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Should eminence based on outstanding innovation be the goal of gifted education and talent development? Implications for policy and research

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ABSTRACT

Systemic goals for gifted programs can take many forms. The authors place most program goals into a dichotomy — those that address the present academic needs of gifted students in schools and those designed to prepare future eminent path breakers and innovators. To clarify our arguments, we first define eminence and then offer examples from national mission statements that target gifted programs either to academic needs of advanced students or future needs of society. Although we support both goals, we promote the latter, even in light of the complications that we delineate. To demonstrate a model of eminence development that might be implemented more widely, we present a prototype program generated at the American Psychological Association. We close our argument with recommendations and implications for research and policy.

1. Defining eminence

VanTassel-Baska defines eminence as "society's highest standard… high-level achievement and societal recognition, usually marked by a contribution that has historical significance in a given field or across several fields" (1989, p. 146). Beginning with Terman (1925), modern scholars have sought to connect giftedness in youth with adult eminence (Feldman, Csikszenmihalyi, & Gardner, 1994; VanTassel-Baska, 1989). Yet Subotnik (2009) and VanTassel-Baska (1989) have observed that children identified as gifted often do not become eminent adults (an exception can be found in the retrospective work of Catharine Cox, 1926), while eminent adults often report that they were not identified as gifted children. Thus, a connection between child giftedness and eminence may be difficult to construct.

Various scenarios could explain this disjunction. Strategies that have been and continue to be used for giftedness identification seek general abilities, such that, for example, mathematically talented students without equally stellar verbal skills are left unidentified and underserved. It is also possible that adults identified as gifted when they were children will not possess the drive or motivation that it takes to become outstanding innovators. Another explanation for disconnects between giftedness in childhood and adulthood might be that renowned adults did not grow up in communities with special services, and families or mentors provided successful alternatives. Further, some fields, such as the vocal arts, identify potential giftedness in late adolescence or early adulthood. If all identification takes place in school at a relatively early age, then some of our most important domains of talent might be entirely underdeveloped.

In seeking to understand eminence and whether it should be a measure of success for childhood gifted programs, it is helpful to differentiate between "little-c creativity" and "Big-C Creativity" (Kaufman & Beghetto, 2009; Simonton, 2000). According to Kaufman and Beghetto (2009), those who exhibit little-c creativity use "unconventionality, inquisitiveness, imagination, and freedom" (p. 3) throughout their daily lives. While not achieving breakthroughs in professional domains, "small c creatives" concern themselves with linking new knowledge to old knowledge.

In contrast, Big-C Creativity generates path-breaking ideas that lead to international acclaim and recognition, even posthumously. Examples include winning a Nobel Peace Prize or Pulitzer Prize in fiction or making contributions to a field that remain long after one's death, exemplified by Mozart's compositions. Scientists debate over the traits or skills that lead to Big-C Creativity (Csikszentmihalyi, 1996; Simonton, 2000), and acknowledge that the cultivation of Big-C Creativity is extremely difficult. For example, Gardner (1994) identifies the tendency of people who exhibit Big-C Creativity to "sacrifice everything in their life for the use of their creative gifts" (Kaufman & Beghetto, p. 2).

It goes without saying that both types of creativity – Big-C and little-c – are invaluable to societies. Just as we need ground-breaking scientists who can further our ability to combat cancer, we also need creative individuals with skills to handle routine problems effectively. If Big-C Creativity were to be the aspirational goal for gifted programming, how

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would it be measured? How big does *big* have to be? Must a musician perform at the most prestigious concert hall in order to achieve eminence or is it sufficient and more influential to acquire the respect of one's artistic peers in less publicly known venues? Is it *enough* to become a well-known specialist in one's field as opposed to achieving global renown?

2. Sample national missions that typify a focus on current achievement vs future innovation

Many countries around the world include gifted education prerogatives within their formal education systems. Some ministries of education focus on immediate and short term goals, categorizing gifted education as a form of k-12 special education for advanced learners. Other countries seek to develop human capital in particular areas, such as science and technology, in order to develop a critical mass of creative researchers and entrepreneurs who will contribute to their nation's development The latter set of nations look beyond differentiation or acceleration for K-12 gifted students and ask, "What are we preparing these gifted students to do in the *future*?" The purpose of this article is to explore this central question: As researchers and policy makers, should we focus primarily on serving gifted students' present needs for challenge in the classroom and/or should we develop their giftedness with a goal of attaining outstanding innovation in adulthood?

Without clear goals for gifted education and talent development, many countries, including the US, experience difficulty in aligning educational initiatives for gifted education with greater societal goals. Ki-Soon (2007), writes of Korea's ISEP Science-Gifted Education Center's need to, "look deeply into gifted education practices and to discuss the meaning and function of gifted education itself, both synthetically and systematically…(p. 451)." Indeed, in looking at just a few countries' mission statements for gifted education, visions for how to serve such children seem widely diverse.

Following are some sample prototype approaches from various countries. According to the Department for Children, Schools and Families Web site, England's national program for gifted and talented education seeks

> "to improve pupil outcomes, particularly for the most disadvantaged, in attainment, aspirations, motivation and self-esteem; to improve the quality of identification, teaching and support in all schools and classrooms; and to improve the quality of out-of-school learning opportunities and support for pupils, and support for parents, educators and schools at local, regional and national levels" (Department for Children, Schools & Families, United Kingdom, 2008).

Denmark also views gifted education as a necessary means to challenging students academically in the classroom, as evidenced by its Folkeskole Act. This act states, "…it is the task of the school to ensure the identification of the individual needs of each student and to offer provisions for the development of potential"(Mönks & Pflüger, 2005, p. 42).

In contrast, the Singapore Ministry of Education describes its aim for gifted education through an emphasis on "nurturing gifted individuals to their full potential for the fulfillment of self and the betterment of society" (Singapore Ministry of Education, 2008). This "betterment of society" implies that the country not only concerns itself with maximizing *student* potential, but also focuses on how this potential will contribute to the nation in the future. Similarly, Saudi Arabia's vision for gifted education, as noted on the Web site for King Abdulaziz and His Companions Foundation for the Gifted, includes the desire to improve "professional pathways in the areas of medicine, environmental science, communication, education, the arts, telecommunication, engineering science, and technology" (King Abdulaziz & His Companions Foundation for the Gifted, 2008).

This article seeks to organize a rationale for empirical thinking on long-term goals for gifted education programs and policies. First, we ask whether it is possible to come to consensus on long-range goals for gifted education. If so, we propose some mechanisms for how our educational programs and policies can meet these goals.

3. Inspiration for eminence

In addition to possessing a creative spark, Ericsson, Roring, and Nandagopal (2007) discuss various characteristics and models that spur adult eminence. Using their expert performance framework, the authors note that long immersion in a field (encompassing ten or more years of experience) must take place before even the most talented adults peak with accomplishment. This age of prime productivity varies from field to field, but generally happens between ages 25 and 40. Even young prodigies, like chess master Bobby Fischer, honed their skills for years before they achieved recognition for their talent.

Childhood home environment is a factor in eminence. According to Simonton's (2005) review of the literature, most eminent people are genetically programmed for environmental triggers to set off epigenetic advantages. Simonton shows that many eminent adults grew up in homes that were stimulating and valued learning and achievement. Simonton and other scholars also reveal that counter-intuitively, childhood home environments can also be emotionally difficult places (Olszewski-Kubilius, 2001). Goertzel and Goertzel (1962) analyzed the biographies of 300 famous people and discovered that those studied did not come from conventionally happy homes. As children, the famous people in their book tended to have "stage parents" who carted them to music and theater auditions or prestigious academic competitions in order to further their children's chances of childhood or adult success. The authors suggest that although the subjects of their study were raised in homes with high expectations and associated stress, parents afforded their gifted children the time and resources that it took to develop their children's talents.

Ochse (1990) dismissed the idea derived from humanistic psychology that creativity thrives once an individual's immediate needs have been met and he or she achieves self-actualization. She argues that great ideas and performances thrive in response to adversity. Ochse analyzed the experiences of groups such as homosexuals who have been marginalized at home or in their societies, but nevertheless are overrepresented among those who have had great influence, especially in arts and aesthetics.

Training for great performance can also be engendered by society. The former Soviet Union, for example, developed outstanding educational institutions to support the development of young people's talent in the sciences and arts (Vogeli, 1968). Tannenbaum (1983) discusses the contributions of a number of categories of talent, all of which respond to various levels of societal reinforcement. He posits that the first two are always in short supply, the third is in short supply for targeted periods of time and the fourth is always available: (1) talents that bring health and safety (such as Jonas Salk's invention of the polio vaccine), (2) talents that provide us with beauty and reasons to make life worth living (such as great music), (3) talents essential to a specific time and place (such as engineers and space scientists to build a space shuttle), and (4) talents that are designed to beat a record and have no other purpose (such as the record for stuffing a telephone booth with as many people as possible).

As defined earlier, eminence is associated with transforming perspectives on the current thinking in a field, profession or discipline. Some individuals derive eminence not from creating a new idea, but from being the first from a subgroup to be able to participate at high levels in a field, profession or discipline. Others are able to bring populations to accept an idea or concept, even if idea being promoted is not their own. Finally some people become more eminent than others with equal talent because they have good agents. We elaborate on these nuances of eminence below.

4. Some complications in defining eminence

4.1. Pioneers

A nation's most eminent citizens are not always those who have invented Big-C ideas for a healthier and safer future, or created stunning works of art. Some individuals become eminent by displaying courage and commitment, forging new roles for members of their society. Pioneers open doors for those who have been less politically, culturally or financially powerful within their societies.

Sally Ride, the first female U.S. astronaut to enter outer space, and Elizabeth Blackwell, the first woman to gain a medical degree in the US, came from various backgrounds and times in history. Neither of them generated a new theory or idea, or created an original work of artistic beauty. Yet, they shared the extra ordinary courage of becoming the first women in their fields to persist through political, cultural and financial setbacks that maintained the status quo. They were risk-takers with a sharp focus on a desired goal, and were willing, if necessary, to sacrifice other components of their lives in order to achieve those goals. Their work dramatically changed the lives of women who came after them.

4.2. Leadership, performance and eminence

If we return to the association between Big-C creativity and eminence, leaders, like pioneers, are not necessarily innovators, but they are definitely path breakers. Nations clearly view some of their leaders as eminent, particularly those who guide them out of periods of great distress. For example, American citizens elected Franklin Delano Roosevelt to the presidency of the US three times. He led the country through the Great Depression, World War II and the aftermath of both. Great performers and athletes may also be eminent for developing a new style or interpretation that influences how new generations conduct themselves on the stage or in the sports arena. However, the analogy between leadership and great performance in music and sport is not a perfect one. The training of elite musicians and athletes takes place by way of codified and carefully delineated guided practice over 10 years (Ericsson et al., 2007). In contrast, charismatic leadership has no specific roadmap for eminence levels of performance.

4.3. Eminence influenced by promotion

Although most can agree that renowned individuals are those who have discovered new and powerful ideas, there are many examples of artists and scientists who have worked on path-breaking ideas in relative obscurity. One of the key factors in acquiring recognition is by way of social skills and self-promotion (Subotnik & Jarvin, 2005; Subotnik, Pillmeier, & Jarvin, 2009). Yet, self-promotion and networking are difficult for many people. It can take time away from creative work and requires patience to refine social skills. In modern times, artists and scientists have mentors, agents or communication officers who broadcast new products or scholarship. For example, film studios spend exorbitant amounts of money to promote their company's films to Oscar judges, as films most heavily promoted by the industry tend to win the prestigious award. And Nobel laureates are often mentored by previous Nobel laureates (Zuckerman, 1977), an important fact given that former Nobel laureates heavily populate the selection committees for future Nobel prizes.

4.4. Eminence is sometimes affected by time, place and context

Is eminence a permanent label or one that is affected by time, place and context? The seven individuals featured in Gardner's *Creating Minds* (1994) (Igor Stravinsky, T.S. Eliot, Martha Graham, Mahatma Gandhi, Albert Einstein and Sigmund Freud) remain fixed in our minds as eminent contributors to the arts, sciences and society — in spite of the fact that these individuals produced their work in the early 20th century. Igor Stravinsky, T.S. Eliot and Martha Graham were recognized as geniuses during their lifetimes and continue to inspire audiences with their work. And activists still practice Gandhi's philosophy of civil disobedience. Although modern approaches have challenged the theories of the two scientists (Einstein and Freud) mentioned in Gardner's book, Einstein and Freud remain intellectual pillars in their respective fields.

In contrast to Gardner's creative geniuses, who achieved recognition during their lifetimes, poet Emily Dickinson is an example of an artist widely recognized only after her death (VanTassel-Baska, 1989). Further, as a demonstration of the connection between eminence and context, military leaders such as Eisenhower or Patton may not have had the opportunity to show their leadership potential had the world not been convulsed by war as they were in the prime of their military careers (VanTassel-Baska, 1989).

5. Some issues with targeting eminence as a goal for school based gifted education

In viewing the purpose of gifted education through the lens of adult eminence, a few questions arise. Our first question is whether talented students who possess unique gifts have obligations to use those gifts. Although students in a free society should be able to pursue any profession that suits their interests, is there an obligation for gifted students to choose certain careers if they have received a superior education in studies leading to those careers at the state's expense?

Second, do we, as a society, expect certain outcomes from our investment (or lack thereof) in these gifts? In other words, what are we looking to gain when we educate gifted students in our societies? If our goal is that they become responsible and moral citizens who contribute positively to our communities, we argue that we could and should expect that of *any* student who is without severely debilitating conditions. If the goal of investing in our most talented students is to encourage as many of them as possible to make outstanding contributions, we may feel let down when few graduates, despite their talent, reach or even aspire to such a goal.

Third, what is the human capital cost-benefit ratio of educating talented children and adolescents? To date, no one has attempted to measure societal gains from special gifted education programming. For example, does investing the same funds toward educating a gifted student in a gifted program (compared to a regular student in a regular public school program) "pay off" more in future returns to his or her society than a gifted student in a regular program? Conducting such a study will help to inform the debate about the value of identifying gifted children and the value of gifted education. If gifted students do turn out to be a good investment for tax dollars, how might this affect gifted education policy? What if the result of such a study is that gifted children from gifted programs turn out to be indistinguishable from their age and SES peers in terms of adult contributions to society? Would this be acceptable?

In sum, we argue that in order to have a meaningful research agenda on the study of eminent performance or innovation, many of the definitional issues we discussed in this section of the article will have to be resolved. Otherwise, the research on eminence will be limited in its generalizability across societal and educational boundaries.

6. Research housed at the APA Center for Gifted Education Policy related to the development of elite performance or outstanding innovation

Each year, thousands of students compete for admission to schools and special classes devoted to serving gifted students. Subotnik and colleagues (Subotnik, Kassan, Summers, & Wasser, 1993) published a study of middle aged graduates of one of the most selective such

institutions in New York City. The school was designated at its inception as a laboratory for the study of high IQ (97th percentile and above) children living in the borough of Manhattan. Because of these geographic and testing restrictions, students at the school tended, like Terman's population, to come from upper-middle class families with highly educated parents. The researchers employed Terman's mid-life questionnaire (Terman & Oden, 1959). Results replicated, for the most part, those of Terman and his colleagues who found that similarly high IQ and well-educated individuals became productive and healthy citizens. Neither the Terman nor the group studied by Subotnik and her colleagues were stellar producers, surprising, given their abilities and educational, cultural and financial resources.

The students at the school certainly might have languished in regular classes in their local school, and from the perspective of some views of gifted education, the school met their academic needs. Teachers challenged the students at high levels, promoted their intellectual curiosity and encouraged them to be well-rounded. The researchers asked themselves why the graduates did not achieve more highly in terms of outstanding innovation. The best conclusion they could reach was that high IQ, cultural and financial comfort, and a non-pressured *general* liberal arts education tailored for a group of intellectual peers were not sufficient to promote the pursuit of creative productivity at the highest levels.

In response to these outcomes, the focus of Subotnik and her colleagues' scholarship over the years shifted to the development of high level talent in *specific domains*. This line of research began with an 11-year study of Westinghouse (now Intel) Science Talent Search winners from ages 18 to 29 (Subotnik, Duschl, & Selmon, 1993; Subotnik, Maurer, & Steiner, 2001). This competition remains one of the most prestigious in the secondary school arena. Winners were and continue to be identified by way of a research paper submitted to a panel of scientists, as well as recommendations from teachers and professional mentors. The Subotnik, Duschl et al. (1993), Subotnik et al. (2001) longitudinal study enlightened the researchers about challenges and incentives experienced by the Westinghouse group at different points in time. Many of the study subjects made uninformed decisions about where to attend university. Others were not able to replicate the quality of the mentorship they had enjoyed in high school. The outcomes at each stage of the study led the research team to more questions about the roles of opportunity, personal decision-making and psycho-social factors in the intellectual and professional development of the study subjects.

These results are particularly relevant to current policy initiatives that invest large sums of money into STEM (Science, Technology, Engineering and Mathematics) education without sufficient understanding about the links between mentoring and STEM achievement. In addition, decisions about STEM education tend to ignore the links between educational experiences and measures of success like degree attainment, entrance into STEM professions, or eminence in STEM fields (Subotnik, Tai, Rickoff, & Almarode, 2010). According to informal data gathering conducted by the authors of this article with talented students at our summer science program, and in consultation with specialized science high schools, the situation remains the same today. The participants in the Westinghouse study had the talent, drive and early opportunities for specialization that could have led them to eminence in science and other related fields, but for most, support and guidance were either not maintained or sought throughout their university experiences.

The first author of this article was able to spend three years at the Juilliard School of Music investigating how a top conservatory prepares students of the same age and ability as the Westinghouse students, but in a different domain. It is the hope of every student admitted to Juilliard to perform on the world's greatest concert stages, and the faculty prides itself in guiding their students to such goals. There were many interesting outcomes to this project, but two were particularly striking. First, conservatories value the critical role of expert mentoring. Faculty tended to treat conservatory students more like doctoral level students than academically talented undergraduates. Each music student in our study was selected by a studio teacher (main instructor, usually also a performing artist) upon admission. Each teacher had no more than 10 students, and each student received weekly individualized instruction or guidance, as well as group sessions with other members of the studio (Subotnik, 2004).

A second important outcome of the Juilliard project was how much focus the institution placed on tacit knowledge. As in the domain of sport, excellence in the arts derives from coaching not only the skills and content of the domain, but also resilience and persistence through challenging conditions. How does this connect to developing great scientists and entrepreneurs? The principles and practices of talent development in one field, such as classical music, are a great potential source of knowledge, research questions and research methods in others, such as scientific research. This is especially true in fields that involve the acquisition of specialized knowledge and apprenticeship as part of a training and socialization process. The domains of arts and sciences also share the need for psychological strength through many setbacks as a core skill requirement for success.

In collaboration with Linda Jarvin (Subotnik & Jarvin, 2005), Subotnik conducted further studies at music conservatories to build a model of psycho-social variables associated with achieving artistry in music performance. VanTassel-Baska (1989, p. 155) notes, "As individuals become older, more educated and established in a career, ability appears to become less of a factor in distinguishing the gifted from their colleagues." Subotnik et al. (2009) continued to investigate this model with a sample of mathematicians who worked with talented mathematics students at all age levels, from the elementary years through graduate school, and in a wide variety of informal, out-of-school venues in order to prepare them for possible careers as research mathematicians.

6.1. Removing impediments to outstanding performance or innovation

If we know that there are many impediments to achieving eminence for outstanding performance or innovation, and that renown for one's work is indeed a rare achievement, should we realistically focus on eminence as a goal? Arnold, Noble, and Subotnik (1996) explore the idea of whether adult eminence is an appropriate expectation for gifted members of groups whose positions in society are distant from the mainstream. Rising out of grinding poverty to become a professional is a noteworthy accomplishment, but may not classify as "achieving eminence" unless the person is a pioneer (i.e., first woman or underrepresented minority group member).

According to the Arnold et al. (1996) model, opportunity is a component of females' (and, they argue, any marginalized group's) talent development. They further distinguish three factors associated with opportunity: (1) its existence, (2) the perception of its existence, and (3) its pursuit. Clearly, opportunities must be made available, at all levels, to those with potential for greater achievement. In fact, the vast majority of federal funding devoted to gifted education and science education targets promising girls and underrepresented minority youth. If we recognize and provide opportunities early in a child's talent development, we hope to reduce barriers to extraordinary achievement. Beyond providing such opportunities, groups traditionally marginalized must be coached into *taking those opportunities* and capitalizing on them, particularly in out-of-school programs.

Bloom (1985) demonstrated that talent must be developed outside, as well as inside, of school. Out-of-school environments can offer gifted students with more limited school based talent development experience the chance to meet peers with similar interests, and match them with teachers who provide advanced knowledge and skills, and socialize them into the values of the field. However, gifted students who are geographically isolated, poor or underrepresented must also believe that these opportunities are genuine and beneficial.

And they must have the courage and support to take those opportunities.

Based on the research strands described above, the APA Center for Gifted Education Policy argues that students from marginalized groups need coaching to develop the psychological strength that it takes to grab hold of opportunity and benefit from it maximally. Elite athletes and musicians learn to develop confidence through immersion in guided and disciplined practice and through analysis of setbacks to improve their performance. Similarly, young gifted students from vastly different backgrounds and experiences need respected support personnel who can coach them and their peers through significant challenges.

7. What we know from our own program with students

There are fewer differences in talent among elite peers, and greater differences among them in psycho-social skills and perceptions about success (Subotnik, Frank, Cook, Rickoff, & Edmiston, 2009; VanTassel-Baska, 1989). Thus, possessing appropriate psycho-social skills for one's respective field may distinguish between who will achieve renown and who will not. At CGEP, we believe that psycho-social skills, such as restoring self-confidence, can be learned (Subotnik & Jarvin, 2005), and that acquiring these skills will help gifted students along their paths to success (Jarvin & Subotnik, 2005).

For example, our Catalyst program provides an out-of-school mentoring program for gifted adolescents with deep interests in and commitment to the arts or sciences. Matching each student with a Master – a well-known professional in the field of art or chemistry who serves as a mentor for our young gifted scientists or artists – allows for inter-generational professional advice that enhances tacit knowledge about the field for the student. Throughout the school year, students work on independent projects and seek advice from their mentors not only on project outcomes, but also on the life experiences of successful artists or scientists. In addition, well-known artist and science Masters work alongside each other during summer programs, which encourages inter-disciplinary understanding between those fields. Feedback from students has indicated (Subotnik, Edmiston, Cook, & Ross, under review) that this approach has worked well for the needs of these gifted adolescents.

For students who are gifted in the sciences, Catalyst uses a three-part selection process by Masters, mirroring the criteria used by music conservatories to choose their students. The program also provides a platform for students to experience risk-taking and "tasteful" self-promotion, as well as restoration of self-confidence when they've experienced its loss in the face of increased competition. Research has shown that exposure to mentoring experiences will increase the likelihood that talented students persist with their respective interests (Subotnik et al., 2001). The Catalyst program has been in existence for two years and so far, students who have graduated have stayed with science majors in post secondary institutions, although at least a third have chosen to pursue medicine or engineering rather than scientific research.

In addition to assisting gifted students with these skills through the Catalyst program, CGEP also is also exploring the affects of psycho-social skills through a research study funded by the National Science Foundation. A central goal of the *Study of the Impact of Specialized Public High Schools of Science, Mathematics, and Technology* is to delineate educational and career consequences for the life, physical and behavioral sciences associated with the formation of specialized STEM public high schools, and to provide insight into the educational practices that appear to be most strongly associated with these outcomes. This three-year grant focuses on a sample of 5000 specialized STEM public high school graduates who completed high school within the last four to six years and compares them with 1000 similarly talented people who graduated from traditional high schools in the last four to six years. Examples of psycho-social variables in the research study instrument that has been recently completed include student autonomy, persistence through challenging coursework, and school support for risk-taking. The research questions for this project do regard eminence as an important measure of success for gifted science students however, the time frame for data collection is limited to six years post high school. The principal investigators hope to supply useful research to policy makers that will better inform them about how different options in STEM public education play out over students' long-term contributions to the STEM fields. As there are no nationally regarded goals for gifted students who attend specialized STEM schools, the authors hope that their research will encourage more discussion about aspirations for STEM talent development, and gifted education in general.

8. Conclusions

Based on the information discussed in this article, it is clear that we must refine our goals for gifted education in order to better support the learning and development of our talented students. We argue that policy makers should consider whether gifted programs meet immediate needs of advanced students, as well as whether such programs model themselves on developing the future success of their talented students, aiming to supply countries with highly-skilled and innovative professionals in certain fields.

It would make sense to create a vision for gifted students that takes their immediate classroom needs *and* future goals into account. However, which focus is more politically salient in our current landscape of education reform? Whether we approach gifted education to serve today's needs for advanced classroom students *or* whether we wish to focus instead on the development of eminent citizens that would make our lives healthier, safer or more beautiful has profound implications for education policy decisions.

Though goals for gifted education will undoubtedly be different among countries and perhaps, even among US states, we should generally concern ourselves with a few broad categories. First, domains differ in their trajectories (Feldman, 1986; Subotnik & Jarvin, 2005). This means that there are different implications for curriculum and talent identification across different domains. Mathematics talent can be developed meaningfully at a young age (Feldman, 1986; Winner, 1996), whereas social sciences appear to be more salient in adolescence. Therefore, a program design that works for gifted mathematics students will likely differ from the types of classroom experiences provided for potential social scientists.

Second, our identification schema in most environments does not differentiate between and among domains. Scholars and practitioners may disagree as to whether there should be general gifted identification tests or domain-specific identification tests, and this confusion may stem from our inability to develop clear goals for our gifted children. Is there a difference between a child exhibiting giftedness in a general sense and a child who has demonstrated giftedness in the form of mastering a new language or solving advanced mathematical problems at a young age? Given these two points, it seems clear that special talents should be nurtured in those domains where such talents may appear, while general abilities that lead to advanced academic achievement overall may also be supported, although in separate venues.

Third, our current curricula and instruction for gifted students may very well be discouraging pursuits of scholarly productivity or artistry by focusing too much on well-roundedness. Too much focus on general education during secondary school might be robbing our young people of the opportunity to explore a topic in great depth, and to develop the beginnings of expertise. The advantage of gifted children pursuing specialization in an area of interest is that they find other young people who share their interests through the internet, out-of-school programs, or school clubs. These peer support systems provide positive social supports for pursuing academic or performance careers — at least up to university level. Although we do not recommend forcing gifted students to specialize before they are ready,

we would like to see more opportunities available for those who would like to take that path. A research study could explore the advantages and disadvantages of specialization for a group of students with abilities in specific domains.

We argue that gifted education should incorporate long-term goals for outstanding innovation and human capital development and align those goals with current classroom strategies. Further, we should be linking our identification schema for talent development to the prediction of eminence in that domain, and then use that understanding to create policy decisions for our K-12 classroom students. Future discussions and research agendas might include:

1) Studying talent development in domains as applied to schooling (formal education) and out-of-school (informal) experiences.

Currently, schools are not expected to focus on developing deep expertise in academic subjects. Mechanisms for coordination between formal and informal talent development in academic domains are important areas for studies of expertise. Further, talent development would be aided if scholars in gifted education worked in collaboration with disciplinary societies to develop "curricula of excellence" in each academic subject. With such a curriculum in place, formal and informal education institutions could specify their offerings to support benchmarks to the curriculum.

2) Assessing the costs and benefits of specialization at various junctures.

Talent development differs across domains, including the age at which talent is first identified; therefore, different domains require specialization at different times throughout a child's schooling. For example, a child gifted in mathematics may show promise at a very young age, whereas a talented student with a profound understanding of psychology may not demonstrate his abilities until a later age. At the policy level, we have yet to agree whether it is acceptable for students to spend more time in the domains where they show promise, or whether all children, regardless of interest and talent, must stave off specialization until their college years.

3) Ensuring apprenticeships in designated domains.

Mentoring and apprenticeships can be positively influential for gifted and talented students who have taken all available courses at a school in a particular subject of interest. Therefore, scenarios involving mentorships during high school would be more beneficial to subsets of students. For example, a high-school program could allow students to finish four years of high school in three years, completing an internship with a professional during their senior year. Specialized science high schools arrange flexible schedules for students who wish to participate in mentorships or apprenticeships in the afternoons.

4) Coaching for psycho-social abilities.

Without a commitment to pursue excellence and expertise, outstanding abilities can deteriorate or, at the very least, not develop. There are many reasons why a student might not be optimally productive in an area of great interest to him or her. For example, when students encounter others who are equally talented, they may start to doubt their abilities and avoid challenging situations where they might appear less "gifted." Like elite athletes and musicians, novice academically talented scholars need to develop their psychological strengths in order to perform at their best. It is important for schools to identify appropriately respected "coaches" to help with this aspect of gifted education.

Although we strongly oppose forcing anyone into a career or pastime that is not of their own choosing, we just as vigorously support promoting opportunities for young people to test their dreams in various domains of excellence. By clarifying our goals for gifted education, and then aligning education policy decisions to meet those goals, we will be able to provide a clearer pathway to success for our gifted and talented students.

References

Arnold, K. D., Noble, K. D., & Subotnik, R. F. (1996). *Remarkable women: Perspectives on female talent development.* Cresskill, NJ: Hampton.

Bloom, B. S. (1985). *Developing talent young people.* New York: Ballantine Books.

Cox, C. (1926). *The early mental traits of 300 geniuses.* Stanford, CA: Stanford University Press.

Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention.* New York: Harper Perennial.

Department for Children, Schools and Families, United Kingdom. (2008). Gifted and talented principles and aims Retrieved from http://www.standards.dfes.gov.uk/giftedandtalented/principles/.

Ericsson, K. A., Roring, R. W., & Nandagopal, K. (2007). Giftedness and evidence for reproducibly superior performance: An account based on the expert performance framework. *High Ability Studies*, *18*(1), 3—56.

Feldman, D. H. (1986). (with Goldsmith, L.T). Nature's gambit: Child prodigies and the development of human potential, 1st ed . New York: Basic Books.

Feldman, D. H., Csikszenmihalyi, M., & Gardner, H. (1994). *Changing the world: A framework for the study of creativity.* New York: Praeger.

Gardner, H. (1994). *Creating minds: An anatomy of creativity as seen through the lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi.* New York: Basic Books.

Goertzel, V., & Goertzel, M. G. (1962). *Cradles of eminence.* Boston: Little, Brown.

Jarvin, L., & Subotnik, R. F. (2005). Understanding elite talent in academic domains: A developmental trajectory from basic abilities to scholarly productivity/artistry. In F. Dixon, & S. Moon (Eds.), *The handbook of secondary gifted education* (pp. 203—220). Waco, TX: Prufrock Press.

Kaufman, J. C., & Beghetto, R. A. (2009). Beyond big and little: The Four C model of creativity. *Review of General Psychology*, *13*(1), 1—12.

King Abdulaziz and His Companions Foundation for the Gifted (Mawhiba). (2008). *Goals* Retrieved from http://www.gifted.org.sa/HomeEnglish.html.

Ki-Soon, H. (2007). The possibilities and limitations of gifted education in Korea: A look at the ISEP Science-Gifted Education Center. *Asia Pacific Education Review*, *8*(3), 450—463.

Mönks, F. J., & Pflüger, R. (2005). *Gifted education in 21 European countries: Inventory and perspective* Retrieved from German Federal Ministry of Education and Research (BMBF): http://www.bmbf.de/pub/gifted_education_21_eu_countries.pdf.

Ochse, R. (1990). *Before the gates of excellence: The determinants of creative genius.* Cambridge: Cambridge University Press.

Olszewski-Kubilius, P. (2001). The transition from childhood giftedness to adult creative productiveness: Psychological characteristics and social supports. *Roeper Review*, *23* (2), 65—71.

Simonton, D. K. (2000). Creativity: Cognitive, developmental, personal and social aspects. *American Psychologist*, *55*, 151—158.

Simonton, D. K. (2005). Genetics of giftedness: The implications of an emergenic–epigenetic model. In R. J. Sternberg, & J. E. Davidson (Eds.), *Conceptions of giftedness* (pp. 312—3261)., 2nd ed. New York: Cambridge University Press.

Singapore Ministry of Education. (2008). *Gifted education programme mission statement* Retrieved from http://www.moe.gov.sg/education/programmes/gifted-education-programme/.

Subotnik, R. F. (2004). Transforming elite musicians into professional artists: A view of the talent development process at the Juilliard School. In L. Shavinina, & M. Ferrari (Eds.), *Beyond knowledge: Extracognitive aspects of developing high ability* (pp. 137—166). Mahway, NJ: Erlbaum.

Subotnik, R. F. (2009). Developmental transitions in giftedness and talent: Adolescence into adulthood. In F. D. Horowitz, R. F. Subotnik, & D. Matthews (Eds.), *The development of giftedness and talent across the lifespan* (pp. 155—170). Washington, DC: American Psychological Association.

Subotnik, R. F., Duschl, R., & Selmon, E. (1993). Retention and attrition of science talent: A longitudinal study of Westinghouse Science Talent Search winners. *International Journal of Science Education*, *15*(1), 61—72.

Subotnik, R.F., Edmiston, A. & Cook, L. (under review). The catalyst project: A mentoring model for adolescents gifted in the sciences and arts. *Journal of Advanced Academics.*

Subotnik, R. F., Frank, M., Cook, L., Rickoff, R., & Edmiston, A. (2009). Patterns of influence on a developmental path from publication to policy center. In B. MacFarlane, & T. Stambaugh (Eds.), *Leading change in gifted education: The festschrift of Dr. Joyce VanTassel-Baska* (pp. 1—12). Waco, TX: Prufrock Press.

Subotnik, R. F., & Jarvin, L. (2005). Beyond expertise: Conceptions of giftedness as great performance. In R. J. Sternberg, & J. E. Davidson (Eds.), *Conceptions of giftedness* (pp. 343—357)., 2nd ed New York: Cambridge University Press.

Subotnik, R. F., Kassan, L., Summers, E., & Wasser, A. (1993). *Genius revisited: High IQ children grown up.* Norwood, NJ: Ablex.

Subotnik, R. F., Maurer, K., & Steiner, C. L. (2001). Tracking the next generation of the scientific elite. *Journal for Secondary Gifted Education.*, *13*, 33—43.

Subotnik, R. F., Pillmeier, E., & Jarvin, L. (2009). The psychosocial dimensions of creativity in mathematics: Implications for gifted education policy. In R. Leikin, A. Berman, & B. Koichu (Eds.), *Creativity in mathematics and the education of gifted students* (pp. 165—179). Rotterdam, The Netherlands: Sense Publishers.

Subotnik, R. F., Tai, R. H., Rickoff, R., & Almarode, J. (2010). Specialized public high schools of science, mathematics, and technology and the STEM pipeline: What do we know now and what will we know in five years? *Roeper Review*, *32*, 7—16.

Tannenbaum, A. J. (1983). *Gifted children: Psychological and educational perspectives.* New York: Teachers College Press.

Terman, L. M. (1925). *Mental and physical traits of a thousand gifted children.* Stanford, CA: Stanford University Press.
Terman, L. M., & Oden, M. H. (1959). *The gifted group at mid-life: Thirty-five years' follow up of the superior child.* Stanford, CA: Stanford University Press.
VanTassel-Baska, J. L. (1989). Characteristics of the developmental path of eminent and gifted adults. In J. L. VanTassel-Baska, & P. Olszewski-Kubilius (Eds.), *Patterns of influence on gifted learners: The home, the self, and the school* (pp. 146−162). New York: Teachers College Press.
Vogeli, B. R. (1968). *Soviet secondary schools for the mathematically gifted.* Washington, DC: National Council of Teachers of Mathematics.
Winner, E. (1996). *Gifted children: Myths and realities.* New York: Basic Books.
Zuckerman, H. (1977). Scientific elite: Nobel laureates in the U.S. New York: The Free Press.