

Brounstein, P.J., Holahan, W., & Dreyden, J. (1991). Change in self-concept and attributional styles among academically gifted adolescents. *Journal of Applied Social Psychology, 21*, 198-218. [Keywords: Self-Concept; Program Evaluation]

A nonequivalent control group design involving academically gifted students who would participate in a residential summer program where they could achieve "consensual validation" by being with other gifted students (n=156), those eligible but who would not attend the program (n=172), and academically competent students (n=106), was used to identify differences in global self-concept, the structure of self-concept and attributional style, before, immediately after, and about four months after the intervention. There were no initial differences on any of the measures for the two gifted groups. However, competent students differed from gifted students on both self-concept and attributional measures. While global self-concept for gifted and competent students was similar, competent students boasted significantly greater self-concepts in the domains of social and physical activities and significantly lower self-concepts in the academic domain. On the attributional style measure, gifted students were significantly less likely than competent comparisons to take credit or see as pervasive the causes for social successes. In general, differences observed initially were robust over time. Only tentative support for the effectiveness of the short-term intervention being effective in modifying aspects of social self-concept among the gifted was obtained. Here, gifted program attenders decreased the extent to which they internalized blame for or perceived as pervasive the causes for social failure subsequent to program participation. The relationship of observed changes in attribution to self-concept and the effectiveness of short-term interventions to effect change in cognitive functioning and personality are discussed.

Brounstein, P.J., & Holahan, W. (1987). Patterns of change in scholastic aptitude test performance among academically talented adolescents. *Roepers Review, 10*, 110-116. [Keywords: Talent Identification]

The Scholastic Aptitude Test (SAT) scores of 640 gifted adolescents attending an academic summer residential program were analyzed. Of special interest were the scores of 169 (26.4%) students who had taken the test more than once. Average test-retest score gains were large-89.8 points on the math, and 70.2 points on the verbal portions of the SAT. Growth seemed largely compensatory, with greater achieved scores in their initial area of weakness. Nevertheless, students maintained greater achieved scores in their initial area of strength, and maintained their rank ordering among their peers over repeated test administrations. Implications for targeted educational programs are discussed.

Brounstein, P.J., Holahan, W., & Sawyer, R. (1988). The expectations and motivations of gifted students in a residential academic program: A study of individual differences. *Journal for the Education of the Gifted, 11*, 36-52. [Keywords: Program Evaluation]

The investigation was conducted to determine what, if any, differences in expectations, motivations, satisfaction, and performance existed among 612 extremely gifted adolescents attending the Talent Identification Program's Summer Residential Program. As part of a thorough program evaluation, a staged series of statistical analyses were effected. Three discernible groups of students emerged (Academically Oriented, Socially Oriented, and Highly Motivated- Gregarious). Investigation of the composition and correlates of these groups revealed a number of interesting differences. The implications of this effort for program modification and future investigation of differences within the academically gifted population are discussed.

DeLong, M.R., Jensen, D.L., & Sawyer, R.N. (1985). Modern mail and ancient tongues: By-mail options for classical studies. *Classical Outlook*, 62, 111-114. [Keywords: Program Model]

Describes two correspondence courses for early adolescent students ("Latin-By-Mail" and "Ancient Greek-By-Mail") established by the Talent Identification Program at Duke University to help fill the gap caused by the teacher shortage in classical languages. The Latin program includes introductory, intermediate, and advanced courses; the ancient Greek consists of one long introductory course.

Dreyden, J.I., & Gallagher, S.A. (1989). The effects of time and direction changes on the SAT performance of academically talented adolescents. *Journal for the Education of the Gifted*, 12, 187-204. [Keywords: Gender]

In an attempt to explain the gender gap in Scholastic Aptitude Test (SAT) scores, a study tested the effects of changing time limits and directions on the performance of academically talented males and females. Students took either the SAT-Math subtest (n=46 males and 27 females) or the SAT-verbal subtest (n=36 males and 33 females) under Timed or Untimed conditions and with Standard or Non-standard Directions. Analyses involved comparisons of performance by gender under the experimental conditions. Resulting trends indicated differences on the basis of time and gender on the SAT-M subtest. Further analysis revealed several patterns which could potentially explain reasons for performance differences outside of ability. No significant differences were found on the SAT-V subtest. Discussion of study results include the reasons why performance on the SAT-M with its current time limit to identify academic talent.

Gaultney, J.F., Bjorklund, D.F., & Goldstein, D. (1996). To be young, gifted, and strategic: Advantages for memory performance. *Journal of Experimental Child Psychology*, 61, 43-66. [Keywords: Characteristics of Gifted Youth]

Gifted and non-gifted children's use of an organizational strategy was contrasted on multi-trial free-recall tasks, using different sets of items on each trial. In an initial experiment, gifted children initially had higher levels of recall and strategic functioning than non-gifted children, but this advantage was lost on later trials. While overall there was an advantage to memory of being strategic, this advantage was statistically significant for the gifted children only at trial 1, whereas it was significant for the non-gifted children on trials 2 through 5. A sort-recall procedure was used in Experiment 2, with results indicating that gifted children benefited more than non-gifted children when strategy use was simplified, while the results of Experiment 3, which used nonsense words as stimuli, demonstrated that gifted children demonstrated greater use of active strategies than non-gifted children. The results of these experiments were interpreted as evidence that at least a portion of gifted children's advantage on free recall tasks lies in nonstrategic processes.

Goldstein, D., Haldane, D., & Mitchell, C. (1990). Sex differences in visual-spatial ability: The role of performance factors. *Memory and Cognition*, 18, 546-550. [Keywords: Talent Identification; Gender]

Two studies were designed to explore the role of performance factors as sources of the frequently noted higher male scores on visual-spatial ability tests. In the first study, the mental rotations test (MRT) was administered to male and female college students of equally high quantitative ability (based on SAT math scores). Although males had significantly more correct responses on the test than did females, their advantage was eliminated when the ratio of correct

responses to items attempted was used as the dependent measure. In the second study, the same test was administered to new groups of male and female college students. In this sample, the males had significantly higher SAT math scores. The MRT was administered under standard, timed conditions and under untimed conditions. Both raw and ratio scores were calculated. With SAT math score as the covariate, analyses of covariance indicated that males demonstrated higher performance in the timed, raw-score condition but not in the untimed or in the ratio-score conditions. The theoretical and social policy implications of these studies are discussed.

Goldstein, D., & Stocking, V.B. (1994). TIP studies of gender differences in talented adolescents. In K.A. Heller & E.A. Hany (Eds.), *Competence and responsibility: The third European conference of the European Council for High Ability (held in Munich, Germany)*, October 11-14, 1992, (Vol.2; pp.190-203). Seattle: Hogrefe & Huber. [Keywords: Gender]

Since the Duke University Talent Identification Program (TIP) was established in 1980, data on talented students aged 12 through 16 have been gathered in conjunction with the 16-state regional talent search as well as the Summer Residential Program (SRP) held each summer on the Duke University campus. This paper presents an overview of research at TIP that documents some differences- and some surprising lack of differences- between academically talented young males and females. We begin with a summary of gender differences in both mathematical and verbal ability, as measured by the Scholastic Aptitude Test (SAT): In particular, trends indicating a recent decrease in the gender gap on the mathematical portion of the test are highlighted. In addition, data from questionnaires administered to talent search participants are presented that highlight gender differences in attitudes about school and career. Attitudes towards school, approached from a variety of perspectives, varied with gender according to traditional sex stereotypes: significant differences were found in girls' and boys' perceptions of classes in terms of degree of liking, perceived usefulness, and forced-choice comparisons as well as gender differences in degree of interest in most- but not all- potential college majors. Questionnaire data also revealed significant differences in the degree of liking of most careers, with a few students that demonstrated that SRP course selection varied with gender, although performance in the courses did not. These data, taken together, suggest that gender differences in high ability students are found primarily in the domain of attitudes. Gender differences in performance and ability are much smaller than commonly believed. These findings have important implications both for our understanding of the nature of gender differences as well as for education policies and practices.

Holahan, W. & Sawyer, R. N. (1986). The counseling and consultation of TIP's summer residential program. *Roeper Review*, 9, 108-113. [Keywords: Program Model]

Describes a university talent-identification program (TIP) that developed a strong counseling and consultation component within its summer residential program to deal with the normal developmental problems and emotional difficulties experienced by academically gifted adolescents. The personnel, methods, and the presenting problems of students are described. Future directions for counseling and consultation are discussed.

Jarosewich, T., & Stocking, V. B. (2003). Talent Search: Student and parent perceptions of out-of-level testing. *Journal of Secondary Gifted Education*, 14, 137-150. [Keywords: Talent Identification]

Every year, hundreds of thousands of academically gifted 7th- and 8th-grade students participate in 1 of 4 regional or several local talent searches, through which they take the ACT or SAT as an out-of-level test. Participation in a talent search offers young students the opportunity to learn about their abilities, practice taking the standardized test they will eventually take for college admittance, obtain information about educational opportunities, and become eligible for rigorous summer and weekend education programs with similarly gifted peers. Very little information is available from the perspectives of students and parents regarding what it is like to take these tests as a 7th or 8th grader. We surveyed 909 students and their parents about their reasons for participating in one of the regional talent searches, the ways in which they prepared for the test, and their feelings while taking the test. Results suggest that students participated in the talent search primarily to gain experience taking the test and to learn about their abilities. Students and parents reported that taking the test was a positive experience for the student. Parents reported being proud that their children were invited to take the test and felt that participation was an honor.

Jarosewich, T., Pfeiffer, S. I., & Morris, J. (2002). Identifying gifted students using teacher rating scales: A review of existing instruments. *Journal of Psychoeducational Assessment, 20*, 322-336. [Keywords: Talent Identification]

Reviews the technical adequacy and usefulness of 3 popular teacher rating scales designed to identify gifted students: the Gifted and Talented Evaluation Scales (GATES), Gifted Evaluation Scale, Second Edition (GES-2), and Scales for Rating the Behavioral Characteristics of Superior Students (SRBCSS). Scale characteristics, scoring and standardization procedures, and test reliability and validity were compared. It is concluded that teacher-completed gifted rating scales can assess all of the areas presented in the federal definition of giftedness. However, the findings lead the authors to recommend caution in using the GATES, GES-2, and SRBCSS in the identification of gifted learners. This review suggests concerns with the technical adequacy of the 3 gifted rating scales.

Jarosewich, T., & Stocking, V. B. (2003). Medication and counseling histories of gifted students in a summer residential program. *The Journal of Secondary Gifted Education, 14*, 91-99. [Keywords: Characteristics of Gifted Youth]

Many gifted students are served through special programming. However, little large-scale information is available regarding the incidence of psychological disorders, medication requirements, and counseling histories in that population. This type of information is important to ensuring the well-being of gifted students, particularly those served through residential programming. This study reports the results of a review of medical information forms for over 1,900 gifted 8th-11th graders participating in a 3-week residential academic programs. Rates of diagnosed psychological disorders, medication prescriptions, and counseling needs are presented. In general, this sample reported low rates of psychological disorders, medication use, and counseling. Results are discussed in terms of program development and program policy issues.

Lee, S.Y., Olszewski-Kubilius, P., Makel, M. C., & Putallaz, M. (2015). Gifted students' perceptions of an accelerated summer program and social support. *Gifted Child Quarterly, 59*, 265-282.

Using survey responses from students who participated in the summer programs at two university-based gifted education institutions, this study examined changes in gifted students'

perceptions of their learning environments, accelerated summer programs and regular schools, and social support in lives after participation in the summer programs. Our sample of gifted students was generally favorable about their classroom experiences and interactions with their teachers both in the gifted programs and regular school classes. Some noticeable differences were greater acceptance and support for giftedness, a stronger connection to peers, and greater ease in peer relationships reported during the programs, and enhanced maturity and orientation toward future after the programs. While all students relied on family and peers as sources of social support before, during and after the summer programs, older students also endorsed being able to rely more on themselves. Perceptions of greater social support seemed to be related to more positive assessment of students' summer and school classes, although causality can go in either direction. Overall, this study suggests that gifted students' summer program experiences may be instrumental in receiving affirmation about their giftedness from peers, enhancing independence and maturity for academic life, and building stronger belief in themselves.

Lee, S., Matthews, M. S., & Olszewski-Kubilius, P. (2008). A national picture of talent search and talent search educational programs. *Gifted Child Quarterly, 52*, 55-69. [Keywords: Program Model; Talent Identification]

This article presents a comprehensive portrait of talent search testing and associated educational programs in the United States, now some 35 years after Dr. Julian Stanley originated the concept. Survey data from the six major talent search centers in the United States were used to examine the scope of talent search educational offerings, including accelerated summer, distance education, Saturday and weekend, and leadership programs. Reported data reveal that over 3 million students have participated in talent search testing since these programs' inception, and subsequently thousands of these students participate each year in other educational programs offered by these organizations. In addition to above level test scores, data used to pre qualify students to participate include on-level standardized achievement tests, teacher or parent nominations, and portfolios. Disproportional representations within talent search testing and educational programs by racial and household income levels were addressed with a need for more financial support and collaborative work between talent search centers and local schools for more students to benefit from the talent search model.

Li, Y., Alfeld, C., Kennedy, R. P., & Putallaz, M. (2009). Effects of summer academic programs in middle school on high school test scores, course-taking, and college major. *Journal of Advanced Academics, 20*, 404-436. [Keywords: Program Evaluation; Achievement and Motivation]

Through their participation in a seventh-grade talent search in 1996-1997, students qualified to attend a summer program at Duke University's Talent Identification Program (Duke TIP). Of the North Carolina students in this group, some attended at least one summer program in middle school and others had qualified for but did not attend a summer program at Duke TIP. The two groups did not differ significantly on gender, parent education level, or ethnicity. Some positive effects of Duke TIP summer programs were found on later academic achievement and educational choices using both standardized objective measures and self-reports of high school and college academic experiences. We found that students who participated in a Duke TIP math program in middle school did indeed take more AP math courses in high school, but there were no effects for other types of advanced math classes or for any other subjects. Additionally, compared to Search only students, students who took a math/science course at Duke TIP were

more likely to major in math/science in college. More Duke TIP students than Search only students aspired to earn a doctorate. Anecdotally, we also have heard from many former Duke TIP participants how much Duke TIP has affected their lives, and it is noteworthy that we are now able to empirically document some of these effects.

Linnenbrink-Garcia, L., Patall, E. A. and Messersmith, E. E. (2013), Antecedents and consequences of situational interest. *British Journal of Educational Psychology*, 83, 591–614.[Keywords: Gender]

Luthar, S.S., Zigler, E., & Goldstein, D. (1992). Psychosocial adjustment among intellectually gifted adolescents: The role of cognitive-developmental and experiential factors. *Journal of Child Psychology and Psychiatry*, 33, 361-375. [Keywords: Characteristics of Gifted Youth; Gender]

Levels of psychological adjustment were examined among 51 high achieving intellectually gifted adolescents matched with a mean age of 14.1 years. These students were compared with older adolescents matched with them on cognitive maturity (n=30), and with two groups matched with them on chronological age (CA). One of the CA-matched groups contained children not identified as gifted (n=47), while the other consisted of athletically talented youngsters (n=39). All participants belonged to upper middle class families. On multiple indices of adjustment, intellectually gifted adolescents were comparable to older adolescents with similar cognitive skills, but differed from both groups of age mates. Differences between the gifted and non-gifted CA-matched groups were stronger than were those between the gifted group and the athletes of the same age. The findings were interpreted in terms of cognitive-developmental and experiential influences on psychological adjustment. The study also revealed gender effects which appeared to be linked with conflicts faced by gifted females between issues of achievement and those of social acceptance.

Makel, M. C. (2014). The empirical march: Making science better at self-correction. *Psychology of Aesthetics, Creativity, and the Arts*, 8, 2-7.

Psychology has been criticized recently for a range of research quality issues. The current article organizes these problems around the actions of the individual researcher and the existing norms of the field. Proposed solutions align the incentives of all those involved in the research process. I recommend moving away from a focus on statistical significance to one of statistical power, renewing an emphasis on prediction and the pre-registration of hypotheses, changing the timing and method of peer-review, and increasing the rate at which replications are conducted and published. These strategies seek to unify incentives toward increased methodological and statistical rigor to more effectively and efficiently reduce bias and error.

Makel, M. C., Kell, H. J., Lubinski, D., Putallaz, M., & Benbow, C. P. (2016). When lightning strikes twice: Profoundly gifted, profoundly accomplished. *Psychological Science*. doi:10.1177/0956797616644735 [keywords: Talent Identification; Program Evaluation]

The educational, occupational, and creative potential of the profoundly gifted participants (IQs > 160) in the Study of Mathematically Precocious Youth (SMPY) is astounding, but is it representative? Duke University's Talent Identification Program (TIP) identified 259 young adolescents who were equally gifted. By age 40, their life accomplishments also were extraordinary: Thirty-seven percent had earned doctorates, 7.5% had achieved academic tenure (4.3% at research-intensive universities), and 9% held patents; many were high-level leaders in

major organizations. As was the case for the SMPY sample before them, differential ability strengths predicted their contrasting and eventual developmental trajectories—even though essentially all participants possessed both mathematical and verbal reasoning abilities far superior to those of typical Ph.D. recipients. Individuals, even profoundly gifted ones, primarily do what they are best at. Differences in ability patterns, like differences in interests, guide development along different paths, but ability level, coupled with commitment, determines whether and the extent to which noteworthy accomplishments are reached if opportunity presents itself.

Makel, M. C., Lee, S. Y., Olszewski-Kubilius, P., & Putallaz, M. (2012). Changing the pond, not the fish: Following high ability students across different educational environments. *Journal of Educational Psychology, 104*, 778-792. doi:10.1037/a0027558. [Keywords: Program Model; Self-Concept]

Big-fish-little-pond effect (BFLPE) research (e.g., Marsh & Parker, 1984) has found that perceptions of academic ability are generally positively related to individual ability and negatively related to classroom and school average ability. However, BFLPE research typically relies on environmental differences as a between-subjects factor. Unlike most previous BFLPE research, the current study used group average ability as a within-subject variable by measuring student self-concept before and after high ability students left their regular school environment to participate in a supplemental academic summer program. Results revealed that academic self-concept (ASC) and educational aspirations did not undergo significant declines when students were in the relatively higher ability environment. Even with ceiling effects limiting potential increases in ASC, participants were more than two times as likely to increase or maintain their ASC as they were to report declines in ASC. Further, several boosts were found in non-academic self-concepts. Such findings indicate that BFLPEs are not necessarily associated with supplemental educational environments.

Makel, M. C., Li, Y., Putallaz, M., & Wai, J. (2011). High-ability students' time spent outside the classroom. *Journal of Advanced Academics, 22*, 720-749. [Keywords: Characteristics of Gifted Youth]

This study considered how three groups of academically talented high school students—those who attended an academic summer program (TIP), those who qualified for the program but chose not to attend (QNA), and those who did not qualify (DNQ)—spent time outside the classroom. These groupings differentiated students by ability (QNA vs. DNQ) and attendance (TIP vs. QNA). Male-female comparisons were also conducted. By comparing participation rates across a variety of activities and by sex, the current study helps explain the lives of high-ability students outside the arena by which they are defined: their academic ability. Results reveal numerous group and sex differences based on how high-ability students spend their time outside the classroom. Females tended to participate more than males in activities that were generally positively associated with academic achievement, while also participating in more types of activities. Males, however, reported watching more TV and were less likely to participate in any activity. QNA students reported spending more time on academic-related activities, such as homework and academic clubs, than did DNQ students, indicating a generally higher interest in academic endeavors. However, the QNA and TIP groups differed only in their service club participation rates, indicating that attending a summer program is not associated with spending time outside the classroom differently during the school year. This research underscores the heterogeneity of different groups of high-ability students and suggests some caution when generalizing from

research findings based only on program participants. Knowing how students spend their time can help parents, educators, and researchers understand and foster adolescent development.

Makel, M. C., Wai, J. Peairs, K., & Putallaz, M. (2016). Sex differences in the right tail of cognitive abilities: An update and cross cultural extension. *Intelligence*, 59, 8-15. doi: 10.1016/j.intell.2016.09.003 [Keywords: Gender, Talent Identification]

Male–female ability differences in the right tail (at or above the 95th percentile) have been widely discussed for their potential role in achievement and occupational differences in adults. The present study provides updated male–female ability ratios from 320,000 7th grade students in the United States in the right tail (top 5%) through the extreme right tail (top 0.01%) from 2011 to 2015 using measures of math, verbal, and science reasoning. Additionally, the present study establishes male-female ability ratios in a sample of over 7000 7th grade students in the right tail from 2011 to 2015 in India. Results indicate that ratios in the extreme right tail of math ability in the U.S. have shrunk in the last 20 years (still favoring males) and remained relatively stable in the verbal domain (still favoring females). Similar patterns of male-female ratios in the extreme right tail were found in the Indian sample.

Makel, M. C. & Plucker, J. A. (2015). An introduction to replication research in gifted education: Shiny and new is not the same as useful. *Gifted Child Quarterly*, 57, 157-164.

This methodological brief introduces readers to replication methods and their uses. Broadly defined, replication is the duplication of previously conducted research to verify or expand the original findings. Replication is particularly useful in the gifted education context because so much education theory and research are based on general education students and environments; the extent to which this prior work extends to gifted education contexts needs to be evaluated. The rationale, definition, implementation methods, and current state of replication in the social sciences generally, as well as in giftedness and creativity research specifically, are reviewed. Finally, guidance for conducting replications is provided, including recommendations on selecting important topics, engaging original authors, ensuring sufficient power, using appropriate measures and analyses, framing the manuscript, and submission planning.

Makel, M. C. & Plucker, J. A. (2014). Creativity is more than novelty: Reconsidering replication as a creativity act. *Psychology of Aesthetics, Creativity, and the Arts*, 8, 27-29.

Modern conceptions of creativity differentiate it from novelty, yet many researchers focus solely on novelty when considering contributions of research, belittling the role of replication. In this rejoinder, we respond to commentators while augmenting arguments for replication, clarifying how it differs from meta-analysis, and providing examples of what journals are doing to better incorporate replication into the scientific publishing process. We make the case that replications are a necessary (but not sufficient) component of an innovative, scientific field.

Makel, M. C. & Plucker, J. A. (2014). Facts are more important than novelty: Replication in the education sciences. *Educational Researcher*, 43, 304-316.

Despite increased attention to methodological rigor in education research, the field has focused heavily on experimental design and not on the merit of replicating important results. The present study analyzed the complete publication history of the current top 100 education journals ranked by 5-year impact factor and found that only 0.13% of education articles were replications. Contrary to previous findings in medicine, but similar to psychology, the majority of education

replications successfully replicated the original studies. However, replications were significantly less likely to be successful when there was no overlap in authorship between the original and replicating articles. The results emphasize the importance of third-party, direct replications in helping education research improve its ability to shape education policy and practice.

Makel, M. C. & Plucker, J. A. (Eds). (2017). *Toward a More Perfect Psychology: Improving Trust, Accuracy, and Transparency in Research.* Washington, DC: American Psychological Association. [Keywords: Methods in Research]

At its foundational level, the heart of science is that its methods allow for others to believe its results. This foundation is served by trust, accuracy, and transparency. Unfortunately, current research practices in psychology are known to produce inaccurate, irreproducible, and imprecise results. This book introduces a plethora of strategies to help strengthen the field by improving research quality. Readers will learn how research methods are evolving and how to maximize the quality and impact of their own work. This includes strategies for not just developing research ideas, designing studies, and analyzing and disseminating results, but also evaluating and responding to the research of others.

Makel, M. C., Plucker, J. A., Freeman, J., Lombardi, A., Simonsen, B., & Coyne, M. (2016). Replication of special education research: Necessary but far too rare. *Remedial and Special Education*. doi:10.1177/0741932516646083.

Increased calls for rigor in special education have often revolved around the use of experimental research design. However, the replicability of research results is also a central tenet to the scientific research process. To assess the prevalence, success rate, and authorship history of replications in special education, we investigated the complete publication history of every replication published in the 36 journals categorized by ISI Web of Knowledge Journal Citation Report as special education. We found that 0.5% of all articles reported seeking to replicate a previously published finding. More than 80% of these replications reported successfully replicating previous findings. However, replications where there was at least one author overlapping with the original article (which happens about two thirds of the time) were statistically significantly more likely to find successful results.

Makel, M. C., Plucker, J. A., Hegarty, B. (2012). Replications in psychology research: How often do they really occur? *Perspectives on Psychological Science*, 7, 537-542.

Recent controversies in psychology have spurred conversations about the nature and quality of psychological research. One topic receiving substantial attention is the role of replication in psychological science. Using the complete publication history of the 100 psychology journals with the highest 5-year impact factors, the current article provides an overview of replications in psychological research since 1900. This investigation revealed that roughly 1.6% of all psychology publications used the term replication in text. A more thorough analysis of 500 randomly selected articles revealed that only 68% of articles using the term replication were actual replications, resulting in an overall replication rate of 1.07%. Contrary to previous findings in other fields, this study found that the majority of replications in psychology journals reported similar findings to their original studies (i.e., they were successful replications). However, replications were significantly less likely to be successful when there was no overlap in authorship between the original and replicating articles. Moreover, despite numerous systemic biases, the rate at which replications are being published has increased in recent decades.

Makel, M. C., Putallaz, M., & Wai, J. (2012). Teach students what they don't know but are ready to learn: A commentary on "Rethinking giftedness and gifted education." *Gifted Child Quarterly*, 56, 198–201. [Keywords: Talent identification]

We were thrilled to see an article focusing on giftedness, written by such thoughtful and well-respected researchers as Subotnik, Olszewski-Kubilius, and Worrell (2011). The expansive scope of their synthesis is so impressive that it could serve as a crash course introduction to gifted education. In our commentary, we focus specifically on the perspective of education service delivery. From this perspective, we review their guiding principles, chief goal, and provide some follow-up questions for further clarification as well as an implementation option also based on talent development.

Makel, M. C., Snyder, K., Thomas, C., Malone, P., & Putallaz, M. (2015). Gifted students' implicit beliefs about intelligence and giftedness, *Gifted Child Quarterly*, 59, 203-121.

Abstract Growing attention is being paid to individuals' implicit beliefs about the nature of intelligence. However, implicit beliefs about giftedness are currently underexamined. In the current study, we examined academically gifted adolescents' implicit beliefs about both intelligence and giftedness. Overall, participants' implicit beliefs about giftedness and intelligence were significantly positively correlated while also having statistically significant mean differences, suggesting that they perceived the nature of the two constructs differently. Specifically, many students viewed intelligence as malleable (incremental view) and giftedness as fixed (entity view), whereas very few students viewed giftedness as malleable and intelligence as fixed; however, heterogeneity was observed. The beliefs identified in the current study provide important insight into the domain-specific nature of implicit beliefs of gifted students and suggest that caution be used against using terms like giftedness and intelligence interchangeably.

Makel, M. C. & Wai, J. (2016). Does economic research in education work? For which studies? *Journal of Advanced Academics*, 27, 73-80. doi:10.1177/1932202X15628013.

In their National Bureau of Economic Research (NBER) working paper, "Does Gifted Education Work? For Which Students?" Card and Giuliano (C&G) made an enormous splash in not just gifted education but also the world (e.g., The Washington Post, The Atlantic, Five Thirty Eight). In this commentary, we highlight what we think C&G have done well, what they could have done better, and what the field can learn from their economic perspectives and approaches to the evaluation of gifted education.

Makel, M. C., Wai, J., Putallaz, M., & Malone, P. S. (2015). The academic gap: An international comparison of the time allocation of academically talented students. *Gifted Child Quarterly*, 59, 177-189.

Despite growing concern about the need to develop talent across the globe, relatively little empirical research has examined how students develop their academic talents. Toward this end, the current study explored how academically talented students from the United States and India spend their time both in and out of school. Indian students reported spending roughly 11 more hours on academics than their U.S. peers during the weekend in both STEM (science, technology, engineering, and math) and non-STEM topics. U.S. students reported spending about 5.4 more hours than their Indian peers on non-STEM academics during the week, leaving an approximately 7-hour-a-week academic gap between U.S. and Indian students. Additionally,

U.S. students reported using electronics over 14 hours per week more than their Indian peers. Indian students also reported having control over a greater proportion of their time during the week than U.S. students did. Generally, there were far more cross-cultural differences than gender differences. These results inform discussions on how academically talented students develop within educational systems as well as what each culture supports in and out of school.

Malin, J. & Makel, M. C. (2012). Gender differences in gifted students' advice on solving the world's problems. *Journal for the Education of the Gifted*, 35, 175-187.

Gender differences in interests and preferences are among the currently accepted potential explanations for the underrepresentation of women in science, technology, engineering, and mathematics (STEM) fields. In an attempt to analyze the development of such preferences, gender differences expressed in essays written by gifted elementary students were assessed. Students were asked to hypothetically embody a cabinet member and advise the president to solve the nation's most important problem. Numerous significant gender differences were found, including which cabinet post was selected, the type of problem selected as well as the implications for solution implementation. These findings illustrate that the development of gender differences is an ongoing process that has already begun by the end of elementary school.

Malone, P.S., von Brock, A., Brounstein, P.J., & Shaywitz, S.S. (1991). Components of IQ scores across levels of measured ability. *Journal of Applied Social Psychology*, 21, 15-28. [Keywords: Talent Identification]

Forty-three (43) students from the Talent Identification Program's Summer Residential Program living in North Carolina took the Wechsler Intelligence Scale for children- Revised (WISC-R; Wechsler, 1974) during the program. The test was also administered to 50 other North Carolina Students who qualified for the SRP but did not attend, as well as 34 students who had not been identified as gifted. The scores were evaluated for normative and idiographic strengths and weaknesses on the 12 subtests of the WISC-R. The idiographic differences were calculated by comparison against the average score of only the 6 subtests in the same subscale of the test (Verbal or Performance) as well as against all 12 subtests on the test. It was found by means of the former comparisons that the gifted students showed significantly more idiographic strengths on the Verbal scales and weaknesses on the Performance scales than the academically competent sample.

Marsh, H. W., Plucker, J. A., & Stocking, V. B. (2001). The Self-Description Questionnaire II and gifted students: Another look at Plucker, Taylor, Callahan, and Tomchin's (1997) "Mirror, Mirror on the Wall." *Educational and Psychological Measurement*, 61, 976-996. [Keywords: Self-Concept]

J. A. Plucker, J. W. Taylor, C. M. Callahan, and E. M. Tomchin (1997) concluded that confirmatory factor analyses (CFA) of responses to the Self-Description Questionnaire (SDQ) II provided only limited support for construct validity with gifted students because of the modest fit of their CFA models. They acknowledged, however, that potential complications (e.g., their CFA models, treatment of missing data, and highly non-normal data) meant that their conclusions may be premature. Here, the authors analyzed data from their original study of 374 students (aged 10-16 yrs) and new data from another gifted-student program (including 352 females and 465 males who served as Ss), exploring alternative approaches to missing data and data normalization. The a priori model based on the design of the SDQII resulted in a good fit to the data for the total

group, and the factor solution was invariant across the two samples of gifted students. The results strongly support the construct validity of responses to the SDQII by gifted adolescents.

Matthews, M. S. (2004). Leadership education for gifted and talented youth: A review of the literature. *Journal for the Education of the Gifted*, 28, 77-113. [Keywords: Characteristics of Gifted Youth]

A brief narrative description of the journal article, document, or resource. Leadership has been retained in the federal definition of giftedness, across major revisions, since its inclusion in the Marland Report (1972) definition more than 30 years ago. Despite this history, there appears to be little consensus regarding the relationship between leadership education and education for talented and gifted youth. This review analyzes publications about leadership education among talented and gifted students since 1980. Four major emphases are identified within this literature, and empirical articles within each area of emphasis are summarized and critiqued. Analysis confirms that a consolidated theoretical framework for leadership giftedness has not yet materialized, although limited consensus may be emerging regarding the aspects of leadership that are more or less responsive to instruction. Findings suggest that more research may be needed to justify retaining leadership ability within the federal definition of giftedness. Three suggested directions for future research on youth leadership giftedness are extrapolated from this foundation.

Matthews, M. S. (2006). Gifted students dropping out: Recent findings from a Southeastern state. *Roeper Review*, 28, 216-223. [Keywords: Achievement and Motivation]

Dropping out of school has been presented as a serious problem affecting gifted students, with some authors suggesting that 20% or more of dropouts could be gifted (e.g., Pimm, 1995; Robertson, 1991). Longitudinal data from North Carolina were used to investigate high-school dropout rates among gifted students (N = 7916) who had participated in a regional talent search program as seventh graders. In contrast to some prior estimates, results indicate that dropout rates among this particular gifted population are extremely low. Dropout rates among all gifted subgroups, as well as across this entire population, were below 1%. Gifted students differed from the general dropout population in being less likely to report dropping out due to attendance problems and more likely to drop out to attend a community college. Limitations of the findings are discussed, and implications for gifted education policy and practice are offered.

Matthews, M. S., & Farmer, J. L. (2008). Factors affecting the Algebra I achievement of academically talented learners. *Journal of Advanced Academics*, 19, 472-501. [Keywords: Achievement and Motivation]

Understanding student performance in Algebra I is important because this course serves as the gateway to advanced coursework in mathematics and science through the remainder of high school and into post secondary education. In the current study, we analyzed secondary data to evaluate the relationship between selected indicators of mathematics and the Algebra I performance of academically able and gifted learners who participated in above-level talent search testing. We used structural equation modeling to examine the relationship among selected CO variables and students' scores on a standardized measure of Algebra I achievement. Variables included prior mathematics ability, parental education level, whether a student was identified as gifted, participation in after school activities, the time spent on homework, and the amount of class time spent on discussions and lectures. Results indicate the strongest relationships were

between mathematics reasoning and Algebra I achievement. Although gifted status was a strong predictor of mathematics reasoning, it was not strongly related to Algebra achievement, which supports the need for differentiated instruction for gifted learners. The amount of class time spent on discussion had a significant effect on the amount of time spent weekly on Algebra I homework. Rather than reliance on traditional lecture-based instruction, teachers should consider incorporating more classroom discussion on mathematical topics.

Matthews, P. H., & Matthews, M. S. (2004). Heritage language instruction and giftedness in language minority students: Pathways toward success. *The Journal of Secondary Gifted Education, 15*, 50-55. [Keywords: Characteristics of Gifted Youth]

Language minority students, while often underrepresented in traditional gifted programs, can benefit from "heritage language" courses focused on developing academic proficiency and exploring challenging content in their home language. We describe how heritage language courses can provide an appropriate venue for the identification of gifted potential among language minority students, how such courses can enhance student motivation for learning, and what cognitive benefits may be associated with additive bilingualism developed through such courses.

Matthews, M. S., & McBee, M. T. (2007). School factors and the underachievement of gifted students in a talent search summer program. *Gifted Child Quarterly, 51*, 167-181. [Keywords: Achievement and Motivation]

The topic of underachievement and how to reverse it has received a great deal of attention in the gifted education literature. The present study sought to add to the knowledge base on this issue by investigating the occurrence of underachievement behaviors and their predictors in a population of highly gifted students attending a summer educational program based on the talent search model. A group of 440 students in Grades 8-10 were given the School Attitude Assessment Survey-Revised at the beginning of the program. Attitudes toward and grades obtained in students' regular schools had little to no predictive value on students' academic and behavioral performance during the summer program. Results support qualitative findings in the literature, suggesting that educational interventions can be extremely effective in reversing the expression of underachieving behaviors.

Mayer, J.D., Caruso, D.R., Zigler, E., Dreyden, J. (1989). Intelligence and intelligence-related personality traits. *Intelligence, 13*, 119-133. [Keywords: Characteristics of Gifted Youth]

Psychologists have searched for personality traits related to intellectual performance for nearly a half century. The greatest success has been obtained with traits that are closely related to intellectual functioning, as opposed to more general personality traits. Intellect-related traits include such characteristics as curiosity, but may also include less studied traits. A 76-item test of intellect-related personality traits was developed, measuring both traditional traits as well as less studied ones such as absorption. The test was administered to a group of 150 individuals, of whom 46 were Gifted children and the remainder were wither part of chronological- or mental-age comparison group. Three component-based traits were obtained: Intellectual Absorption, Apathy, and Pleasure, and these were found to be related to intellectual performance.

Miller, D., & Wai, J. (2015). The bachelor's to PhD STEM pipeline no longer leaks more women than men: A 30-year analysis. *Frontiers in Psychology: Developmental, 6*, 37. [Keywords: Talent Identification, Gender, Achievement and Motivation]

For decades, research and public discourse about gender and science have often assumed that women are more likely than men to “leak” from the science pipeline at multiple points after entering college. We used retrospective longitudinal methods to investigate how accurately this “leaky pipeline” metaphor has described the bachelor’s to Ph.D. transition in science, technology, engineering, and mathematics (STEM) fields in the U.S. since the 1970s. Among STEM bachelor’s degree earners in the 1970s and 1980s, women were less likely than men to later earn a STEM Ph.D. However, this gender difference closed in the 1990s. Qualitatively similar trends were found across STEM disciplines. The leaky pipeline metaphor therefore partially explains historical gender differences in the U.S., but no longer describes current gender differences in the bachelor’s to Ph.D. transition in STEM. The results help constrain theories about women’s underrepresentation in STEM. Overall, these results point to the need to understand gender differences at the bachelor’s level and below to understand women’s representation in STEM at the Ph.D. level and above. Consistent with trends at the bachelor’s level, women’s representation at the Ph.D. level has been recently declining for the first time in over 40 years.

O’Keefe, P. A., Ben-Eliyahu, A., & Linnenbrink-Garcia, L. (2013). Shaping achievement goal orientations in a mastery-structured environment and concomitant changes in related contingencies of self-worth. *Motivation and Emotion*, 37, 50-64. [Keywords: Achievement and Motivation; Program Evaluation].

Across three time-points spanning nine months, changes in achievement goal orientations and contingencies of self-worth were assessed as a function of participating in a mastery-structured academic program for high-ability adolescents (N = 126). Endorsement of mastery goal orientations increased during the program and remained high even after students returned to their home learning environments. In contrast, performance-approach and performance-avoidance goal orientations decreased during the summer program, but returned to previous levels when assessed 6 months later. Latent growth curve models assessed the co-variation of performance goal orientations and two contingencies of self-worth (outperforming others and others’ approval) hypothesized to represent elements of performance goal orientations. Changes in the contingency of self-worth based on outperforming others positively co-varied with observed changes in both performance goal orientations; however, changes in self-worth contingent on others’ approval did not. Results are discussed in terms of mastery-structured environments’ potential to alter achievement goal orientations via their underlying psychological processes. Implications for achievement goal theory and the design of achievement-oriented environments are discussed.

Olszewski-Kubilius, P., Makel, M. C., Plucker, J. A., Subotnik, R. F. (2017). Universal principles of learning require unique applications for gifted students. *Canadian Psychology*, 58, 271-275. doi: 10.1037/cap0000118. [Keywords: Program Model, Talent Identification, Characteristics of Gifted Youth]

The question of whether gifted students learn differently from other students has long plagued the psychology and education communities. On the one hand, the field of gifted education has promoted special programs that capitalize on gifted children’s individual abilities and needs. At the same time, evidence from rigorous studies has supported the notion that gifted children, like their age peers, learn optimally in classrooms that apply proven psychological principles. Are gifted students unique, or not? In this commentary, we rely on two versions of recent

publications on teaching and learning to make the case that gifted students may be simultaneously unique from—and the same as—typical students. Gifted students are the same as other students in that their learning hinges on general psychological learning principles. However, to be effective, the application of those principles may be different for gifted students than for their classmates. We use four examples of the varied ways in which psychology promotes the application of principles based on the needs of special groups of learners.

Peairs, K. F., Eichen, D., Putallaz, M., Costanzo, P. R., Grimes, C. L. (2011). Academic giftedness and alcohol use in early adolescence. *Gifted Child Quarterly*, 55, 95-110. [Keywords: Characteristics of Gifted Youth]

Adolescence is a period of development particularly vulnerable to the effects of alcohol use, with recent studies underscoring alcohol's effects on adolescent brain development. Despite the alarming rates and consequences of adolescent alcohol use, gifted adolescents are often overlooked as being at risk for early alcohol use. Although gifted adolescents may possess protective factors that likely inhibit the use of alcohol, some gifted youth may be vulnerable to initiating alcohol use during adolescence as experimenting with alcohol may be one way gifted youth choose to compensate for the social price (whether real or perceived) of their academic talents. To address the dearth of research on alcohol use among gifted adolescents the current study (a) examined the extent to which gifted adolescents use alcohol relative to their non-gifted peers and (b) examined the adjustment profile of gifted adolescents who had tried alcohol relative to non-gifted adolescents who tried alcohol as well as gifted and non-gifted abstainers. More than 300 students in seventh grade (42.5% gifted) participated in the present study. Results indicated gifted students have, in fact, tried alcohol at rates that do not differ from non-gifted students. Although trying alcohol was generally associated with negative adjustment, giftedness served as a moderating factor such that gifted students who had tried alcohol were less at risk than their non-gifted peers. However, evidence also suggests that gifted adolescents who tried alcohol may be a part of a peer context that promotes substance use, which may place these youth at risk for adjustment difficulties in the future.

Peters, S. J., Matthews, M. T., Rambo-Hernandez, K., Makel, M. C., & Plucker, J. A. (2017). Should millions of students take a gap year? Large numbers of students start the school year above grade level. *Gifted Child Quarterly*, 61, 229-238. doi: 10.1177/0016986217701834. [Keywords: Achievement and Motivation, Characteristics of Gifted Youth]

Few topics have garnered more attention in preservice teacher training and educational reform than student diversity and its influence on learning. However, the actual degree of cognitive diversity has yet to be considered regarding instructional implications for advanced learners. We used four data sets (three state-level and one national) from diverse contexts to evaluate how many students perform above grade level in English Language Arts and mathematics. Results revealed that among American elementary and middle school students, 20% to 49% in English Language Arts and 14% to 37% in mathematics scored 1 year or more above grade level. We address what these findings imply for K-12 schools, grouping decisions, and educational policies that strive to foster advanced abilities.

Petersen, N.M., Brounstein, P.J., & Kimble, G.A. (1988). Evaluation of college level coursework for the gifted adolescents: An investigation of epistemological stance, knowledge gain and generalization. *Journal for the Education of the Gifted*, 12, 46-61. [Keywords: Program Evaluation]

The investigation evaluated the proximal and distal effects of an innovation course of study, a college level Introductory Psychology course which was offered to precocious adolescents in a three-week summer session at the Talent Identification Program at Duke University. More specific purposes of the study were to assess level of mastery of the content of the course, retention over time, ability to generalize this content and use it to interpret psychological issues, non-cognitive impacts of the course on students' orientation toward psychology and its influence on the students' future plans. The design of the study involved immediate post-course assessments and follow-up assessments at points at six months and 1.5 years remote in time. The same measures were obtained from similar students who did not take the course. Results demonstrated the knowledge gain from course participation was substantial and long-lived. There was a dramatic effect on the quality of the students' understanding and their ability to generalize and apply psychological concepts to real world situations. Although there was loss of factual content over time, level of understanding and ability to generalize and apply material remained relatively constant. There was a slight shift in the students' outlook on psychology as a discipline. Students just completing the course were quite "humanistic" in their outlook. After a six month period their orientation had moved toward the "scientific" pole. In addition, large proportions of students reported that the course had affected their educational plans (50.0%) and career plans (36.7%). This study suggests a model of evaluation for educational programs. By focusing on several factors potentially affected by education we can better understand the full effects of tailored interventions on participants. Such information can serve as a guide to developing more focused and effective educational efforts.

Pfeiffer, S. I. (2001a). Professional psychology and the gifted: Emerging practice opportunities. *Professional Psychology: Research and Practice*, 32, 175-180.

Professional psychology has an opportunity to assume a leadership role in working with the gifted. The gifted have many unmet social, emotional, and psychoeducational needs and are arguably one of America's most valuable resources. The Duke University Talent Identification Program conducted a survey to better understand emerging issues in the gifted field. The survey identified a number of areas in which professional psychologists can play an active role. Three specific practice opportunities are discussed: assuming a leadership role in the identification of gifted students, serving as a consultant to promote talent development in the schools, and providing counseling services.

Pfeiffer, S. I. (2001b). Emotional intelligence: Popular but elusive construct. *Roeper Review*, 23, 135-143.

There is a growing interest in the concept of emotional intelligence (EI), as a result of a new zeitgeist that embraces nontraditional views of intelligence, and a belief promulgated in the popular press that EI holds the promise for solving many of society's most pressing problems. Two important bodies of writing on EI, the work of D. Goleman and P. Salovey & J. Mayer, are discussed as illustrative of recent theorizing on EI. The article discusses conceptual and measurement problems that presently challenge the usefulness of the EI construct. It is suggested that EI be tentatively viewed as a possible kind of intelligence, awaiting further theory development and validation.

Pfeiffer, S. I. (2002). Identifying gifted and talented students: Recurring issues and promising solutions. *Journal of Applied School Psychology*, 19, 31-50. [Keywords: Talent Identification]

This article offers a set of recommended best practices in the identification of students who are gifted and talented. The article recommends that school psychologists gain familiarity with gifted children and their families, recognize the multiple manifestations of giftedness and the developmental nature of talent development, link identification to intervention, employ multiple assessment measures, include the assessment of motivation, consider social and emotional needs, and monitor the recommended interventions. The article also reviews recurring issues that adversely impact upon the provision of gifted services in the public schools. These issues include society not viewing the gifted as a high-priority special needs group, definitions of giftedness that vary across states, differing expert opinions on what giftedness represents, uncertainty about prevalence rates, under-representation of certain groups of gifted students, the role of creativity, and whether gifted education should be a part of special education.

Pfeiffer, S. (2003). Challenges and opportunities for students who are gifted: What the experts say. *Gifted Child Quarterly*, 47, 161-169. [Keywords: Talent Identification]

Five questions were answered by 64 authorities in the gifted field: (1) What do you see as the three greatest identification, assessment, and/or definitional issues in the gifted field? (2) What do you see as the three greatest curricula, instruction, and/or program issues for the gifted student? (3) What are the three most pressing unanswered questions in the gifted field? (4) What have been the three most important research findings in the last years in the gifted field? (5) What are the three most significant developments or innovations in gifted education in the last 5 years? Responses were coded and sorted according to an analytic strategy that permitted the descriptive data to be grouped into a small number of categories. Most frequent categories included need for consensus on how to define, conceptualize and identify giftedness; new procedures to increase the under-representation of gifted minority students; and the importance of translating research on educational innovations into practice. Research and practical implications for the gifted field are provided.

Pfeiffer, S. I., Reddy, L. A., Kletzel, J. E., Schmelzer, E. R., & Boyer, L. M. (2000). The practitioner's view of IQ testing and profile analysis. *School Psychology Quarterly*, 15, 376-385 [Keywords: Talent Identification]

Pfeiffer, S. I., & Stocking, V. B. (2000). Vulnerabilities of academically gifted students. *Special Services in the Schools*, 16, 83-93. [Keywords: Characteristics of Gifted Youth]

It is often assumed that gifted students enjoy relatively good social and emotional adjustment, vibrant mental health, and overall wellbeing. A significant number of gifted students experience painful, troubling, and often debilitating psychological problems. Gifted children and youth possess a set of personality characteristics (e.g., perfectionism, excitability) that make them uniquely vulnerable for mental health dysfunction or for social or emotional problems. School personnel and parents need to be cognizant of these risk factors so that they can provide coordinated and comprehensive educational and social opportunities to foster resilience and, when needed, provide preventive and therapeutic mental health interventions for those gifted students with actual psychological problems.

Pleasants, R., Stephens, K. R., Selph, H., & Pfeiffer, S. I. (2004). Incorporating service-learning into leadership education: Duke TIP's Leadership Institute. *Gifted Child Today*. 27, 16-23. [Keywords: Program Model]

Plucker, J. A., Makel, M. C., Matthews, M. S., Peters, S. J., & Rambo-Hernandez, K. E. (2017). Blazing new trails: Strengthening policy research in gifted education. *Gifted Child Quarterly*, 61, 210-218. doi: 10.1177/0016986217701838. [Keywords: Methods in Research]

Policy research in gifted education has occurred at much lower rates than other areas of research within the field, such as identification and talent development. However, without changes and implementation of these policies, systematic change is unlikely to occur. Therefore, the purpose of this article is to argue that policy research should be a top priority. To begin, we define and contrast three terms common in crafting policy—policy, advocacy, and intervention. Next, we provide a context of previous policy research in gifted education. We then detail areas in which policy research is the most critical. Finally, we conclude with action steps to engage more researchers and practitioners in policy development, implementation, and monitoring.

Plucker, J. A., Rinn, A. N., & Makel, M. C. (Eds.) (2017). From Giftedness to Gifted Education: Reflecting Theory in Practices. Waco, TX: Prufrock Press. [Keywords: Program Model, Talent Identification, Characteristics of Gifted Youth]

The fields of gifted education and talent development have numerous theories and conceptions for how to identify and serve students. This book helps introduce and apply these ideas to help reflect theory in practice. Each chapter introduces readers to a different theory by providing definitions of key concepts, explaining the fundamental conceptual/theoretical approach, and concluding with advice on how the conception can be put into practice. Suggestions for further reading are also provided. Some chapters are based on theories that have been around for decades, and some have been developed more recently. But all chapters focus on helping empower readers to understand and take action without having to reinvent the wheel.

Plucker, J., & Stocking, V. (2001). Looking outside and inside: Self-concept development of gifted adolescents. *Exceptional Children*, 67, 535-548. [Keywords: Self-Concept]

The internal/external frame of reference model (H. W. Marsh, 1986) was proposed to explain the development of academic self-concepts for general ability samples. Recent research calls into question the model's applicability for gifted adolescents' academic self-concept development. This model was examined for 131 adolescents (aged 12–16 yrs) participating in a summer program for academically talented students. Results suggest that the model is useful in understanding the academic self-concept development of students who are gifted, with no significant differences among students with demonstrable strengths in mathematics, verbal areas, or both areas. Educators should be aware that exceptional performance in one area, such as mathematics, will probably have a positive impact in mathematics self-concept but a negative impact on other academic self-concepts, such as verbal self-concept.

Pridemore, W. J., Makel, M. C., & Plucker, J. A. (2018). Replications in criminology and the social sciences. *Annual Review of Criminology*. doi: 10.1146/annurev-criminol-032317-091849. [Keywords: Methods in Research]

Replication is a hallmark of science. In recent years, some medical sciences and behavioral sciences struggled with what came to be known as replication crises. As a field, criminology has yet to address formally the threats to our evidence base that might be posed by large-scale and systematic replication attempts, although it is likely we would face challenges similar to those experienced by other disciplines. In this review, we outline the basics of replication, summarize reproducibility problems found in other fields, undertake an original analysis of the amount and

nature of replication studies appearing in criminology journals, and consider how criminology can begin to assess more formally the robustness of our knowledge through encouraging a culture of replication.

Putallaz, M., Baldwin, J., & Selph, H. (2005). The Duke University Talent Identification Program. *High Ability Studies, 16*, 41-54. [Keywords: Program Model]

The Duke University Talent Identification Program (Duke TIP) holds the distinguished position of being the first 'transplant' of the Center for Talented Youth (CTY) regional talent search model developed by Professor Julian Stanley at Johns Hopkins University. Duke TIP was established in 1980, one year after CTY officially began. This article describes the history of Duke TIP and the evolution of its talent searches and various formats of its educational programming models as well as the complementary role that research has played at Duke TIP. The success of Duke TIP stands as a truly remarkable tribute to Julian Stanley and to the robustness of the talent search model that he created at Johns Hopkins University. Although the specific types of programs and initiatives may have taken different forms at Duke TIP, the underlying philosophy and commitment to identify and further the development of gifted and talented youth remains steadfast.

Sawyer, R.N. (1984). The Duke University educational programs for brilliant youths. *Roeper Review, 7*, 103-109. [Keywords: Program Model]

The Duke University Precollege Program, Summer Residential Program for Verbally and Mathematically Precocious Youths, the By-Mail and Commuter Programs are reviewed. These offerings allow brilliant young students to plan a multi-summer program beginning in the summer prior to grade 8 and culminating in the senior year in high school. The residential life activities are reviewed. The relationship with the parochial, private, and public schools and teachers is explored.

Sawyer, R.N. (1985). The early identification and education of brilliant students: The Duke model. *The College Board Review, 135*, 2-8. [Keywords: Program Model]

A brief narrative description of the journal article, document, or resource. The Duke University Talent Identification Program was initiated to identify verbally and mathematically precocious youngsters. This program is a 16-state effort not only to identify brilliant students, but to follow and nurture their talent and assist in their educational development.

Sawyer, R.N. (1986). Intellectual challenges and emotional support of the precocious child. *Journal of Counseling and Development, 64*, 593-597. [Keywords: Program Model]

The author discusses the rationale and validity for talent searches, with special emphasis on the Duke University Talent Identification Program (TIP). The Precollege and Summer Educational Programs are described and typical results are noted. The by-mail program and the efforts by TIP to serve as a resource to schools as they develop their own programs to serve the nation's most brilliant youth are discussed. The role of the counselor in the identification and nurturing of academically talented young people is suggested.

Sawyer, R. N., DeLong, M. R., & von Brock, A. B. (1987). By-mail learning options for academically talented middle-school youth. *Gifted Child Quarterly, 31*, 118-120. [Keywords: Program Model]

The Duke University Talent Identification Program includes a By-Mail learning component designed to provide gifted students with challenging courses while they remain in their own school. The results of the Advanced Placement Examinations associated with this component of the Duke Program suggest that By-Mail courses provide intellectual stimulation for brilliant middle school youth, prepare them for college credit exams, and can serve as a vehicle to assist school systems in meeting the educational needs of academically talented youngsters.

Sawyer, R.N. (1988). In defense of academic rigor. *Journal for the Education of the Gifted*, 11, 5-19.

Schiel, J. (1998). Academic benefits in high school of an intensive summer program for academically talented seventh graders. *ACT Research Report Series*, 98-4.
http://www.act.org/research/researchers/reports/pdf/ACT_RR98-04.pdf [Keywords: Program Evaluation]

Duke University's Talent Identification Program invites seventh graders who score in the top 3% on nationally normed, standardized tests to participate in the Talent Search. A small number of these students subsequently qualify, on the basis of relatively high ACT Assessment of SAT scores, for the Summer Residential Program (SRP), which provides intensive involvement in a particular academic subject. This study developed statistical evidence of how the SRP benefits students. Results show that SRP participation is positively related to academically talented students' subsequent academic performance in high school, over and beyond their ACT scores as seventh graders. This information should be useful for encouraging academically talented students to participate in talent searches and intensive residential programs. Prospective students could be shown, for example, that SRP participants score about two scale score points higher on the ACT Mathematics test in high school, on average, than do Talent Search students who do not participate in the SRP. This finding is true regardless of the ACT Mathematics scores that Talent Search and SRP participants earn in seventh grade.

Schiel, J. L., & Stocking, V. B. (2001). Benefits of TIP summer residential program participation, as reflected by subsequent academic performance in high school. In N. Colangelo & S.G. Assouline (Eds.), *Talent development IV: Proceedings from the 1998 Henry B. and Jocelyn Wallace National Research Symposium on Talent Development* (pp. 435-438). Scottsdale, AZ: Gifted Psychology Press. [Keywords: Program Evaluation]

Developed statistical evidence of how the Summer Residential Program (SRP), offered by Duke University Talent Identification Program, benefits 35,317 Talent Search students (7th graders). The differences between SRP participants and nonparticipants were compared by examining their subsequent academic performance in high school, as indicated by high school ACT scores, grades, and advanced course work. The results suggest that participation in the SRP is positively related to academically talented students' subsequent academic performance in high school, over and above their ACT Assessment scores as seventh graders.

Spain, S.L., Pedroso, I., Kadeva, N., Miller, M.B., Iacono, W.G., McGue, M., Stergiakouli, E., Smith, G.D., Putallaz, M., Lubinski, D., Meaburn, E.L., Plomin, R. & Simpson, M.A. (2015). A genome-wide analysis of putative functional and exonic variation associated with extremely high intelligence, *Molecular Psychiatry*, 1-7.

Although individual differences in intelligence (general cognitive ability) are highly heritable, molecular genetic analyses to date have had limited success in identifying specific loci

responsible for its heritability. This study is the first to investigate exome variation in individuals of extremely high intelligence. Under the quantitative genetic model, sampling from the high extreme of the distribution should provide increased power to detect associations. We therefore performed a case–control association analysis with 1409 individuals drawn from the top 0.0003 (IQ >170) of the population distribution of intelligence and 3253 unselected population-based controls. Our analysis focused on putative functional exonic variants assayed on the Illumina HumanExome BeadChip. We did not observe any individual protein-altering variants that are reproducibly associated with extremely high intelligence and within the entire distribution of intelligence. Moreover, no significant associations were found for multiple rare alleles within individual genes. However, analyses using genome-wide similarity between unrelated individuals (genome-wide complex trait analysis) indicate that the genotyped functional protein-altering variation yields a heritability estimate of 17.4% (s.e. 1.7%) based on a liability model. In addition, investigation of nominally significant associations revealed fewer rare alleles associated with extremely high intelligence than would be expected under the null hypothesis. This observation is consistent with the hypothesis that rare functional alleles are more frequently detrimental than beneficial to intelligence.

Steenbergen-Hu, S., Makel, M. C., Olszewski-Kubilius, P. (2016). What one hundred years of research says about the effects of ability grouping and acceleration on K-12 students' academic achievement: Findings from two second-order meta-analyses. *Review of Educational Research*, 86, 849-899. doi:10.3102/0034654316675417. [Keyword: Program Model]

Two second-order meta-analyses synthesized approximately 100 years of research on the effects of ability grouping and acceleration on K–12 students' academic achievement. Outcomes of 13 ability grouping meta-analyses showed that students benefited from within-class grouping ($0.19 \leq g \leq 0.30$), cross-grade subject grouping ($g = 0.26$), and special grouping for the gifted ($g = 0.37$), but did not benefit from between-class grouping ($0.04 \leq g \leq 0.06$); the effects did not vary for high-, medium-, and low-ability students. Three acceleration meta-analyses showed that accelerated students significantly outperformed their nonaccelerated same-age peers ($g = 0.70$) but did not differ significantly from nonaccelerated older peers ($g = 0.09$). Three other meta-analyses that aggregated outcomes across specific forms of acceleration found that acceleration appeared to have a positive, moderate, and statistically significant impact on students' academic achievement ($g = 0.42$).

Stephens, K., & Karnes, F. A. (2000). State definitions for the gifted and talented revisited. *Exceptional Children*, 66, 219-238. [Keywords: Talent Identification]

Definitions of gifted and talented students have been in a state of evolution for some time. Many states rely on the federal interpretation as a guideline for establishing their definitions relating to gifted education. However, the federal definition has gone through a series of metamorphoses with the addition and deletion of various terms and components. This article presents a brief history of the transition of the federal definition for students who are gifted and talented, as well as a description of other definitions that have impacted state definitions. An overview of state definitions in 1990 and 1998 is also presented and analyzed.

Stephens, K., Kiger, L., Karnes, F. A., & Whorton, J. E. (1999). Use of nonverbal measures of intelligence in identification of culturally diverse gifted students in rural areas. *Perceptual and Motor Skills*, 88, 793-796. [Keywords: Talent Identification]

Children and youth from economically disadvantaged and culturally diverse backgrounds have been under-represented in programs for gifted students. A method is needed for identifying potentially gifted students from such backgrounds via alternative testing measures. To identify culturally diverse, potentially gifted students in rural areas, the Culture-Fair Intelligence Test, the Raven Standard Progressive Matrices, and the Naglieri Nonverbal Abilities Test were administered to 189 3rd-8th graders in a rural elementary school. These 3 tests together identified 26 students who merited additional testing. For the purposes of screening and developing a pool of gifted students from culturally diverse students, a single test will not suffice.

Stocking, V. B. (1998). "What I did on my vacation": Summer options for gifted students. *Education for the Gifted and Talented*, 82, 93-100. [Keywords: Program Model]

A brief narrative description of the journal article, document, or resource. Most summer programs for gifted students are affiliated with universities or schools, involve immersion in a content area, have varied costs and entrance requirements, and employ excited, committed instructors. Some programs are open only to young women and minorities. Others offer a chance to experience college life or faraway places. All contribute a motivational push and a chance to interact with a community of peers.

Stocking, V. B., & Goldstein, D. (1992). Course selection and performance of very high ability students: Is there a gender gap? *Roeper Review*, 15, 48-51. [Keywords: Gender; Identification and Testing]

Recent attention has focused on the decreasing levels of scholastic achievement of youth in the United States, particularly in areas of mathematics and science. In particular, concern has been expressed about the involvement and achievement of girls in traditionally sex stereotyped curricula, such as mathematics and science. This paper reports on an investigation exploring the course-taking and achievement patterns of academically talented girls and boys, selected by Scholastic Aptitude Test (SAT) scores. The subjects in this study were enrolled in the Talent Identification Program's Summer Residential Program at Duke University, an intensive 3-week academic experience. The study found that girls and boys performed equally well in all types of classes. Main effects in achievement and motivation were found only for type of class. The success of the students indicated that the SAT is a valid selection instrument. In addition, the usefulness of the SAT as an identifier of very high academic ability is described.

Stocking, V. B., & Plucker, J. A. (2001). Evaluation of the internal/external frame of reference model for gifted adolescents. In N. Colangelo & S.G. Assouline (Eds.), *Talent development IV: Proceedings from the 1998 Henry B. and Jocelyn Wallace National Research Symposium on Talent Development* (pp. 439-443). Scottsdale, AZ: Great Potential Press, Inc. [Keywords: Self-Concept]

Evaluated the appropriateness of the internal/external frame of reference model (I/E model) for understanding academically talented students through an examination of the internal component of the model. 131 rising eighth, ninth, and tenth graders enrolled in Duke University's Talent Identification Program Summer Residential Program completed the Self-Description Questionnaire II. The results confirm that the internal/external frame of reference model may be an appropriate framework with which to view the development of self-concept for gifted adolescents.

Wai, J. (2015). Long-term effects of educational acceleration. In. S.G. Assouline, N. Colangelo, J. VanTassel-Baska, & A.E. Lupkowski-Shoplik (Eds.) *A nation empowered: Evidence trumps the excuses that hold back America's brightest students* (V. II, pp. 73-83). Iowa City, IA: The Belin-Blank Center for Gifted and Talented Education. [Keywords: Program Model; Program Evaluation; Talent Identification; Characteristics of Gifted Youth; Achievement and Motivation]

Educational intervention comes in many forms. Educational acceleration is an important class of interventions that comprise the appropriate educational dose for an individual. Dosage implies that one specific intervention may not be as relevant as the right mix, number, and intensity of educational interventions for any given person. This chapter reviews findings from the Study of Mathematically Precocious Youth (SMPY), a longitudinal study of thousands of intellectually talented students followed for many decades to the present. The long-term educational-occupational impact and positive subjective impressions about educational acceleration from academically advanced participants reported in these studies supports the importance of educational acceleration and, more broadly, an appropriate educational dose. The longitudinal research findings reveal that an educational program designed to move students at a pace commensurate with their rate of learning is educationally appropriate and necessary.

Exceptionally talented students benefit from accelerative learning opportunities, have few regrets about their acceleration, and demonstrate exceptional achievements. What matters for each student is a consistent and sufficient educational dose across a long span of time, what we think of as life-long learning, or learning at a pace and intensity that matches a student's individual needs. All students deserve to learn something new each day, and if academically talented students desire to be accelerated and are ready for it, the long-term evidence clearly supports the intervention.

Wai, J. (2014). Investigating the world's rich and powerful: Education, cognitive ability, and sex differences. *Intelligence*, 46, 54-72. [Keywords: Talent Identification, Gender, Achievement and Motivation]

To investigate who becomes a member of the global elite, three groups were examined: the world's billionaires (N = 1426), most powerful people (N = 231) according to Forbes magazine, and World Economic Forum (Davos) attendees (N = 2624). All groups were highly educated and cognitively able: roughly 34% of billionaires, 31% of self-made billionaires, 71% of powerful males, 58% of powerful females, and 55% of Davos participants attended elite schools worldwide. Among billionaires and Davos attendees, many majored in business and STEM. In the U.S., top 1% ability individuals were highly overrepresented: 45 times (base rate expectations) among billionaires, 56 times among powerful females, 85 times among powerful males, and 64 times among Davos participants. Many powerful people and Davos attendees resided in the U.S. Education and ability level differences were found across countries and sectors in which billionaires and Davos attendees resided. Even within the top 0.0000001% of wealth, higher education and ability were associated with higher net worth, even within self-made and non-self-made billionaires, but not within China and Russia. Females were underrepresented among all groups, especially among self-made billionaires. These global elites were largely drawn from the academically gifted, with many likely in the top 1% of ability. The clustering of brains, wealth, and power may have important implications.

Wai, J. (2014). Matching potential and passion leads to promise: A model for educating intellectually talented youth (pp. 237-259). In S. Moon & F. Dixon (Eds.), *Handbook of*

Secondary Gifted Education. Waco, TX: Prufrock Press Inc. [Keywords: Program Model, Talent Identification, Characteristics of Gifted Youth, Achievement and Motivation]

The talent development model described in this chapter was built upon research from an intellectually talented or gifted population within the top 1% of ability whose abilities and preferences were measured at an early age. These students were consequently followed up through the decades to determine where they ended up in education, work, and life. Through the longitudinal Study of Mathematically Precocious Youth (SMPY), empirical data was used to demonstrate that measured abilities and preferences do indeed predict both the level and area of achievement of these talented students later in life. Therefore, this model can be used to provide reasonable guideposts when counseling gifted students.

Wai, J. (2014). What does it mean to be an expert? *Intelligence, 45*, 122-123. [Keywords: Talent Identification, Achievement and Motivation]

Ericsson's (2014) response focuses on how his expert-performance framework is special, and how general population data cannot be used to address the topic of expertise development because of how special his expert performers are. He also critiques each of the papers in the special issue. Many of Ericsson's minor critiques of my work have already been addressed (see Wai, 2013, 2014). Therefore, I have focused this response to a handful of general themes: 1. The strengths of prospective and retrospective longitudinal data, 2. Disentangling cognitive ability and educational supports, 3. In the top 1%, more ability matters for expertise, 4. Broadening what it means to be an expert, and 5. In science, no specific theory or approach is special. Ericsson appears unable to go beyond his own framework and definitions to incorporate the approaches of others as well as the full network of evidence surrounding the development of expertise.

Wai, J. (2014). Experts are born, then made: Combining prospective and retrospective longitudinal data shows that cognitive ability matters. *Intelligence, 45*, 74-80. [Keywords: Talent Identification, Achievement and Motivation]

Does cognitive ability matter in the development of expertise in educational and occupational domains? Study 1 reviewed prospective longitudinal data from the top 1% in ability within two cohorts of the Study of Mathematically Precocious Youth (SMPY; Total N = 1975) and examined four cohorts of a stratified random sample of America's population (Project Talent; Total N = 1536) to see whether ability differences at a younger age made a difference in the attainment of a higher percentage of educational degrees and specifically doctorates (e.g., JDs, MDs, or PhDs) at a later age. Compared to the general population, the top 1% in ability earned a much higher percentage of educational degrees at each level. And even within the top 1% of ability, ability differences made a difference in obtaining a doctorate degree. Study 2 reviewed retrospective longitudinal data from five groups of America's elite (Total N = 2254)—Fortune 500 CEOs, federal judges, billionaires, Senators, and members of the House of Representatives—to determine what percentage of each group was in the top 1% of general ability at a younger age. A large percentage of individuals within each of these areas of occupational expertise were found to be in the top 1% of ability. By combining multiple samples of both prospective and retrospective longitudinal data, cognitive ability was found to matter in the acquisition of educational and occupational expertise. **Wai, J. (2013).** Investigating America's elite: Cognitive ability, education, and sex differences. *Intelligence, 41*, 203-211. [Keywords: Talent Identification, Gender, Achievement and Motivation]

Are the American elite drawn from the cognitive elite? To address this, five groups of America's elite (total N = 2254) were examined: Fortune 500 CEOs, federal judges, billionaires, Senators, and members of the House of Representatives. Within each of these groups, nearly all had attended college with the majority having attended either a highly selective undergraduate institution or graduate school of some kind. High average test scores required for admission to these institutions indicated those who rise to or are selected for these positions are highly filtered for ability. Ability and education level differences were found across various sectors in which the billionaires earned their wealth (e.g., technology vs. fashion and retail); even within billionaires and CEOs wealth was found to be connected to ability and education. Within the Senate and House, Democrats had a higher level of ability and education than Republicans. Females were underrepresented among all groups, but to a lesser degree among federal judges and Democrats and to a larger degree among Republicans and CEOs. America's elite are largely drawn from the intellectually gifted, with many in the top 1% of ability.

Wai, J., Cacchio, M., Putallaz, M., & Makel, M. C. (2010). Sex differences in the right tail of cognitive abilities: A 30-year examination. *Intelligence*, 38, 412-423. [Keywords: Gender Research]

One factor in the debate surrounding the underrepresentation of women in science technology, engineering and mathematics (STEM) involves male-female mathematical ability differences in the extreme right tail (top 1 percent in ability). The present study provides male-female ability ratios from over 1.6 million seventh grade students in the right tail (top 5 percent in ability) across 30 years (1981-2010) using multiple measures of math, verbal, and writing ability and science reasoning from the SAT and ACT. Male-female ratios in mathematical reasoning are substantially lower than 30 years ago, but have been stable over the last 20 years and still favor males. Over the last two decades males showed a stable or slightly increasing advantage in science reasoning. However, more females scored in the extreme right tail of verbal reasoning and writing ability tests. The potential role of sociocultural factors on changes in the male-female ability ratios is discussed and the introduction of science reasoning as a potential new factor in the debate is proposed. The implications of continued sex differences in math and science reasoning is discussed within the context of the many important interlocking factors surrounding the debate on the underrepresentation of women in STEM.

Wai, J., & Lincoln, D. (2016). Investigating the right tail of wealth: Education, cognitive ability, giving, network power, gender, ethnicity, leadership, and other characteristics. *Intelligence*, 54, 1-32. [Keywords: Talent Identification; Gender; Achievement and Motivation]

The extent to which people in the right tail of wealth are highly educated and cognitively able was examined in a sample of 18,245 ultra high net worth (UHNW) individuals with net worth's of USD \$30 million plus. How education and ability was related to religion, ethnicity, political affiliation, relationship status, country, industry, leadership, gender, net worth, giving, and network power was assessed. And whether gender, religion, ethnicity, or network power differences existed in the right tail of wealth was examined. Overall, these people were highly educated and cognitively able, and smarter (more educated) people were wealthier, gave more, and had more powerful social networks (but when controlling for multiple confounds the association between education/ability and wealth was found to be quite small). Females were underrepresented, and female CEOs needed to be more select to reach the top of a company. Males and billionaires gave the most, but females and UHNW individuals gave more of what

they had. U.S. Blacks and self-made females had the highest network power. U.S. Blacks and Caucasians were similarly educated and cognitively able. Democrats had a higher education and cognitive ability level than Republicans. Married people dominated and were the most educated and cognitively able, but least likely to have inherited their money and give. The finance, banking, investment, and internet sectors dominated. Jewish individuals were overrepresented by a factor of about 234. Today, the typical UHNW individual profile includes U.S. married (Christian and Jewish) men who are largely Chairman and CEO, Republican, and earned their money in finance, banking and investments. This study provides evidence for the clustering of brains wealth and power, and suggests that elite education may matter in the trajectory of developing expertise in wealth and power generation.

Wai, J., Putallaz, M., & Makel, M. C. (2012). Studying intellectual outliers: Are there sex differences, and are the smart getting smarter? *Current Directions in Psychological Science*, 21, 382-390. [Keywords: Talent Identification, Gender, Achievement and Motivation]

By studying samples of intellectual outliers across 30 years, researchers can leverage right-tail data (i.e., samples at or above the 95th percentile on tests of ability) to uncover missing pieces to two psychological puzzles: whether there are sex differences in cognitive abilities among smart people, and whether test scores are rising (a phenomenon known as the Flynn effect) among smart people. For the first puzzle, data indicate that the high male-to-female ratio among extremely high scorers on measures of math ability has decreased dramatically, but is still likely one factor among many explaining female underrepresentation in some professions. For the second puzzle, data indicate that the right tail has risen at a similar rate as the general (or middle portion of the) distribution; it is thus likely that the entire curve is rising at a relatively constant rate, consistent with the Flynn effect, which may explain why a greater number of gifted students have been identified in recent years. However, the causes for these gains and whether they reflect real gains in intelligence continue to remain a mystery. We show how these two puzzles are linked and stress the importance of paying attention to the entire distribution when attempting to address some scientific questions.

Wai, J., & Putallaz, M. (2011). The Flynn effect puzzle: A 30-year examination from the right tail of the ability distribution provides some missing pieces. *Intelligence*, 39, 443-455. <http://dx.doi.org/10.1016/j.intell.2011.07.006> [Keywords: Achievement and Motivation]

The Flynn effect is the rise in IQ scores across the last eighty or more years documented in the general distribution of both industrialized and developing nations primarily on tests that require problem solving and non-verbal reasoning. However, whether the effect extends to the right tail (i.e., the top 5% of ability) remains unknown. The present study uses roughly 1.7 million scores of 7th-grade students on the SAT and ACT as well as scores of 5th- and 6th-grade students on the EXPLORE from 1981 to 2010 to investigate whether the effect operates in the right tail. The effect was found in the top 5% at a rate similar to the general distribution, providing evidence for the first time that the entire curve is likely increasing at a constant rate. The effect was also found for females as well as males, appears to still be continuing, is primarily concentrated on the mathematics subtests of the SAT, ACT, and EXPLORE, and operates similarly for both 5th and 6th as well as 7th graders in the right tail. These findings help clarify the nature of the effect and may suggest ways that potential causes can now be more meaningfully offered and evaluated.

Wai, J., & Rindermann, H. R. (2015). The path and performance of a company leader: An historical examination of the education and cognitive ability of Fortune 500 CEOs. *Intelligence*, 53, 102-107. [Keywords: Talent Identification; Achievement and Motivation]

The path to becoming a CEO (and performance on the job) can be viewed as a difficult cognitive challenge. One way to examine this idea is to see how highly selected CEOs are in terms of education and cognitive ability. The extent to which Fortune 500 CEOs were selected on education and cognitive ability at an earlier age was retrospectively assessed at four time points that spanned 1996 to 2014 (Total N = 1,991). Across the last 19 years, between 37.5% and 41.0% of these CEOs were found to attend an elite school which likely placed them in the top 1% of cognitive ability. People in the top 1% of ability, therefore, were likely overrepresented among these CEOs, at about 37 to 41 times the base rate. Even within each of the four samples, higher CEO education and cognitive ability was associated with higher gross revenue of the CEO's company. Although Fortune 500 CEOs were highly selected on education and cognitive ability, when placed in the context of a broader array of occupations in the extreme right tail of achievement (e.g., politicians, judges, billionaires, journalists, academics, powerful people, and other business elites), CEOs were not at the top. This showed the wide cognitive ability range (and mental test difficulty) across various occupations that compose the U.S. elite. That Fortune 500 CEOs had similar education and cognitive ability selectivity over time shows that the CEO (and perhaps business) occupational and filtering structure has remained relatively unchanged across the last two decades.

Wai, J., & Worrell, F. C. (2016). Helping disadvantaged and spatially talented students fulfill their potential: Related and neglected national resources. *Policy Insights from Behavioral and Brain Sciences*, 3, 122-128. [Keywords: Talent Identification; Characteristics of Gifted Youth; Achievement and Motivation]

For at least the last half-century, we have underserved advanced learners, losing countless minds and corresponding innovations. The scientific evidence is clear on educational interventions that are most effective and relatively easy to implement for this population. Despite this, such educational opportunities are not readily available to all students. Whereas financially advantaged students can access opportunities outside of school that develop their talents, financially disadvantaged students cannot, and their talents largely go underdeveloped. Another underserved population is spatially talented learners, who can reason by using well-structured visual images. They are often underidentified and neglected in standardized tests and school systems that emphasize verbal and mathematical skills. Although all advanced learners deserve to have their talents developed to the fullest, a policy focus on the financially disadvantaged and spatially talented would be an actionable and effective strategy to quickly level the playing field. Because spatial reasoning is less correlated with socioeconomic status than are math and verbal reasoning in the population, identifying spatial talent will also identify more students from low-income and disadvantaged backgrounds. A policy focus on helping and challenging such disadvantaged students would contribute to fulfilling their talent and increasing their well-being; it also would increase demographic and intellectual diversity among the ranks of the highest achievers and benefit society. The current K-12 federal educational allocation to advanced learners is currently near zero. Research suggests a small early investment in advanced learners would pay off in intellectual and technological innovations, as well as GDP.

Wiley, J., & Goldstein, D. (1991). Sex, handedness and allergy: Are they related to academic giftedness? *Journal for the Education of the Gifted*, 14, 412-422. [Keywords: Characteristics of Gifted Youth]

This study attempted to replicate findings that left-handedness and allergy occur more frequently in highly gifted students (Benbow, 1986). Samples of highly gifted and less gifted twelve-year olds were identified through a regional talent search and subsequently administered questionnaires. In agreement with Benbow's finding, the highly gifted (those with extremely high scores on the Scholastic Aptitude Test) were disproportionately male. However, the present study failed to replicate the findings that the highly gifted were more likely to be left-handed and to have allergies. The theoretical importance of these findings as well as their practical implications for the identification of the gifted are discussed.

Wilson, J. S., Stocking, V. B., & Goldstein, D. (1994). Gender differences in motivations for course selection: Academically talented students in an intensive summer program. *Sex Roles*, 31, 349-367. [Keywords: Achievement and Motivation; Gender]

This study examines the motivations of students in an intensive summer program. Gender differences in motivations for course selection: Academically talented factors contributing to course selection in a sample of students enrolled in an intensive three-week academic experience for exceptionally talented adolescents. Our sample included 947 gifted adolescents, of whom 3.7% were Black, 73.5% were White, 2.2% Hispanic, 0.1% Native American, 19.8% Asian, and 0.6% categorized themselves as "other." Girls and boys selected different types of classes, with course participation falling along traditional gender-stereotyped lines. Boys and girls both performed exceptionally well, and said they chose their course because the subject was interesting, useful for future goals, and challenging. Females more often than males enrolled in classes because they perceived them as challenging, different from usual, not offered at school, and as making them more well-rounded. Males more often than females tended to select classes because they thought they would do well and/or because they viewed these classes as being useful for future schooling or career. However, these gender differences varied by the type of course the students took. The resulting complex picture of students' motivations is discussed in terms of the need to specify both the contexts in which males and females make their academic choices, and the interactive determinants of their motivations.

Zabaneh, D., Krapohl, E., Gaspar, H. A., Curtis, C., Lee, S. H., Patel, H., ... & Breen, G. (2017). A genome-wide association study for extremely high intelligence. *Molecular Psychiatry*, 1-7. <https://www.nature.com/mp/journal/vaop/ncurrent/pdf/mp2017121a.pdf>. [Keywords: Characteristics of Gifted Youth]

We used a case-control genome-wide association (GWA) design with cases consisting of 1238 individuals from the top 0.0003 (~170 mean IQ) of the population distribution of intelligence and 8172 unselected population-based controls. The single-nucleotide polymorphism heritability for the extreme IQ trait was 0.33 (0.02), which is the highest so far for a cognitive phenotype, and significant genome-wide genetic correlations of 0.78 were observed with educational attainment and 0.86 with population IQ. Three variants in locus ADAM12 achieved genome-wide significance, although they did not replicate with published GWA analyses of normal-range IQ or educational attainment. A genome-wide polygenic score constructed from the GWA results accounted for 1.6% of the variance of intelligence in the normal range in an unselected sample of 3414 individuals, which is comparable to the variance explained by GWA studies of intelligence

with substantially larger sample sizes. The gene family plexins, members of which are mutated in several monogenic neurodevelopmental disorders, was significantly enriched for associations with high IQ. This study shows the utility of extreme trait selection for genetic study of intelligence and suggests that extremely high intelligence is continuous genetically with normal-range intelligence in the population.

Zabaneh, D., Krapohl, E., Simpson, M. A., Miller, M. B., Iacono, W. G., McGue, M., ... & Breen, G. (2017). Fine mapping genetic associations between HLA region and extremely high intelligence. *Scientific Reports*, 7, 41182. DOI: 10.1038/srep41182. [Keywords: Characteristics of Gifted Youth]

General cognitive ability (intelligence) is one of the most heritable behavioural traits and most predictive of socially important outcomes and health. We hypothesized that some of the missing heritability of IQ might lie hidden in the human leukocyte antigen (HLA) region, which plays a critical role in many diseases and traits but is not well tagged in conventional GWAS. Using a uniquely powered design, we investigated whether fine-mapping of the HLA region could narrow the missing heritability gap. Our case-control design included 1,393 cases with extremely high intelligence scores (top 0.0003 of the population equivalent to $IQ > 147$) and 3,253 unselected population controls. We imputed variants in 200 genes across the HLA region, one SNP (rs444921) reached our criterion for study-wide significance. SNP-based heritability of the HLA variants was small and not significant ($h^2 = 0.3\%$, $SE = 0.2\%$). A polygenic score from the case-control genetic association analysis of SNPs in the HLA region did not significantly predict individual differences in intelligence in an independent unselected sample. We conclude that although genetic variation in the HLA region is important to the aetiology of many disorders, it does not appear to be hiding much of the missing heritability of intelligence.