



Fully Developing the Potential of Academically Advanced Students

HELPING THEM WILL HELP SOCIETY

Jonathan Wai and Frank C. Worrell

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A M E R I C A N E N T E R P R I S E I N S T I T U T E

Executive Summary

As a society, we care deeply about narrowing achievement gaps and helping students who struggle academically, and this is reflected in education policy conversations. However, academically advanced students are left out of reform discussions. This is clearly communicated through funding: In the \$59.8 billion 2015 federal education budget, one dollar was spent on gifted and talented education for every \$500,000 spent on everything else. This lack of investment in talented students is remarkable, given their importance to maintaining national competitiveness, increasing gross domestic product, and enhancing societal innovation through developments in science, technology, engineering, and math; artificial intelligence; cybersecurity; and big data.

The lack of attention paid to talented students is most likely related to the stereotype that such students do not need help due to their intellectual advantages and resource-rich parents. But disadvantages related to poverty and parents with low educational attainment exist across the full range of talent, and millions of low-income advanced learners are poorly served in public schools. These students who rely on public education to meet their academic needs are often the biggest losers in education policy, and we as a society lose out on their intellectual and creative contributions.

K-12 education generally lacks systematic identification and talent development, which leads to gifted but disadvantaged students being unable to compete in elite college admissions. As a result, fewer of these students end up in leadership positions that largely select students from elite colleges. This opportunity gap has implications for students' well-being throughout their lives, their performance on international tests, and a cumulative loss of innovation.

We use the terms “academically advanced” and “gifted” interchangeably in this paper to refer to students who score highly (e.g., in the top 5 percent) on standardized tests, which usually include math and verbal reasoning measures. We describe the population of gifted students, discuss how they can vary widely in their talents, and introduce the importance of using spatial reasoning measures. Taking into account these different intellectual talents and how they are distributed in the population is crucial for developing sound educational policy.

We review evidence for the disproportionate positive contributions of academically talented students to society and the economy, show that the talents of academically advanced students are relatively underdeveloped, and suggest that universal testing and appropriate educational interventions be provided. This would help identify and challenge advanced students, narrow opportunity gaps, and enhance societal innovation.

Fully Developing the Potential of Academically Advanced Students: Helping Them Will Help Society

JONATHAN WAI AND FRANK C. WORRELL

The greatness of a nation may be manifested in many ways—in its purposes, its courage, its moral responsibility, its cultural and scientific eminence, the tenor of its daily life. But ultimately the source of its greatness is in the individuals who constitute the living substance of the nation. . . . Our devotion to a free society can only be understood in terms of these values. It is the only form of society that puts at the very top of its agenda the opportunity of the individual to develop his potentialities.

—*The Pursuit of Excellence: Education and the Future of America*¹

Much of education policy is understandably focused on finding effective ways to help the majority of students, especially students who struggle academically.² As a society, we care deeply about achievement gaps and improving educational outcomes for disadvantaged students. However, academically advanced or gifted students are frequently left out of education reform conversations.

The lack of value placed on developing these students is most clearly communicated through funding. In the \$59.8 billion 2015 federal education budget, one dollar was spent on gifted and talented education for every \$500,000 spent on everything else,³ and this rate of funding has remained near zero for at least the past two decades.⁴ It is remarkable that we invest so little in the students whose success is essential to maintaining national competitiveness;⁵ enhancing societal innovation through developments in science, technology, engineering, and mathematics (STEM), artificial intelligence, cybersecurity, and big data talent;⁶ and increasing gross domestic product (GDP).⁷

We typically assume academically advanced students do not need help, but disadvantages related to poverty and parents with low educational attainment exist across

the full range of talent.⁸ In fact, while the stereotype is that academically advanced students have resource-rich parents to supplement their educational development,⁹ millions of low-income advanced learners in the US are not well-served in public schools.¹⁰ These students, the academically advanced who rely on public education to meet their academic needs, are often the biggest losers in education policy.¹¹

Oftentimes, academically talented but disadvantaged students are not identified for advanced opportunities, which has important long-term consequences for those students and for society. K–12 education generally lacks systematic identification and talent development, which leads to many talented but disadvantaged students not being prepared to compete for elite college admission slots.¹² This causes a lack of representation of disadvantaged but talented students in leadership positions that largely select students from elite colleges.¹³ This divide between talented resource-rich and resource-poor students—often referred to as the “opportunity gap”—also has implications for students’ well-being throughout their lives, performance on international tests such as the Program for International Student Assessment (PISA), and a cumulative loss of innovation broadly.¹⁴

This is why investment in talented students is very much a national competitiveness and defense issue, even if it is not typically seen that way.

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We review evidence for the disproportionate positive contributions of academically talented students to society and the economy, show that the talents of academically advanced students are relatively underdeveloped, and suggest that universal testing and appropriate educational interventions be provided. This would help identify and challenge advanced students, narrow opportunity gaps, and enhance societal innovation.

Who Are the Academically Advanced?

There is tremendous natural range in athletic talent.¹⁵ The same holds true for academic talent.¹⁶ Just as there are students with learning disabilities who are performing well below the typical student, there are also students with learning gifts who are performing well above the typical student.

Broadly, academically talented students are those who score high on standardized tests, which indicates they are ready for an advanced educational curriculum. For example, stories about kids entering college early or inventing something¹⁷ point to the top end of academic talent and academic readiness. In fact, many high achievers and influencers in society were identified as gifted children.

Although gifted education has largely been absent from policy conversations, gifted students are part of many of our societal conversations. The students who participate in the Mathcounts national competition, the Science Talent Search, the Google Science Fair, First Lego League competitions, robotics competitions, or

the National Spelling Bee, or those who attend highly selective high schools or magnet schools, are academically advanced. When we talk about elite college admissions or students at places such as Harvard, the Georgia Institute of Technology, the University of Chicago, or the University of California, Berkeley, we are essentially talking about postsecondary gifted and talented education. When we talk about improving PISA performance at the high end, we are talking about gifted students.

Thomas Jefferson wrote, “We hope to avail the state of those talents which nature has sown as liberally among the poor as the rich, but which perish without use, if not sought for and cultivated.”¹⁸ Nationally representative samples of the US population indicate that more academically talented students tend to come from higher-income backgrounds.¹⁹ However, Jefferson is correct that *all* youths of genius, whether rich or poor, will have their talents perish if not appropriately sought for and cultivated.

Because math and verbal ability are more strongly tied to socioeconomic status than is spatial ability in the US population, there are likely more students with spatial talent who come from lower-income and disadvantaged backgrounds.²⁰ Although the talent development of students across the socioeconomic spectrum is essential, focusing on identifying and developing low-income and spatially talented students would help level the playing field.²¹

Why Should We Care About Helping Gifted Students?

When gifted students grow up, a few become entrepreneurs and CEOs, such as Marissa Mayer, Elon Musk, Sheryl Sandberg, Peter Thiel, or Mark Zuckerberg, or Nobel Prize-winning scientists, such as Linda Buck, Marie Curie, or Albert Einstein. Many others become the intellectual force that supports the innovations those outliers make. For example, the engineers at SpaceX or Blue Origin are highly spatially talented. In short, when we discuss high to extraordinary achievers, we are often talking about people who were part of the academically advanced population in school.²² These people also usually come from relatively advantaged backgrounds.²³

A large body of research shows that academically advanced students contribute disproportionately to societal innovation and GDP as adults. Research from the Study of Mathematically Precocious Youth, a US sample of highly select advanced learners,²⁴ shows that adults who were advanced learners make substantial intellectual and technological contributions, such as registering patents at rates *two to eight times higher* than the general population, publishing fiction and nonfiction at higher rates, and earning doctorates and university tenure at higher rates.²⁵ In addition to these contributions, these adults pay taxes on the substantially higher incomes they often earn. As a result, advanced learners around the world have an outsized influence on GDP, which has a substantial long-term economic impact.²⁶

Nobel Prize-winning economist James Heckman showed that investing in students early in their lives can have a long-term economic and societal payoff.²⁷ Specifically, Heckman illustrated that early investments in *high-ability* students in comparison with *low-ability* students result in much greater rates of return. Extending this work suggests that even a small investment in advanced learners would result in a huge payoff in terms of intellectual and technological innovations and GDP and would improve national competitiveness and defense.

The typical assumption is that academically advanced students have a head start in life and therefore do not really need policy strategies to support their learning. And, because we as a society care deeply about narrowing rather than widening gaps between groups, it would appear that providing assistance to students who already have talent would disadvantage others. Although by definition gifted students have an academic advantage, this does not mean that they are always academically challenged and learn something new each day or that they could not be further “advanced.” In fact, many of them are performing well above grade level but are not developing academically, and consequently, many of these students are not reaching their full potential.²⁸ Gifted students need our help to ensure that they are challenged academically, remain engaged, and retain their love of learning.

Low-income and disadvantaged students are especially vulnerable because they do not usually have resource-rich parents to help develop their talents.²⁹ In fact, in parallel to achievement gaps for the general

population, large achievement gaps exist in the academically advanced population.³⁰ These gaps are unlikely to be fully closed because of the first law of individual differences—when you raise the average of a distribution (student performance overall goes up), you also increase the variance of a distribution (student performance spreads out even more).³¹ However, these achievement gaps can be narrowed, and at the very least it would seem appropriate to provide sufficient educational resources to ensure that talented but disadvantaged students develop their talents fully.

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Those who are advanced in spatial reasoning are also at risk of having their talents underdeveloped. More than a half-century of research shows that spatial reasoning is linked to STEM innovation, over and above math and verbal reasoning.³² Spatial reasoning is therefore crucial to scientific advances that have a lasting benefit to society.

MIT Technology Review has routinely identified breakthrough technologies and scientific advances that will likely transform our future.³³ Many of these advances are clearly spatial in nature. In computing, we have witnessed 3D transistors; in mathematics, the discovery of a new mathematical tile; in engineering, nano-architecture

and agile robots; in chemistry, a self-healing polymer and DNA origami; and in biology and medicine, microscale 3D printing and implantable electronics. These are just a handful of innovations that have relied on individuals' spatial ability and imagination, and these skills will be even more important with the coming revolution in artificial intelligence.³⁴

However, educational testing at all levels largely omits spatial measures. As a result, students who excel at spatial reasoning are not systematically identified or do not receive educational programming suited to their strengths. Their talent goes underdeveloped, and this leads to a cumulative loss of innovation.

The research linking advanced learners to long-term innovation shows why investment in such learners is a national competitiveness issue.³⁵ In both sport and education, there are below-average, average, and advanced individuals. If a coach decided to focus largely on developing the talent of the least competent athletes, fans would probably not approve because it would limit the team's competitiveness. Yet in the United States, in academics, we focus on low-performing learners (as we should) and ignore advanced learners (which we should not).³⁶ This strategy is equally ineffective in academic domains and limits performance in an increasingly competitive global economy.

What Educational Reforms Would Most Effectively Help Academically Advanced Students?

We recommend paying attention to advanced learners through universal assessment (for math, verbal, and spatial talent), providing challenging educational opportunities, educating all teachers about advanced learners, learning about what might work from other countries and talent domains, adopting evidence-based policies, and personalizing learning based on individual differences in learning rates. Many of these strategies will require increased (or redistributed) funding, at which some might balk; however, we consider these reforms to be essential. Ultimately, it comes down to extending the concept used in special education of a student's right to a "free and appropriate education" to *all* students.³⁷

Identification: Assess All Students. Developing talent properly and maximally is difficult if you do not identify it early.³⁸ A key part of the problem is that gifted low-income students are not being identified systematically.³⁹ Typically, parents or teachers nominate individual children as gifted. These children are then assessed and placed in educational programming that matches their ability. Consequently, identifying gifted children is often left to the discretion of parents and teachers, which has been shown to underrepresent low-income and minority children.⁴⁰

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The solution is to give everyone the same reliable and valid test to ensure that all students are systematically and appropriately assessed. School systems primarily focus on verbal and mathematical aspects in testing and teaching, but we should assess all students on spatial reasoning as well, due to the clear link between spatial reasoning and innovation and creativity.⁴¹ Additionally, spatially advanced learners are less likely to be vocal or speak out in class. This is significant because teachers and administrators often focus on students who are more verbal and speak out.⁴² Finally, assessing spatial reasoning is important because educators themselves are likely to have higher verbal and math reasoning (relative to spatial reasoning), and they may more readily recognize their own talents in their students and inadvertently neglect spatially talented students.

Educational Talent Development. The research findings have been clear about both the *educational interventions*⁴³ and *educational dosage*⁴⁴ that are most effective in developing the talents of academically advanced students. The key is to provide individualized interventions that challenge students at the appropriate level and pace and are sustained over a long period of time.

Challenge All Students. Students should be exposed to educational opportunities that are available, interesting, and at the upper limit of their current capability. Although some interventions are likely more impactful than others on average, research suggests that students can enhance their long-term achievement through a variety of educational opportunities and that educational interventions are, to some extent, *interchangeable* because there is no single winning formula for everyone.⁴⁵

The broad intervention of *educational acceleration*—essentially moving advanced learners through the curriculum at faster rates—has been supported by decades of evidence.⁴⁶ Acceleration can range from more intense forms of advancement such as skipping full grades⁴⁷ and entering college early⁴⁸ to less intense forms such as taking Advanced Placement or honors courses or moving ahead in individual subjects. These interventions have been shown to be beneficial academically and occupationally in the long run; on average, they also do not have detrimental social and emotional effects.⁴⁹

Teaching Educators About Gifted Students. Systematically identifying academically advanced students and providing appropriate educational interventions requires understanding the existing research. For example, researchers have known for decades that assessing all students is the fairest and least biased way to find talent from all backgrounds and that moving students ahead in the educational curriculum at the level and area in which they are naturally functioning helps keep them challenged and engaged. However, many educators may not know about this research. In fact, there appears to be strong resistance or uncertainty about programs such as grade skipping or early entrance to college, most likely due to school implementation issues and social and emotional concerns.⁵⁰ Additionally, educators may

not understand the different types of academic talent (e.g., general, math, verbal, and spatial) and their association with socioeconomic backgrounds and therefore not realize that many talented students are overlooked. Education reforms should involve teaching educators about gifted students at least as much as about students with learning disabilities.

Learning from Other Talent-Selection and Education Models. Sound education policy should be built on research-based evidence, not educational fads. We should also consider what can be learned from talent and identification models in other countries and domains and how the personalization of learning based on individual differences can change education in the future.

Talent Identification and Development from Other Countries. The US benefits substantially from the contributions of immigrants educated in countries that outscore us on PISA or other international comparisons. Many of our innovators, including recent Nobel Prize winners Sir J. Fraser Stoddart, Oliver Hart, and David J. Thouless, fit this description.⁵¹ Many winners of top STEM competitions—such as the Science Talent Search—are also from other countries,⁵² which suggests that a lot of enhanced innovation and increase in GDP comes from the US welcoming talented immigrants. Tech companies have made concerted efforts to secure international talent, including through programming competitions such as Kaggle Recruit, Code4Bill, Imagine Cup, and Code Jam.⁵³

As a nation, it would behoove us to study selection and education strategies from a broad sample of countries whose academically advanced students consistently perform at the top of international comparisons. From there, we can assess commonalities and craft our own solutions for the US school system.

Talent Identification and Development in Other Domains. Among men, 28 percent have the needed height and weight combination to be professional soccer players, 23 percent elite sprinters, 15 percent professional hockey players, and 9.5 percent rugby union forwards.⁵⁴ Height is relatively immutable and is somewhat analogous to general intellectual talent. Although there is

little evidence to suggest that one's basic intellectual abilities can be largely improved, one can invest those abilities in developing skill sets and talents through interventions such as "education," however that is conceptualized and quantified.

The way general intellectual talent is distributed in the population, and across math, verbal, and spatial talent specifically, is important to account for when considering the likelihood of someone reaching the top of any educational or occupational domain.⁵⁵ For example, research indicates that academic ability *level* matters (math + verbal + spatial) but that the academic ability *pattern* of math, verbal, and spatial also matters,⁵⁶ before considering the impact of education and other factors.

It is crucial to focus education reform efforts on what the evidence base supports to date, not on popular ideas or terms with little scientific backing.

Beyond this, research suggests that educational development matters over and above basic abilities. From a pragmatic standpoint, this means that, similar to "body types" in athletics, there are "mental types" in education (e.g., students whose math and spatial talents are greater than their verbal talent) and that we should take this into account. For example, students with primarily spatial strengths may benefit from educational programs that focus on working with one's hands and tinkering, such as robotics.⁵⁷ Additionally, talent selection in athletics, performing arts, and several other domains have been helped by sports franchises and television shows, which open up opportunities to a broad range of individuals. Companies, the

media, and government, among others, need to pick up on this for academics.

Focusing on Evidence. Education is full of fads that are supported by little evidence but whose influence can span decades.⁵⁸ This paper focuses on reforms based on the available evidence. For example, longitudinal work has shown that although both cognitive ability and personality can predict later educational and occupational achievement, cognitive ability plays a larger role than personality in helping students overcome socioeconomic disadvantage.⁵⁹ Conversely, research has shown that "grit," which is currently a hot topic, does not contribute to academic achievement beyond established personality factors.⁶⁰ It is crucial to focus education reform efforts on what the evidence base supports to date, not on popular ideas or terms with little scientific backing.

Personalizing Learning Based on Individual Differences. The role of technology and artificial intelligence in education may increase personalized learning.⁶¹ Because "academically advanced" and "gifted" are essentially arbitrary labels for students along the continuum of academic or intellectual ability, if a time comes when technology can accurately assess academic level, strengths, and specific learning outcomes, then talent identification and educational development might become more seamless and could more effectively accommodate academic and socioemotional needs. For example, programs such as Khan Academy⁶² allow anyone around the world to educate themselves at their own pace and in any subject, and these programs are probably precursors to future models of personalized education. When new educational policies are being conceptualized and written, legislators should ensure that students of all ability levels will be given appropriate attention and customization.

Funding Change

The Individual with Disabilities Education Improvement Act allocates more than \$50 billion per year for special education.⁶³ Contrast this with annual

spending on gifted and talented education of less than \$10 million.⁶⁴ That is 0.0002 percent of the K–12 federal education budget spent on 6 percent of students.⁶⁵ Proportionate funding would allocate \$3 billion for gifted education.

There are constant conversations about the need for technological, artificial intelligence, big data, and STEM talent; anxiety over the mediocre performance of top students on international tests; and concerns about national competitiveness. Yet as a country we spend a small fraction of what would be proportionate funding for academically advanced students.

By underfunding gifted education, we are hurting not only US innovation but also the advanced students who most need our help. Despite our best intentions to close gaps,⁶⁶ only resource-rich students are challenged because their parents spend the money to ensure their (own child's) talent is developed. The ones who lose out are the low-income, disadvantaged, and spatially talented students who are not systematically identified or developed and who rely on public funding because their parents cannot afford special programs.

Even if we do not fund gifted education proportionately, we should target more resources toward low-income, disadvantaged, and spatially talented students. That would help level the playing field, would improve the well-being of these students, and would be an evidence-based approach to narrow the achievement gaps in academically advanced populations.

Fully Developing the Potential of Academically Advanced Students Will Benefit Society

PayPal Cofounder Peter Thiel famously said, in remarking on future technological developments and the creation of Twitter, “We wanted flying cars; instead, we got 140 characters.”⁶⁷ As innovative as Twitter might be, it pales in comparison to STEM or other breakthroughs that could truly transform our future.

Many things that were futuristic in the past remain futuristic today, largely because we have not funded numerous potentially breakthrough technologies. Yet perhaps more fundamentally, we have failed to identify and develop the *minds* that go on to solve many of the world's problems and dream up ideas and products that today are unimaginable.⁶⁸ The least we can do is help talented students maximize their potential, which will ultimately help society and our nation prosper.

About the Authors

Jonathan Wai is a research fellow at Geisinger Health System in the Autism & Developmental Medicine Institute and a visiting researcher at Case Western Reserve University in the Department of Psychology.

Frank C. Worrell is a professor in the Graduate School of Education at the University of California, Berkeley.

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