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In 1957, when Sputnik took the world by storm, the Ford Foundation was several years into a project for talented students based on early college entrance. An evaluation of that program from the Fund for the Advancement of Education read: “There are those who argue that it is psychologically unsound and politically undemocratic for one child to proceed faster or to have a 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 which are frustrating the development of young talent at a time in history when this nation urgently needs to develop its human resources to the full.”

The authors argued that focusing on the *most* able students is critical in a democracy for nurturing a cadre of capable leaders, among other advantages. The resulting infusion of attention and resources to talented youths through the National Defense Education Act led to a boom of innovation and scientific productivity in the U.S.

Today researchers, policy makers and teachers pay little to no attention to high-achieving students. School-based gifted education receives scant state or federal funding. Only four states currently fully fund their mandates to identify and serve gifted students. Many such students spend their days in school unchallenged —relearning material they have already mastered. The failure to develop their talents means that fewer of them will become future innovators of products and services; creative thinkers to solve major social, economic and environmental problems; leaders to tackle national priorities; or performers to entertain, inspire and soothe our souls.

America's neglect of its talent is showing, particularly where math is concerned. As economist Eric Hanushek of Stanford University and his colleagues reported in 2010, 30 of the 56 countries that participated in the

Program for International Student Assessment (PISA) study, which tests the reading, science, and math skills and knowledge of 15-year-old children, had larger percentages of high-achieving math students than the U.S. did. New Zealand, Canada and Australia have nurtured at least twice the proportion of mathematically advanced students that the U.S. has.

We think a renewed commitment to gifted education is critical for expanding the pool of individuals who can make pathbreaking discoveries and creative contributions to our society. The first step is to train teachers and others to spot giftedness, which may show up in a child's IQ score but could also surface as aptitudes in specific areas such as number sense or musical ability. Social and emotional qualities that can be developed through training, such as persistence, grit and passion, are also important contributors to later success.

Offering young children a wide palette of activities could spawn new interests and enable a greater diversity of talents to surface. Once an exceptional aptitude emerges, we need programs in place, including accelerated classes and psychological coaching, that can nurture its development as early and vigorously as possible. The chief goal of these efforts is preparing young people for outstanding achievement.

Talent

For nearly a century scholars have sought to understand, measure and explain giftedness. To some, the term is a misnomer for the result of endless practice or social advantage. We believe, however, that extraordinary abilities do exist and do matter. Giftedness implies an ability to perform at the extreme upper end of the distribution in a certain area. Early on it is determined and largely defined by potential, followed by demonstrated achievement and, later, by eminence. In elementary schools, it is often equated with IQ. Students who score above the 95th percentile (although cutoffs vary) on an intelligence test are often classified as gifted.

IQ is generally predictive of achievement in school, but new research shows that narrower academic assessments can help forecast the likelihood of adult contributions to, say, literature or physics. In 2005 psychologist David Lubinski of Vanderbilt University and his colleagues reported that scores on the math and verbal parts of the SAT measured around age 13 in high-achieving students (as well as tests of student interests) can indicate whether an adolescent will choose to later pursue the humanities or a math or science field as a career. Even differences within the 99th percentile of mathematical ability—the top 1 percent—are associated with variations in outcomes, such as income level, number of patents and the likelihood of obtaining a doctorate.

In recent years educators have begun to look beyond IQ scores to measure giftedness. Specialized schools or programs for science or the arts admit students based on achievement test scores, essays and projects. Elementary school programs may ask teachers to complete checklists that reveal a student's commitment to learning. As we discover how to better identify the core abilities associated with each domain of knowledge and skill, these methods will become more valid and reliable.

The nonacademic domains are more advanced on this front. For example, New York–based choreographer and ballet dancer Eliot Feld, who has had years of experience building dance troupes and educating novice performers, identifies those with potential around the age of eight using indicators of flexibility, body

proportion and physical memory. Characteristics such as pitch perception and audiation—a way of cognitively processing music—have been associated with musical performance. In response to a survey, voice teachers identified intonation, timbre, musicality and pitch control as important factors related to singing talent.

Our ability to identify and assess the aptitudes that matter varies, however. In athletics, dance, music and chess, experts have developed visible benchmarks of talent at various ages. In academics, so far only in mathematics do we have reliable ways to detect potential talent early on.

Commitment

To achieve greatness in any realm requires more than talent. It also demands extraordinary creativity, grit, passion and social skills. Creativity, the ability to come up with novel, useful and elegant ideas or ways of doing things, has a long historical association with giftedness. It may depend on relevant skills and knowledge, but at its essence are mental processes such as metaphorical thinking, tolerance for complexity, and flexibility in problem solving. [For more on creativity and how to cultivate it, see “Your Creative Brain at Work,” by Evangelia G. Chrysikou; Scientific American mind, July/August 2012.]

Precursors of adult creativity may include independent thinking, a willingness to entertain different perspectives and views, and the creation of projects and products that are novel when compared with those of one's peers. Children who exhibit these characteristics are more likely to make creative contributions as adults. In 1999 educational psychologist Jonathan Plucker of Indiana University reported results from a multidecade follow-up of students identified as creative with the Torrance Tests of Creative Thinking while they were in elementary school. Scores on this test, which largely measures divergent thinking, were three times better than IQ tests at predicting the quantity and quality of publicly recognized creative accomplishments in adulthood.

Aside from their ability and creativity, gifted individuals stand out in the commitment and sacrifice they are willing to make in pursuit of their goals. In a chapter in a 1985 book entitled *Advances in Motivation and Achievement*, psychologist Mihaly 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.”

Giftedness has long been associated with high levels of intrinsic motivation—that is, engaging in a task for the sake of learning. In fact, many high academic achievers are also motivated by and enjoy extrinsic factors such as trophies, scholarships and other forms of recognition. In a 2010 study school psychologist David J. Kover of the San Francisco Unified School District and one of us (Worrell) showed that a group of

academically talented students had similar levels of intrinsic and extrinsic motivation. High achievers may hunger more than others not only for knowledge but also for fame, fortune or power to change the world.

High achievers may have exceptional task commitment, meaning they are willing to engage in study and practice that, though not necessarily enjoyable, is instrumental to improvement. In a 2008 study psychologist Timothy W. Curby, then at the University of Virginia, and his colleagues demonstrated that the kindergarten pupils most likely to be identified as gifted in third grade exhibited not only high cognitive ability but also early task orientation, which is "the ability to do and complete work even in an environment in which teachers may not be directly supervising the work or when there are distractions present." In findings published in 1990 psychologists Camilla P. Benbow and Olya Arjmand, then at Iowa State University, used a statistical method to determine variables that distinguished between high and low achievers in mathematics among 356 students identified as mathematically gifted based on their SAT scores. Their analysis revealed that the strongest predictor of high achievement in a related area—going to medical school or graduate school for math or science—was the number of optional math and science examinations the students had taken, a variable that reflects a *commitment* to the discipline.

Passion contributes to the development of great ideas and performances, although it has been rarely studied in the context of gifted education. In one exception, psychologist Jennifer A. Fredricks of Connecticut College and her colleagues examined the quality in a 2010 study of 66 high school and college students who had been identified as gifted in academics, sports or the arts in childhood. The athletes and artists readily expressed passion about their involvement, telling experimenters, for instance, "I love the game … I want to play all the time." Among academically gifted youths, however, a typical statement was: "Well, I don't get all excited or anything—I mean, it's schoolwork." The study suggested that academically gifted children do not show a lot of enthusiasm for school in general. Yet students might have displayed interest in specific subjects if the survey had been structured that way.

Opportunity

Although the goal of education in the U.S. is for all children to maximize their potential, the focus of funding has primarily been on the most vulnerable children, such as those with disabilities, who are rightly guaranteed a free appropriate public education. Educators and policy makers assume that academically gifted children will be successful no matter what their educational environment. Yet research has shown that it takes about 10,000 hours of guided study or practice to reach levels of expertise in most domains. Although substantial numbers of children with outstanding intellectual ability are singled out and receive at least some support, few of these youngsters become eminent in adulthood, suggesting that many are not receiving the guidance and instruction they need to fulfill their potential.

A key to developing this talent may lie in giving students lots of opportunities to pursue their interests. In a 2010 study Jonathan Wai of Duke University and his colleagues assessed participation in various educational opportunities such as academic competitions, research apprenticeships, academic clubs, summer programs and accelerated classes among 1,467 individuals who had been identified as talented in math at age 13. They found that those who had been involved in more of these activities and classes—what

the authors called a larger “educational dose”—had, at age 33, a higher rate of notable accomplishments in science, technology or math, such as earning a Ph.D., obtaining patents or securing tenure.

Effective talent development requires different kinds of teachers at different stages. Mentorship is vital for transforming ability into renown. In a study of the origins of eminence through mentorship published in 1977, sociologist Harriet Zuckerman, then at Columbia University, interviewed 92 Americans who had won a Nobel Prize in science between 1901 and 1972. She found that more than half the interviewees had studied or collaborated with previous laureates. These mentors helped their protégés develop a feel for important problems and elegant solutions and mobilized resources, such as access to grants, fellowships, jobs and publications, on their behalf.

Developing youthful talents, especially in low-income and rural communities, by extending and supplementing the regular curriculum can expose children to new topics and ideas and enable them to engage with a subject in more depth. Summer programs, for example, may feature a range of topics that are not typically available in the regular classroom, such as human anatomy for fourth graders and robotics for middle schoolers.

Such enrichment activities are a staple of most gifted programs in schools, but expanding them could ferret out new talent. Courses that introduce subjects typically not studied until high school or college, for example, may give interested and able students a head start. In some cases, students may take these courses in specialized schools for gifted students such as the Illinois Mathematics and Science Academy and New York City's Brooklyn Technical High School and Bronx High School of Science.

The greater the diversity of offerings, the greater are our chances of unmasking potential. In 2004 the news program *60 Minutes* ran a piece on low-income adolescents of color from Harlem, four of whom were representing the U.S. 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? By good fortune, a former African-American 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 to discover that they had a talent for the sport (as well as the interest, passion and commitment to pursue it).

Students who seize such opportunities and demonstrate sufficient commitment should be given access to increasingly challenging classes or competitions, regardless of their age. Academic acceleration may involve skipping a grade, entering a higher grade level in a single subject or enrolling early in Advanced Placement courses. It may also consist of speeding up instruction in a course so that two years of material are covered in one year.

Acceleration significantly boosts both achievement and motivation in gifted students. In several meta-analyses reported in 2004 by psychologist James A. Kulik, then at the University of Michigan, he found that accelerated elementary and secondary students demonstrated levels of achievement superior to mainstreamed gifted students of the same age and ability. Kulik also found that accelerated students were more likely to seek degrees beyond a bachelor's. In the same year gifted education specialist Karen B. Rogers of the University of St. Thomas in Saint Paul, Minn., reported that accelerated students placed in

various types of programs advanced beyond their peers between two and seven months, with greater improvement seen in classrooms in which students covered several years of content in an academic year.

Exceptionally gifted students may benefit the most from a faster-paced learning environment. In a study published in 2006, gifted education researcher Miraca Gross of the University of New South Wales in Australia tracked for over two decades the educational, social and emotional development of 60 youths in Australia with IQ scores of 160 and above. Seventeen of these youths were radically accelerated, allowing them to graduate from high school three years early. These students were very satisfied with their lives, professionally and personally. In contrast, many of the students accelerated only one year or not at all experienced significant social difficulties, and some even dropped out of high school or college.

Schools hardly ever use acceleration strategies. Educators often cite scheduling difficulties, but in fact, a strong bias exists against them. Yet acceleration should be a key part of gifted education. Indeed, we should expect children with talent to increasingly channel their efforts into specific areas as they mature. Schools should be staffed with extremely knowledgeable teachers even at the earliest grades, and we need more affordable summer programs that compress semester-long or yearlong courses into a few weeks of intensive instruction.

Persistence

Providing opportunities is not enough, however. Talented individuals must take advantage of them. Research shows that young people may shy away from educational or extracurricular offerings for various reasons, including fear of competition and failure, poor study and organizational skills, and shyness. Capitalizing on favorable circumstances thus requires certain psychological strengths, among them an ability to cope with challenges and criticism and a willingness to take strategic risks.

Such traits, along with persistence, focus and drive, are also essential to the ability to undergo the intense practice and preparation necessary to reach the top. In a 2001 study sports psychologist Daniel Gould of Michigan State University and his colleagues investigated the development of psychological strength in U.S. Olympic champions. He found that becoming a champion required more than just athletic prowess. It also depended on an ability to focus, mental toughness, facility with setting goals, competitiveness, confidence, coachability, drive, optimism and emotional control.

Coaches routinely teach elite athletes how to handle setbacks, adjust anxiety levels for optimal performance and imagine success. In recent years music conservatories have given more systematic attention to these skills. The Juilliard School's precollege and conservatory programs implicitly inculcate values, such as deep devotion to one's art and teachers, that are associated with successful negotiation of the conservatory years. The school has also offered courses on mental-skills training to directly address variations in outcome, from music star to underachiever.

Academically talented students can experience competitive and occasionally stressful environments. Although these youths often display extraordinary motivation and commitment, they rarely receive additional psychological coaching to deal with the rigors of acceleration and other challenges. School and college

teachers receive no systematic training in this realm. Neither are they typically trained to boost creativity through exercises that invigorate metaphorical and divergent thinking or problem solving.

Schools could do more to encourage high academic achievement, too. Although teachers and administrators often publicly recognize accomplishments in athletics, leadership and the performing arts, they tend to ignore or downplay academic feats. Stereotyping kids with intellectual talents as “nerds” or “brainiacs” also betrays a lack of support for these children, many of whom work very hard to meet their goals.

Indeed, the idea that gifted children are “naturals” and do not need to study or practice can severely undercut motivation. According to research by psychologist Carol S. Dweck of Stanford, the assumption that intelligence and talent are fixed traits can lead people to focus primarily on proving themselves worthy of their gifted or “smart” label and to undervalue the role of effort in achievement. In contrast, believing that intelligence and talent are malleable motivates a person to put in the daunting amount of effort necessary to achieve goals such as becoming a respected physicist, historian or philosopher. Dweck's research suggests that this attitude can be fostered with proper instruction and parenting practices [see “The Secret to Raising Smart Kids,” by Carol S. Dweck; Scientific American Mind, December 2007/January 2008].

The aim of our proposed framework is to increase the number of individuals who can develop the innovative products and services and to deliver the creative performances that can improve and enhance our lives. The world needs more of these people. We are not advocating that all services be channeled to those on the path to eminence. Yet a focus on eminence sustains a continued attention to excellence. When people are given the means to transform talent into transcendent achievement, they experience great personal satisfaction and, at the same time, deliver unimaginable benefits to society.