and decisions, such as which course to take, what to major in, whether to attend a summer program, and whether to try to get an A in a course—decisions that accumulate over time and thereby make eminent levels of achievement possible. What we might call "big-*M*" Motivation (analogous to big-*C* creativity) refers to compelling drives, rooted in early experiences and underlying overarching goals, such as the desire for fame, fortune, power, notoriety or the desire to change the world that is associated with achieving eminence (Amabile, 1996; Csikszentmihalyi, 1988; Ochse, 1990; Olszewski-Kubilius, 2000; Piirto, 1998, 2004).

Finally, the talent-development process is driven by expert teachers, mentors, and coaches. At each stage, the strategies and goals of instruction change (B. J. Bloom, 1985b). In the earliest stage, it is the job of the teacher to engage the explicit or undeveloped interests of young people in a topic or domain and to engender and capitalize on motivation. At the next stage of development, it is critical that teachers help the individual to develop the needed skills, knowledge, and values associated with the acquisition of expertise in that domain. The third-stage teacher helps the talented individual develop a niche in the field, a personal style, method or approach, or unique area of application.

Of course, movement from ability to eminence can, on the one hand, be impeded by factors such as low motivation, mindsets that prevent coping with setbacks or thwart resiliency, less-than-optimal learning opportunities, or chance events. On the other hand, progress can be enhanced, maintained, or accelerated by the availability of educational opportunities including out-of-school enrichment and mentoring, psychological and social support from significant individuals, and social capital. Enhancers and delimiters are included at the bottom of the figure.

VI. Central Methodological Challenges

As can be seen from the review of the literature presented thus far, the study of giftedness and talent has engendered a substantial amount of scholarship. This is particularly true when investigations from a number of domains outside of academics are incorporated and integrated into the analysis. Nevertheless, several challenges make study of this population difficult, particularly with the kinds of investigations that are most likely to hold policy implications.

Thus before proposing a research agenda for the field, we review central methodological challenges faced by scholars studying gifted populations. These scholars seek to (a) identify variables that predict potential high performance, (b) determine how to operationalize those variables for use in interventions and programming, and then (c) evaluate program effectiveness (Callahan, 2004, 2006). Since its inception over 100 years ago, the field has had to negotiate problems inherent in nonstandardized definitions, incomparable comparison groups, and ceiling effects (Thompson & Subotnik, 2010). Many instruments to directly measure cognitive function of gifted students now exist, including tools employed by neuroscientists or single-subject methods employed by special-education researchers. More recently, however, cohorts of investigators are ushering in a new era of scholarship using advanced statistical techniques and more rigorous research designs (e.g., Henson, 2010; Onwuegbuzie, Collins, Leech, & Jiao, 2010; Sternberg, 2010; VanTassel-Baska, Robinson, Coleman, Shore, & Subotnik, 2006), as well as creative techniques and insights from neuroscience (Buschkuehl, Jaeggi, Shah, & Jonides, in press; Diamond, in press; Pakulak & Neville, in press). Advances in methodology and more focused attention to compelling research questions create possibilities for moving the field forward and will offer a stronger

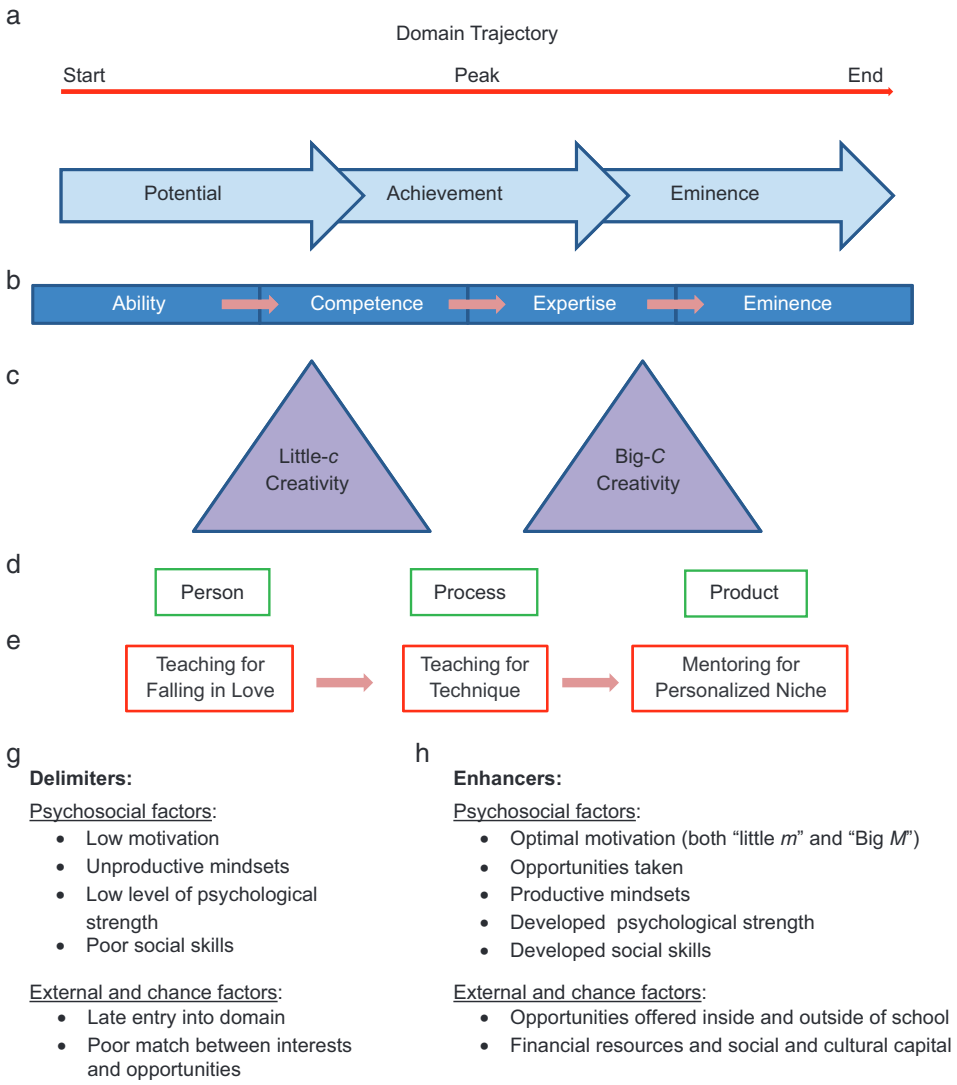

Fig. 3. From ability to eminence in a domain. Domains have developmental trajectories with different start, peak, and end times (a). Giftedness in a domain is evaluated in relationship to others (b)—initially in terms of potential, later by demonstrated achievement, and finally, in adulthood, by eminence. The talent-development process involves several transitions whereby abilities are developed into competencies, competencies into expertise, and expertise into eminence (c). These transitions are distinguished by levels of creativity (d), beginning initially with "little-c" creativity (independent thinking, entertaining different perspectives, creation of projects and products that are novel when compared to those of peers), and ultimately the "big-C" creativity required for eminence. These transitions involve shifting emphasis (e) from "person" (creative approach and attitude") to "process" (acquiring process skills and mind-sets) to "product" (creation of intellectual, aesthetic, or practical products or performances). Each stage in the talent-development process is also characterized by different strategies and goals of instruction (f)—initially, to engage young people in a topic or domain ("falling in love"), then helping the individual develop the needed skills, knowledge, and values ("teaching for technique"), and finally helping the talented individual develop their own unique niche, style, method, or area of application ("mentoring for personalized niche"). Movement from ability to eminence can be delimited (g) by factors such as low motivation, mind-sets that prevent coping with setbacks or thwart resiliency, less-than-optimal learning opportunities, or chance events. Progress can be enhanced, maintained, or accelerated (h) by the availability of educational opportunities including out-of-school enrichment and mentoring, psychological and social support from significant individuals, and social capital.

knowledge base for effective (and efficient) public policy decisions about how and where to invest scarce resources for talent development. And above all, results of an enhanced research agenda will improve the life chances of individual human beings, enabling them to reach their full potential while benefitting society as a whole.

Definitional issues

As mentioned in Section II of this monograph, a major obstacle to establishing baseline knowledge for the field results from definitional issues. Without common definitions of giftedness for characteristics, behaviors, or outcomes, it is difficult to generate hypotheses for testing and theory building (Pfeiffer, 2009). Before the 1980s, IQ reigned supreme as the measure of giftedness. Yet even within this narrow conception, some studies operationalized giftedness at the 99th percentile, whereas others labeled as gifted all those who scored at least one standard deviation above the mean. There are also differences in the types of IQ tests used for classifying students as gifted. Scores on group-administered IQ tests are not as accurate as scores on individually administered tests in high-stakes decision making (e.g., see public deliberations on screening measures for entrance to local and citywide gifted programs reported by the *New York Times* (e.g., Winerip, 2010).

In recent years, multivariable approaches have replaced or complemented IQ scores as criteria for selection or identification. Unlike more universally accepted definitions of intellectual disabilities (combining intellectual functioning and adaptive behavior), districts and even schools have established their own sets of standards. Finally, there is greater acknowledgement of domain-specific abilities (Subotnik & Thompson, 2010), but only a few validated instruments are available for measuring potential in some specific domains. As a result, many fields rely on expert opinion instead to recognize giftedness and assess performance.

Lack of agreement on desired outcomes

Desired outcomes articulated for participants of gifted programs vary widely to include eminence, admission to Ivy League universities, high scores on the SAT or other standardized measures, or nothing at all. Without a consensus on the desired outcomes for gifted programs, it will be difficult to generate policy recommendations based on program results (Kieffer, Reese, & Vacha-Haase, 2010).

Ceiling effects

Academically gifted students tend to score at the highest levels on standardized instruments. That being the case, it is difficult to show that programs are effective using traditional mechanisms for measuring growth (Cross & Cross, 2010; Kieffer et al., 2010; Kline, 2010; McBee, 2010; Olszewski-Kubilius, 2010b). One solution is to use off-level testing, which allows for top students to take tests designed for and typically used with older students, thereby providing better opportunities to measure advanced abilities. This technique is widely used in talent-search programs. Although the norming group for these tests does not include same-age high-ability learners, off-level testing has been a practical solution for identification and evaluation of programs (Lee et al., 2008) in non-school settings. It may also be a viable method for school-based programs. Other promising approaches include adaptive testing (a method whereby more or less difficult items are presented to a student depending on his or her response to a previous item) and establishing standards of excellence for advanced learners in specific domains.

Appropriate comparison groups

Another common problem for researchers studying giftedness is finding appropriate comparison groups (Thompson, 2010), particularly when it comes to measuring program effectiveness and efficiency. Whether warranted or not, participation in gifted programs is coveted; those who qualify are unlikely to be willing to participate in a control group (McCoach, 2010b). Applicants who are not accepted are not usually agreeable to being studied and may not in fact be comparable. Fortunately, some promising statistical techniques, such as propensity score analysis (a statistical technique used to analyze data from two nonrandomly assigned groups of study participants, as in the case of quasi-experiments, that allows for estimating the effects of the same treatment on both groups), may assist in addressing this problem in a meaningful way (Adelson, McCoach, & Gavin, 2011; King & Dates, 2010; McCoach, 2010a ; McCoach & Adelson, 2010; Roberts, Nimon, & Martin, 2010).

Employing inappropriate tests of significance and generalizing from convenience or extreme samples

Too many studies conducted in education cannot be generalized to other samples or populations, notably because of reliance on convenience samples (e.g., recruiting students participating in a local program for a study rather than seeking to engage an existing program that has characteristics more widely shared by other such programs). Most studies continue to employ null-hypothesis significance testing (Cumming, 2010; Fidler, 2010; Gentry & Peters, 2009; M. S. Matthews et al., 2008; Paul & Plucker, 2004; Plucker, 1997). Null hypothesis testing is based on obtaining statistically significant differences, which are often found if the sample is large enough. However, statistically significant differences are not always meaningful or of practical significance, nor are they as precise an estimate of true differences as effect sizes and confidence intervals. Although these problems are not unique to research on giftedness, they do affect the quality of the inferences that can be made regarding this interesting and important population.

Outcomes derived from studying extremely high-functioning subjects are not *directly* generalizable to other populations (Cumming, 2010; Preacher, Rucker, MacCallum, & Nicewander, 2005). However, outliers can, indeed, provide

insights into mechanisms we need to study further to understand exceptional functioning. In order to make the research conducted on elite talent most applicable to other populations—something we strongly support—scholars will need to be more creative in their research designs and analyses. With these caveats in mind, and with the aspiration to influence policy as a goal for the research, we present a proposed agenda for the field.

VII. Research Agenda for the Field

In addition to conducting research on the variables we identified in our proposed mega-model of talent development and improving the rigor of the scholarship in the field, we propose a research agenda that focuses on two central variables associated with development of talent: opportunity and motivation (see Fig. 4). Figure 4 has four quadrants based on high or low access to talent-development opportunities and high or low motivation on the part of the individual. The figure presents the likelihood that individuals in each group will attain eminence, based on the relative amount of opportunity available and the motivation to achieve on the part of a potentially talented individual. In this section, we provide a brief description of the four quadrants in the figure and suggest some research questions that emerged from our review of the literature.

High opportunity and high motivation

Students in the high opportunity/high motivation category have a number of personal and environmental advantages. These include knowledgeable and supportive families, mentors, and access to outside-of-school talent-development programs. As they themselves are also motivated to take advantage of those opportunities, they are the most likely group to achieve at high levels and attain eminence. University-based academic-talent-development programs and summer programs in museums, art institutes, programs for the gifted, selective universities, and other venues are filled with these students. However, it is vitally important to recognize that eminent levels of achievement are rare even among adults who emerge from this group. Further research is needed to understand why. Can we *propel* more of these students toward eminence if we have a better understanding of the talent-development process within given domains? A research agenda to inform this effort would include the following questions:

- What are the person–environmental interactions that are significant in developing psychological traits conducive to high levels of talent development? Can these be deliberately crafted for students for whom they do not occur in their natural environments of home and school?

	High Opportunity	Low Opportunity
High Motivation	Greatest likelihood of eminent outcome with appropriate educational dosage, psycho-social supports, and environmental supports Best “bang for the buck”	Enhanced likelihood of eminent outcome with teaching resources and insider knowledge plus appropriate educational dosage, psycho-social supports, and environmental supports Most important societal responsibility
Low/Undetermined Motivation	Eminence not likely unless motivation is enhanced by programs that assist with changing mindsets and matching to appropriate domains and mentors Limited investment to generate motivation	Outcome depends on provision of opportunities to reveal interests and abilities and enhance motivation Greatest challenge to society; worthy of investment in opportunity With opportunity, motivation may or may not develop

Fig. 4. Achievement as a function of high versus low motivation and high versus low opportunity.

- How do students maintain commitment and motivation during the difficult times that inevitably arise during the talent-development process?
- What is the developmental pattern of intrinsic and extrinsic motivation in individuals who demonstrate high levels of commitment to talent development? Do these patterns vary by domain of talent and stage of development?
- What is the role of competition in positively or negatively affecting motivation for talented students? What is the role of long-term extrinsic incentives in the development of talent?
- Are there identifiable common or typical *critical experiences* within various talent-development trajectories? What is the nature of these experiences (e.g., opportunities to do significant, investigative work on a problem; mentoring by an adult professional)? What are their common and/or essential features or elements (e.g., contact with a caring adult who pushes a student forward, deep intellectual engagement, experiences with content that are personally meaningful)? At what point in development do they need to occur? Are they primarily in-school experiences or outside-of-school experiences? How much variety can there be in these experiences? Can one kind of experience substitute for another?
- What is the mix and pattern of participation in outside-of-school and in-school experiences by individuals who reach high levels of talent development within various domains? Are there different patterns for those who reach levels of expertise versus those who reach levels of eminence? Do differences in dosage predict expertise versus eminence or is this distinction related to psychosocial factors and chance?

Low opportunity but high motivation

Students who possess interest and motivation to learn and achieve, but who lack opportunities (e.g., challenging in-school programs, enriching outside-of-school programs) are at risk for not fully developing their talents. These students may or may not have supportive families or teachers. Either way, not being involved in appropriate educational opportunities from early on can result in domain-specific deficits that are not easily overcome. Without appropriately challenging curricula to reveal their abilities, many of these students may go unnoticed by teachers in school, their talents hidden by easy work. Motivation will dissipate if not fueled and encouraged with appropriate opportunity. Yet, nurturing these students is a vital societal responsibility. Many programs have been crafted through federal Javits funding to assist students like these, and there are examples of scholarship programs that specifically target low-income gifted children. However, these efforts are sporadic and subject to the whims of state and federal legislatures that are most often focused on helping children reach minimum standards (e.g., No Child Left Behind).

Additionally, funding from the government or from private corporations and foundations is often for short-term interventions. These programs may give students a taste of what is possible, but they do not provide the consistent, long-term support required for developing their talents (see Project Excite or the Jack Kent Cooke Young Scholars Program as examples of longer term support programs for low-income gifted students; Lee, Olszewski-Kubilius, & Peternel, 2009). Although considerable resources are needed to provide these students with the supports they need throughout their early education and career paths, the benefits to society of that investment cannot be overestimated. A research agenda that would inform work with these students includes the following questions:

- How can highly motivated students without talent-development opportunities be identified within schools and communities? How can high motivation be discerned in the absence of appropriate educational experiences and opportunities? What are the indicators of high motivation and interest that might be missed by classroom teachers and not readily apparent within unchallenging learning situations and/or could be discerned in other settings (e.g., home and/or community)?
- What are the coping strategies used by students who maintain motivation and interest despite limited opportunities for advanced study and challenging academic opportunities?
- Are there intervention programs or efforts that have been successful in moving students with high motivation and talent but few opportunities into elite-talent-development tracks? If so, how successful are they? What is their cost/benefit ratio? Can these interventions be scaled up?
- What are the most important components of successful interventions with low-income, low-opportunity students who possess talent and motivation (e.g., peer support, academic challenge, parental involvement, teacher expectations, additional formal and informal learning experiences)?
- How does a developmental perspective on talent affect the nature of interventions that can be successful with students who have limited opportunities? How should interventions targeted toward adolescents be crafted and designed and how should they differ from those targeted toward elementary-age students?

High opportunity and low motivation

One of the more frustrating challenges for parents and teachers involves potentially talented children who underachieve in school, shy away from demanding educational opportunities, or choose not to partake of supplemental, enriching activities available through school or their communities. The causes of

underachievement are multiple and complex (McCoach & Siegle, 2003) and include students' self-perceptions or mindsets formed through experiences at home and in school. Reversing underachievement is difficult and becomes more so as children age and beliefs and patterns of behavior become entrenched. There are a few examples of programs focused on underachieving high-IQ students that have used a variety of strategies (e.g., counseling; high-interest, project-based educational interventions) to renew interest and motivation (e.g., Baum, Renzulli, & Hebert, 1999), but these are rare.

Additionally, there are anecdotal reports from eminent individuals who were late bloomers (e.g., Colin Powell, 1995; Tom Brokaw, 2002), documenting their individual and unique turnarounds. Several fundamental questions can be asked about this group of students. To what extent should society devote additional resources to unmotivated students who are already advantaged in terms of opportunities and access? What is society's responsibility—to motivate students or merely provide opportunity and ensure access? What is the likelihood that motivational problems can be addressed successfully, and how should society invest in programs that attempt to do so? A research agenda that would inform work with these students could include the following questions:

- What are the early psychological roots and underpinnings of low motivation and interest in the face of opportunities? What are the most significant factors?
- At what point in development is underachievement or disengagement most likely to occur for talented students? Are there identifiable critical points during which students are most vulnerable to opting out of achievement and similarly critical periods when interventions are more likely to be successful? Are there common factors that can account for these patterns?
- What interventions have been successful in generating or regenerating motivation among underachieving and disengaged, talented students? Why are these successful? What are cost/benefit ratios for these interventions? Can they be scaled up?
- How might existing psychological constructs such as stereotype threat, intrinsic and extrinsic motivation, attributions, mindsets, achievement-goal orientation, and academic self-concept and related theoretical models be useful in providing explanations for failure of talented students to engage in talent-development activities? Do findings with heterogeneous populations of students generalize to gifted students?
- To what extent are low motivation and involvement in talent-development opportunities for gifted students contextually based (e.g., a function of a particular school environment versus a result of durable, acquired self-beliefs and attributions)?

Low opportunity and undetermined motivation

The students who pose the greatest challenge to educators are those with both limited opportunities for talent development within their homes, schools, or communities and low or undetermined motivation to achieve. Poor early home environments, under-resourced schools with ineffective teachers, and lack of access to community-based programs may prevent interest and motivation from developing and becoming apparent to parents, teachers, and coaches. Increasing these students' opportunities is vital and is the key to uncovering hidden abilities and talents. Helping these students requires a considerable investment of resources and sustained interventions from early childhood to early adulthood. A research agenda that could inform work with these students might include the following questions:

- What kind of programming would best cultivate talent and reveal interest and motivation in early and middle childhood? How can this be infused into preschool and early elementary-school education?
- Can programs be crafted that develop skills and competencies but simultaneously also boost the psychological characteristics needed to sustain commitment and persistence in challenging learning environments? What are the essential components of such programs?
- What additional social and psychological supports are most critical for students who have had little opportunity to develop or demonstrate interests and abilities?
- Does the emergence of talent for students who have not had opportunities look the same as that for students who have had early opportunities and substantial supports?
- Is it effective to provide intense dosages of interventions for students who have not yet had or are unlikely to get early opportunities to prepare for rigorous programs? If so, in which domains?
- Which option is most effective in terms of putting more children onto talent-development trajectories—(a) programming that directly focuses on developing psychological characteristics such as coping skills, resilience, academic self concept, and effort-based achievement orientations; (b) programming that focuses on enhancing domain-relevant skills and content knowledge and indirectly provides psychological and social support; or (c) both types of programming combined?

VIII. Conclusions

In this monograph, we have provided a definition of giftedness that is intended to apply across domains, reviewed the concerns and misunderstandings that gifted education raises in the

minds of the public and policymakers, synthesized the literature on the variables related to giftedness, and outlined some of the methodological challenges that this field faces. We have also shared research and theory aimed at crafting a new framework to guide future research and practice in the field of gifted education. Our proposed framework builds upon and extends existing conceptions of talent development. In this final section, we recap the main points that we have covered.

Abilities matter

General intellectual ability and specific abilities such as mathematical cast of mind, spatial ability, physical memory, or musicality predict and are fundamental prerequisites for high achievement and eminence in their respective fields. The amount and source of ability, the balance of general and specific abilities, and the exact nature of specific abilities vary by talent domain and, as of yet, are not completely understood. Although further research is needed, high ability may be most important in maximizing the effects of opportunity, practice, and effort. Because ability is important, research to identify the general and specific abilities that matter in particular domains and fields should be a priority. Teachers should be trained to look for indications of these abilities, and multiple, domain-relevant ways of determining and assessing them should be developed by researchers. Assessment should start with young children and be continuous, systematic, and ongoing throughout early and middle childhood and adolescence.

Although general ability and potential may be the hallmarks of academic giftedness in children, domain-specific ability and achievement become increasingly important as individuals develop and increase their knowledge base in a field. This implies that domain-specific achievement should be emphasized and cultivated, and increasingly expected as children age. Schools should enable children to advance in academic domains where they show interest and developed talent, expecting that children will show advanced development and achievement in some areas and age-appropriate development and achievement in others. Therefore, teachers with high levels of content knowledge and technical expertise are needed even at the earliest levels of education or training to meet the needs of young, very advanced children. Older students should be allowed to specialize early if they demonstrate high levels of interest, commitment, and achievement for a domain with an early trajectory. Subjects typically not studied until high school or college should be introduced earlier to enable individuals with interest and talent in those areas to be identified and begin the process of talent development within those domains. Similar opportunities for appropriate developmental supports should be provided to children and adolescents whose talents are in nonacademic areas.

Domains of talent have unique developmental trajectories across the life span

Because of physical and intellectual demands and cultural traditions, domains have different entry points, peaks, and endings. Some require early exposure and early identification and have short windows for performance and productivity. Others begin later and have no fixed endpoint. Understanding trajectories in different fields is critical so that windows of opportunity for talent development are not missed. Depending on the domain (e.g., music, tennis, art), much of the talent-development process may take place outside of school, through coaches, teachers, mentors, and community programs.

Our focus is on understanding the nature of these domain-specific developmental trajectories from early childhood into adulthood so that appropriate talent-development opportunities can be provided to students with potential and demonstrated interest and talent. Elucidating the nature of these trajectories in many domains will require further research to understand the variables that are most important at each stage of development. At this point, however, we know that most trajectories will require different kinds of teachers and coaches as talented young people acquire knowledge and technical expertise and move on to creative productivity and creative performance in the talent area.

Benchmarks of excellence for the abilities, knowledge, and psychosocial skills needed for different levels and stages of development must be developed and understood by teachers for all talent domains so that progression across different stages can be optimally promoted (see, for example, Kay, 1999). Critical experiences, such as mentoring; opportunities for competition, performance, and work that closely resembles real-life activity in the domain; and research training, need to be thought of as essential components of the talent-development process and incorporated into the curricula of schools at key points. Community-based institutions such as museums and other outreach programs will need to provide some of these critical experiences and work collaboratively with schools to make them accessible to greater numbers of children.

Effort and opportunity are important at every stage of the talent-development process

Opportunity rests on the availability of both in-school and outside-of-school programs tailored to the talent area. Continuous effort is critical, as research has shown that it takes 10,000 hours of continual study or practice to reach levels of expertise in most domains. Many more programs are needed than currently exist, especially in low-income and rural communities. From our perspective, talent-development activities, primarily in the form of enrichment, should be provided to all children as early as possible. Students who demonstrate sufficient effort and task commitment should be supported to move

forward toward increasingly challenging and rewarding talent-development opportunities, regardless of their age. Students who stall at particular points along the path should be encouraged and assisted to reinvest at a later time when they have renewed interest and motivation.

Psychosocial variables are important contributors to outstanding performance at every stage of development

Qualities such as the willingness to take strategic risks, the ability to cope with challenges and handle criticism, competitiveness, motivation, and task commitment will differentiate those students who move to increasingly higher levels of talent development from those who do not. However, from our perspective, it is critical that research determine which of these are most important to successful transitions at various points in the talent-development process, particularly the transition from expertise to eminence, where psychosocial skills may play the greatest role. The psychological sciences have tended to focus on addressing issues that impede performance. This research continues to be very important, particularly in helping talented individuals transfer compelling negative drives for achievement, such as wanting to "show up" others who doubted their capabilities, into positive ones. Even so, more psychological research is needed to elucidate those factors that go beyond neutralizing the effects of impediments to support the development of optimal levels of performance across the lifespan.

It is also our view that psychosocial awareness and skills should be taught in all domains by parents, teachers, coaches, and mentors explicitly and deliberately, not left to chance. We suggest that this psychological strength training is as important as content and skill instruction and practice in a talent area. It should not be assumed that students who possess developed ability also have these psychosocial skills, nor that such skills can be generated without direct guidance and teaching. Students should be helped to prepare for coping with the stresses, strains, and rewards of each stage of talent development, from potential to eminence.

Eminence should be the goal of gifted education

Throughout its history, the field of gifted education has been troubled by a lack of agreement on a definition of giftedness. Outstanding performance is almost always judged relative to others in one's peer group. Increasing the number of individuals who make pathbreaking, field-altering discoveries and creative contributions by their products, innovations, and performances is the aim of our proposed framework for gifted education. The world needs more of these individuals, and gifted education can be organized to provide the supports for optimal performance and productivity.

We value and recognize the importance of high levels of expertise and well-rounded individuals, and we are not implying that we limit services only to those who are on the path to eminence. However, keeping our focus on eminence sustains a continued focus on excellence. We reject the idea that aspiring to eminence need be deleterious to the personal well-being or mental health of individuals, particularly if its promotion is guided by knowledge about the appropriate kinds and levels of support needed from teachers, family, communities, and national and state policy. The confluence of eminence and poor mental health is not substantiated by larger-scale, empirical studies, and it should not be used as the basis for policy and practice in gifted education. We assert, in fact, that aspiring to fulfillment of one's talents and abilities in the form of transcendent creative contributions will lead to high levels of personal satisfaction and self-actualization as well as unimaginable benefits to society.

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