Check for updates

Article

Journal for the Education of the Gifted
1–24
© The Author(s) 2020
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/0162353220912010
journals.sagepub.com/home/jeg
SAGE

Beliefs About Human Intelligence in a Sample of Teachers and Nonteachers

Russell T. Warne[1] and Jared Z. Burton[2]

Abstract

Research in educational psychology consistently finds a relationship between intelligence and academic performance. However, in recent decades, educational fields, including gifted education, have resisted intelligence research, and there are some experts who argue that intelligence tests should not be used in identifying giftedness. Hoping to better understand this resistance to intelligence research, we created a survey of beliefs about intelligence and administered it online to a sample of the general public and a sample of teachers. We found that there are conflicts between currently accepted intelligence theory and beliefs from the American public and teachers, which has important consequences on gifted education, educational policy, and the effectiveness of interventions.

Keywords

intelligence theory, research, survey, research, quantitative

One of the best predictors of academic performance is a child's level of general intelligence (e.g., Cucina et al., 2016; Deary et al., 2007; Zaboski et al., 2018). Indeed, Alfred Binet created the first intelligence test to identify French children who were struggling in school and needed special instruction to accommodate their needs (Wolf, 1973). Less than a decade after Binet's death, Terman (1916) translated Binet's test into English and adapted it for an American context to create the Stanford–Binet intelligence test. Consistent with Terman's longtime interest in gifted education, this Americanized test was expanded to include many more test items that were difficult for typically developing children. The addition of many difficult items made the test

[1]Utah Valley University, Orem, USA
[2]University of Michigan, Ann Arbor, USA

Corresponding Author:
Russell T. Warne, Utah Valley University, 800 W. University Parkway MC 115, Orem, UT 84058, USA.
Email: rwarne@uvu.edu

suitable for studying gifted children, and Terman (1926) would later use this test to identify many of the children who participated in his longitudinal study.

Since that time, gifted education has had a long, complicated relationship with intelligence. Definitions of giftedness range from explicit equating of giftedness with a high score on an intelligence test (e.g., Terman, 1926) to above-average intelligence being one ingredient to giftedness (e.g., Renzulli, 1978), to a total rejection of general intelligence as a construct relevant to giftedness (e.g., Harris & Ford, 1991).

The view that giftedness is synonymous with high intelligence has diminished in popularity over the past generation, which has produced scholars who advocate definitions of giftedness that reject or downplay general intelligence. For example, Morelock (1996) stated that "Giftedness is asynchronous development in which advanced cognitive abilities and heightened intensity combine to create inner experiences and awareness that are qualitatively different from the norm" (p. 8). Another team of scholars (von Károlyi et al., 2003) defined giftedness as high developed ability in any of Howard Gardner's multiple intelligences—a theory that explicitly rejects the existence of any general cognitive ability in favor of a multiplicity of relatively independent abilities (Gardner, 2011). Another example of this tendency to distance giftedness from intelligence appears in a recent article from two leading gifted education scholars who stated that "IQ testing may have outlasted its usefulness as an identification tool for gifted students" (Cross & Cross, 2017, p. 191). They also compared intelligence tests to the Ford Model T, stating that both inventions were useful in their time but are now obsolete (Cross & Cross, 2017, p. 192). Indeed, it is not unusual for gifted education scholars to assert that the field has moved beyond intelligence and intelligence testing (e.g., Cross & Cross, 2017; Sternberg, 2017).

Legal definitions of giftedness tend to be less theoretical and to favor a multiplicity of methods of identifying gifted children, with intelligence test scores being one of many possible sources of data in the identification process (e.g., Marland, 1971). This diversity was apparent in a recent survey of gifted education teachers and personnel. A total of 79% of respondents stated that scores on nonintelligence tests (e.g., aptitude or achievement tests) were an acceptable method of identifying giftedness in their district. Other popular methods of identifying gifted children were nominations and referrals (71%), intelligence test scores (66%), multiple criteria (64%), a "range of approved assessments" (50%), and grades (32%; Education Week Research Center, 2019, p. 12). In another show of the diversity of operationalizations of giftedness, Carman's (2013) found that 62% of gifted education studies reported that a group of gifted children were identified by a score equal to or above a cutoff on an intelligence test, while achievement test scores (34.8% of studies) and prior academic achievement (23.9% of studies) were a means of identifying gifted participants in research studies. But other gifted identification methods, such as teacher or parent nominations, were apparent in the literature. (The percentages in this paragraph sum to more than 100% because often more than one method of identification is permitted.) Although this multiplicity of applied definitions of giftedness and identification methods can cause confusion, the flexibility for state, district, and school personnel to select their own identification practices allows identification methods to align with gifted program content, which is best practice (Peters et al., 2014).

Regardless of one's preferred theoretical definition of giftedness or identification method, intelligence is a relevant construct for gifted education. It is apparent that intelligence test scores are an excellent predictor of a student's (a) probability of qualifying for an academic gifted program, (b) academic performance in advanced academic programs, and (c) aptitude for high academic performance in general (Deary et al., 2007; Warne, 2016b; Zaboski et al., 2018). Indeed, there is good evidence that intelligence has at least a partial causal impact on these outcomes (Gottfredson, 2005; Jensen, 1998).

Primer on Intelligence

Research in differential psychology shows that scores on any series of cognitive and educational performance tests are correlated to some extent and that the common variance among a series of cognitive tests is the result of a general intellectual ability (Jensen, 1998) that is stable across test batteries (Floyd et al., 2013; Johnson et al., 2004, 2008; Keith et al., 2001; Stauffer et al., 1996), the lifespan (Deary et al., 2004), and cultures (Warne & Burningham, 2019). This general intellectual ability is integral to problem solving and academic performance.

Therefore, any excellence in academic performance or cognitive abilities will be related to intelligence in some way (Thompson & Oehlert, 2010), even if theorists proposing a definition of giftedness do not acknowledge the existence or relevance of intelligence. As a result, intelligence is vitally important for virtually any definition of giftedness, with noncognitive viewpoints of giftedness (e.g., athletic giftedness) being an important exception. Indeed, the importance of intelligence extends far beyond giftedness and academics. Intelligence is predictive of many important life outcomes, as shown by positive correlations with job performance (Kuncel & Hezlett, 2010) and education (Deary et al., 2007) and negative correlations with mortality (Batty et al., 2007) and criminal behavior (Beaver et al., 2013).

Although intelligence is important for gifted education and other fields of scientific inquiry, this should not imply that intelligence is the only important cognitive ability. Leading intelligence theories all posit the existence of other cognitive abilities, though none are as broad as intelligence. According to one popular theory, intelligence sits atop a hierarchy of more specific abilities and influences behavior via an influence on broad abilities, such as verbal ability, spatial reasoning, and fluid reasoning. A contrasting theory is the bifactor model, which posits that specific manifestations of mental performance are the product of both intelligence and other broad abilities (Canivez, 2016). A discussion of the relative merits of these models is beyond the scope of this article, but the recognition of abilities beyond general intelligence shows that giftedness need not be synonymous with high IQ, even if one recognizes the importance of intelligence for gifted education purposes (Warne, 2016a).

Surveys of Understandings of Intelligence and Giftedness

Despite the importance of intelligence for gifted education (and other areas), misunderstandings of intelligence and its theoretical underpinnings are common. For example, the authors of one study found that over three quarters of introductory psychology textbooks contained basic factual errors about intelligence, the most common of which was the claim that intelligence tests were biased against diverse examinees (Warne et al., 2018). A similar survey of organizational behavior textbooks showed that intelligence was neglected (Pesta et al., 2015), despite the fact that IQ is one of the best predictors of job performance, especially in complex jobs (Schmidt & Hunter, 1998). Snyderman and Rothman (1988) reported how journalistic reports of research and controversies related to intelligence often did not reflect expert consensus on the topic. These earlier researchers found that basic findings and theories related to intelligence were de-emphasized in favor of egalitarian viewpoints—even when such viewpoints were poorly supported by empirical research. These viewpoints had a tendency to downplay the importance of intelligence outside of school, minimize the existence of individual and/or group differences, and emphasize specific abilities over general intelligence.

There is a similar history of survey research on beliefs about giftedness. Like surveys of knowledge about intelligence, surveys about people's beliefs about giftedness show that misconceptions are common. Baudson and Preckel (2016), for example, found that teachers not only acknowledged the academic aptitude of intellectually gifted students but also believed that these students had more mental health problems than nongifted students, a common incorrect belief about the gifted (Deary et al., 2004; Gale et al., 2010). Heyder et al. (2018) found that German teachers answered only 26.8% of questions about giftedness correctly and admitted that they did not know the answer to about half of the remaining questions. Other surveys have produced disappointing results about school psychologists' (Robertson et al., 2011) and teachers' knowledge regarding giftedness (Schroth & Helfer, 2009; Siegle et al., 2013).

Although there is research about beliefs about both giftedness and intelligence, we found little in the intersection of the two. Because of the importance of intelligence in gifted education—and educational outcomes in general—we chose to conduct a survey of teachers' beliefs and understandings of intelligence. Although surveys of experts on intelligence theory are available (Rindermann et al., 2016, 2017, 2020; Snyderman & Rothman, 1987, 1988), there are no detailed surveys of opinions and knowledge about intelligence from teachers or the general public. We believe that gathering information about the beliefs about intelligence from these two populations has important implications for gifted education for two reasons. First, the ways school personnel understand intelligence and giftedness may influence the interventions they offer to gifted children. As an example, a lack of understanding of the positive correlation between learning speed and intelligence may make school personnel reject acceleration as a viable educational option for gifted students. Second, viewpoints of the general public may be relevant to gifted education because the public's support (or rejection) of gifted programs may be based on what they believe about intelligence and giftedness. If these beliefs are not empirically supported, then public support for gifted programs may be lacking, or stakeholders (e.g., parents, school board members) may have unrealistic expectations for gifted programs.

For these reasons, we surveyed these two groups to ascertain whether their beliefs about intelligence are accurate. An understanding of intelligence research would be useful in making decisions about educational interventions, communicating information about giftedness to stakeholders, and designing politically acceptable gifted programs in public schools. Consequently, it is beneficial to know the beliefs of the general public regarding intelligence research, as it can provide future avenues for improved dissemination practices.

Prior researchers have surveyed teachers' classroom practices for gifted children (Archambault et al., 1993), attitudes regarding gifted children and giftedness (Heyder et al., 2018; McCoach & Siegle, 2007), and theoretical conceptions and definitions of giftedness (Schroth & Helfer, 2009). Few items on these prior surveys connect gifted education to the larger, interdisciplinary body of knowledge and theory that has emerged from research on intelligence. Because gifted education has a tendency to be an isolated, insular field (Ambrose et al., 2010; Robinson, 2006; Tomlinson et al., 1996; Vockell & Conard, 1992), we believe that there is value in understanding the viewpoints of our respondents in regard to intelligence would also help connect gifted education to other fields of research.

Method

To ascertain the understanding of intelligence among teachers and the general public, we surveyed an online convenience sample. Based on prior surveys related to intelligence topics (e.g., Antonelli-Ponti et al., 2018; Bouchard, 2004; Crosswaite & Asbury, 2019; Goslin, 1967; Walker & Plomin, 2005), we chose to investigate the different aspects of intelligence broadly, with question blocks focused on (a) the existence of intelligence, (b) important components of intelligence, (c) biological and genetic influences, (d) education, (e) environmental interventions, and (f) group differences. Both teachers and the general public received the same questions.

A convenience sample (N = 551; 338 females, 212 males, and one unknown/other) of Americans was obtained between May and August 2018 via the sample frame of an internet data collection company (Qualtrics) and through invitations to participate posted on teachers' groups on Facebook and publicly on other social media sites. Social media posts explicitly stated that the study was on people's beliefs about intelligence. We collected two subsamples, current K–12 teachers in the United States (n = 200) and nonteachers (n = 351). Although we did not plan any hypothesis tests to investigate the differences between these two groups, we believed it was important to investigate whether exposure to the education system (an environment where intelligence differences are regularly manifested) and training in human learning would lead teachers to have empirically supported viewpoints about intelligence. All subjects were volunteers and received compensation of US$0 to US$3.00.

We wrote all items in accordance with best practices of item creation for survey research (Dillman, 2007) with special attention to create items that were as neutral as possible. To create the survey items, we drew upon multiple sources of inspiration. The first was preexisting surveys related to topics on intelligence (Antonelli-Ponti et al., 2018; Crosswaite & Asbury, 2019; Goslin, 1967; Heyder et al., 2018; Jones et al., 2013; Reeve & Charles, 2008; Rindermann et al., 2016, 2017; Schroth & Helfer, 2009;

Snyderman & Rothman, 1987, 1988; Walker & Plomin, 2005). We also wrote original questions based on information included in Gottfredson's (1997a) mainstream statement on intelligence. An additional source used to create questions was Gottfredson's (2009) taxonomy of common logical fallacies used to dismiss intelligence research.

Finally, we wrote some items about the correlation of intelligence with life outcome variables and the effectiveness of interventions to raise IQ. Most questions were written on a 5-point Likert-type scale (1 = *strongly disagree* to 5 = *strongly agree*, or 1 = *very unlikely* to 5 = *very likely*). In reporting results for these questions, we followed the example of Reeve and Charles (2008) and simplified the data into the percentages frequency of those who endorse, those who are uncertain, and those who do not endorse the survey prompt. We did this by combining the bottom two categories of the Likert-type items and the top 2 categories of the Likert-type items so that values of 1 or 2 were labeled as *disagree* or *unlikely*, 3 was labeled *uncertain/neutral*, and 4 or 5 were labeled *agree* or *likely*. Collapsing categories in this way helped to simplify reporting, though all effect sizes, means, and standard deviations are calculated with the original data collected from the 5-point scales.

We want readers to recognize, however, that even though we took inspiration from prior surveys, the exact wording of almost all survey items was new. This is because most prior surveys were on subtopics of intelligence research or applications of intelligence tests—such as Reeve and Charles's (2008) survey on test usage for employment purposes, or some of the surveys about genetic influences (e.g., Antonelli-Ponti et al., 2018; Walker & Plomin, 2005)—were written for expert audiences or did not principally address intelligence. These existing items did not seem appropriate for the context of the survey and the target audience. Even when a survey was solely about intelligence, it was always designed for an expert audience (e.g., Rindermann et al., 2016, 2017, 2020; Snyderman & Rothman, 1987, 1988), and we saw a need to reword survey items to remove jargon and make it accessible to our respondents. We wrote all survey items in basic language to be appropriate for an audience of nonexperts. This often meant simplifying questions or removing nuance from items. For example, one item was "A person can be highly creative without scoring high on an IQ test." Experts will recognize that background knowledge in a field is an important prerequisite for creative work and that highly intelligent people learn information better and more quickly (Kuncel et al., 2004). However, this theoretical chain of causality is too complex to describe in a brief survey item. In addition, we recognize that experts draw an important distinction between "IQ" and "intelligence" (e.g., Haier, 2017). However, nonexperts do not (Jensen, 1998), and we sometimes used the terms interchangeably to keep the survey from being repetitive. As a result, items sometimes lack exactness that experts might desire. We found that writing items with more nuance seemed to encourage a response (e.g., pro-intelligence or pro-testing), and this violated our goal of creating a neutral survey. We made a subjective decision to include items that had some ambiguity because we believed that they could still provide valuable information about respondents' beliefs.

We conducted pretesting of the items by circulating drafts of the survey among eight individuals who were nonpsychologists, including two K–12 teachers (all undergraduate students or teachers that we had access to). None of the individuals involved with the pretesting had any expertise in intelligence or giftedness. Some pretesting subjects explained their interpretation of the test items, while others received a draft of the survey and were told to raise any concerns about items they did not fully understand. We found that members of the public and teachers interpreted the items in direct ways with little ambiguity, and few items needed any modification.

There were two instances in the survey in which we provided extra information to the participants to be able to respond to the survey. First, prior to the environmental interventions section, we provided all participants with an image of a normal distribution of intelligence test scores and a brief explanation of the IQ scale. We then asked them to rate how many IQ points they believed various interventions could permanently raise IQ, on a scale from 0 to 20 IQ points. Also, before the group differences section, we informed all participants that, while the distributions overlap, there are mean IQ differences between racial groups. They were then asked questions on how much they believed different explanations regarding why those differences would exist. The survey ended with a rating scale indicating the degree to which participants believed the racial gap in mean IQ scores might change in the next 50 years. The concluding question was a free response item in which participants could explain their beliefs about the future of mean IQ score differences.

After refining item wording in response to the pretest and feedback from colleagues, the final survey had 85 close-ended questions and one free response item (not including the attention check items). We classified the questions into seven groups: (a) existence of intelligence, (b) components of intelligence, (c) biology of intelligence and life outcomes, (d) education and intelligence, (e) interventions to permanently raise IQ, (f) group differences, and (g) plausible causes of group differences. The entire survey, including introductory information, is available in the supplemental file or at https://osf.io/pa7rt/.

It is important to recognize that we do not believe that this survey constitutes a psychometric instrument that measures a coherent “intelligence viewpoint” construct. Instead, we see the survey as measuring a collection of beliefs, attitudes, knowledge, and opinions about intelligence, giftedness, tests, and related concepts. As such, we do not believe there is justification to combine items together in a sum score or through factor analysis or principal component analysis. Rather, the best way to understand survey responses is at the item level.

We used five attention check questions for screening in each section. Four of the attention checks stated, “If you are reading this, select . . .” and one of the rating scale options. The last attention check item was in the survey section devoted to IQ increases from interventions and asked respondents to move the slider to the position labeled “3.” Respondents that failed at least one attention check by selecting any option other than the one indicated were excluded from the data set. The sample sizes reported in this study are the total number of people who passed all attention checks. No other screening tools were used. To avoid having information provided later in the survey affecting responses on prior questions, we did not permit participants to return to an earlier section of the survey after submitting responses.

Because we had no strong pre-existing hypotheses prior to survey construction and data collection, we avoided conducting any specific statistical tests, except when comparing demographics of the teachers and nonteachers (see next paragraph). Moreover, because there are numerous methods by which one may approach analyzing these data, we believed that using null hypothesis tests on the substantive items could encourage selective reporting and distort our interpretation of our data. However, to compare scores between the teacher and nonteacher subsamples, we calculated Cohen's *d* values between groups for all survey items.

Results

Sample Characteristics

Demographic data for our convenience sample are available in Table 1. The teachers were more likely to be female (76.5% of teachers and 52.7% of nonteachers, $\chi^2 = 30.03$, $p < .001$), to have taken a psychology course in college (83.0% of teachers and 36.0% of nonteachers, $\chi^2 = 113.47$, $p < .001$), to be White (95.5% of teachers and 89.5% of nonteachers, $\chi^2 = 6.08$, $p = .016$), and to be better educated (97.0% of teachers and 34.5% of nonteachers with a bachelor's degree or a graduate degree, $\chi^2 = 242.68$, $p < .001$). Both groups are Whiter than the general American adult population, which is 78.6% White (U.S. Census Bureau, 2019, Table 3). The teacher sample is considerably better educated than the general population, of which 32.3% have a bachelor's or graduate degree (U.S. Census Bureau, 2019, Table 1). A little over half (53%) of participants reported that they had taken a college-level psychology course. As 200 of the sample members (36%) were K–12 teachers, education levels in our convenience sample were naturally inflated compared with a general sample of Americans.

Respondent Viewpoints and Accuracy

Although some survey items are not discussed here, all descriptive statistics for all items are available from the supplemental files. In addition, our data and materials are available to download at https://osf.io/pa7rt/. Supplemental Table S8 provides the empirically supported responses (with at least one supporting citation) for every item. Using this information as an answer key, the average respondent provided opinions that were empirically supported for 31.0% of items (33.9% for teachers and 29.4% for nonteachers).

The following tables highlight only some of the items measured on the survey. Table 2 highlights items with high consensus (i.e., items with a low standard deviation) within the sample.

Survey participants' responses were generally aligned with research findings regarding the components of intelligence. Respondents agree with the empirical evidence that crystallized intelligence, logic, and fluid intelligence are all important components of intelligence. This is indicated by the agreement on the following items, respectively:

Table 1. Demographic Data for Survey Sample.

Variable	Full sample (n = 551)	Nonteacher (n = 351)	Teacher (n = 200)
Gender			
Male	212 (38.5%)	165 (47.0%)	47 (23.5%)
Female	338 (61.3%)	185 (52.7%)	153 (76.5%)
Other	1 (0.2%)	1 (0.3%)	0 (0.0%)
College psychology course taken?			
Yes	292 (53.0%)	126 (35.9%)	166 (83.0%)
No	259 (47.0%)	225 (64.1%)	34 (17.0%)
Age			
M	46.35	50.01	39.94
SD	14.7	15.29	11.00
Ethnicity			
White/European	505 (91.7%)	314 (89.5%)	191 (95.5%)
African American	18 (3.3%)	17 (4.8%)	1 (0.5%)
Hispanic/Latino	14 (2.5%)	11 (3.1%)	3 (1.5%)
Asian American	10 (1.8%)	8 (2.3%)	2 (1.0%)
Native American/Alaska Native	6 (1.1%)	5 (1.4%)	1 (0.5%)
Pacific Islander	2 (0.4%)	1 (0.3%)	1 (0.5%)
Other	4 (0.7%)	3 (0.9%)	1 (0.5%)
Level of education			
Doctoral degree or other terminal degree (e.g., JD, MD, PsyD)	11 (2.0%)	9 (2.6%)	2 (1.0%)
Master's degree	138 (25.0%)	28 (8.0%)	110 (55.0%)
Four-year college degree	166 (30.1%)	84 (23.9%)	82 (41.0%)
Some college or technical school training	133 (24.1%)	129 (36.8%)	4 (2.0%)
High school diploma or GED	92 (16.7%)	90 (25.6%)	2 (1.0%)
Less than a high school education	11 (2.0%)	11 (3.1%)	0 (0.0%)

Note. GED = General Educational Development.

- "The ability to retain and use learned knowledge is an important aspect of intelligence" (89.3% agreement).
- "The ability to think logically is an important aspect of intelligence" (88.6% agreement).
- "The ability to think abstractly and solve problems is important to intelligence" (84.2% agreement).

Some of the education items were also endorsed in a way that aligns with empirical research. A total of 76.0% of the sample believed that school could not equalize differences in intelligence, and 73.0% of the sample believed that high and low intelligence students have different needs.

Table 2. Survey Items With High Respondent Consensus.

	Teachers			Nonteachers			Full sample					
Likert-type item	Disagree (%)	Uncertain/ neutral (%)	Agree (%)	Disagree (%)	Uncertain/ neutral (%)	Agree (%)	Disagree (%)	Uncertain/ neutral (%)	Agree (%)	Mean	*SD*	Cohen's *d*
Members of all racial/ethnic groups can be found at all intelligence levels	1.0	2.5	**96.5**	2.6	6.6	**90.9**	2.0	5.1	**92.9**	4.63	0.71	0.33
A person can be highly creative without scoring high on an IQ test	**1.5**	4.0	94.5	**2.3**	9.4	88.3	**2.0**	7.4	90.6	4.45	0.77	0.34
The ability to retain and use learned knowledge is an important aspect of intelligence	4.0	4.0	**92.0**	1.7	10.5	**87.7**	2.5	8.2	**89.3**	4.27	0.74	0.15
The ability to think logically is an important aspect of intelligence	4.5	8.5	**87.0**	1.7	8.8	**89.5**	2.7	8.7	**88.6**	4.30	0.77	−0.05
The ability to think abstractly to solve problems is important to intelligence	1.5	7.0	**91.5**	3.4	16.5	**80.1**	2.7	13.1	**84.2**	4.18	0.77	0.37
There are many kinds of intelligence, such as musical-rhythmic intelligence, verbal-linguistic intelligence, and bodily-kinesthetic intelligence	**10.0**	5.5	84.5	**3.1**	12.5	84.3	**5.6**	10.0	84.4	4.27	0.92	0.08
On average, men and women are equally intelligent	3.5	5.5	**91.0**	3.1	17.9	**78.9**	3.3	13.4	**83.3**	4.33	0.84	0.38
The earlier a treatment occurs, the more noticeable the impact is	5.0	13.5	81.5	2.3	15.1	82.6	3.3	14.5	82.2	4.09	0.82	0.07
Some people are just smarter than others	16.5	10.5	**73.0**	4.0	9.7	**86.3**	8.5	10.0	**81.5**	4.12	0.97	−0.38
Schools alone cannot eliminate differences in intelligence among individuals	7.5	12.5	**80.0**	5.7	20.5	**73.8**	6.4	17.6	**76.0**	4.03	0.93	0.18
Reducing a person's mental abilities to one score is too simplistic	**6.0**	7.0	87.0	**8.8**	21.9	69.2	**7.8**	16.5	75.7	4.05	0.97	0.47
Concussions or other brain injuries can cause a decrease in IQ	5.5	18.0	**76.5**	5.7	20.8	**73.5**	5.6	19.8	**74.6**	3.96	0.88	0.09
The ability to identify patterns is an important aspect of intelligence	2.5	13.5	**84.0**	7.4	25.1	**67.5**	5.6	20.9	**73.5**	3.89	0.81	0.38
High-IQ students and low students have different educational needs	6.0	6.5	**87.5**	11.4	23.9	**64.7**	9.4	17.6	**73.0**	3.91	0.98	0.45
The earlier a treatment occurs, the more permanent the effects are	**7.5**	18.5	74.0	**6.3**	25.9	67.8	**6.7**	23.2	70.1	3.86	0.91	0.09

Note. Empirically supported responses are marked in bold. See Supplemental Table S8 for references regarding each item. Positive Cohen's *d* values indicate that teachers endorsed the item more highly than nonteachers.

Table 3. Survey Items With Low Respondent Consensus.

	Teachers			Nonteachers			Full sample					
Likert-type item	Disagree (%)	Uncertain/ neutral (%)	Agree (%)	Disagree (%)	Uncertain/ neutral (%)	Agree (%)	Disagree (%)	Uncertain/ neutral (%)	Agree (%)	*M*	*SD*	Cohen's *d*
Individuals with a higher IQ score are generally healthier	30.5	39.0	**30.5**	29.6	42.2	**28.2**	29.9	41.0	**29.0**	2.97	1.01	0.07
Less intelligent people are more likely to live in poverty	38.5	25.0	**36.5**	37.0	25.9	**37.0**	37.6	25.6	**36.8**	2.93	1.18	−0.07
Intelligence test scores of people from different cultures can be compared	41.5	22.5	36.0	21.1	33.9	45.0	28.5	29.8	41.7	3.12	1.10	−0.30
When predicting life success, the childhood advantages of wealth are more important than any individual trait—including intelligence or personality	**41.5**	14.5	44.0	**39.9**	31.3	28.8	**40.5**	25.2	34.3	2.89	1.19	0.10
A trait that is highly genetically influenced cannot be changed	**60.0**	20.0	20.0	**35.3**	35.0	29.6	**44.3**	29.6	26.1	2.77	1.03	−0.45
Students scoring with higher intelligence test scores tend to perform just as well in school as the average student	**33.0**	29.5	37.5	**19.1**	33.6	47.3	**24.1**	32.1	43.7	3.24	1.03	−0.33
Using standardized tests to select students for college, gifted programs, or special education programs is just a way of keeping low-income students out of good schools/programs	**48.5**	15.5	36.0	**41.6**	29.9	28.5	**44.1**	24.7	31.2	2.74	1.25	−0.07
IQ tests are also important for measuring success in life outside of school	59.5	16.5	**24.0**	37.0	30.2	**32.8**	45.2	25.2	**29.6**	2.75	1.18	−0.31
A student with high grades in one school subject tends to do well in others	48.0	10.0	**42.0**	41.6	26.5	**31.9**	43.9	20.5	**35.6**	2.82	1.15	−0.01
The concept of intelligence often doesn't make sense in other cultures	23.0	31.0	46.0	19.9	35.0	45.0	21.1	33.6	45.4	3.29	1.04	−0.04
Nobody really knows how to measure intelligence	**37.0**	19.5	43.5	**26.2**	24.8	49.0	**30.1**	22.9	47.0	3.24	1.14	−0.24
Street smarts is more important for life success than IQ	**21.5**	39.0	39.5	**17.9**	35.9	46.2	**19.2**	37.0	43.7	3.33	0.99	−0.18
People with lower intelligence are more likely to die at younger ages	35.0	41.0	**24.0**	44.4	39.9	**15.7**	41.0	40.3	**18.7**	2.66	1.04	0.24
IQ scores fluctuate a lot throughout the lifespan	**42.0**	21.0	37.0	**17.9**	24.8	57.3	**26.7**	23.4	49.9	3.30	1.14	−0.55
Men tend to do better than women on spatial tasks (e.g., navigating through an unfamiliar city, assembling a child's toy)	21.5	34.0	**44.5**	15.7	36.8	**47.6**	17.8	35.8	**46.5**	3.36	1.04	−0.16

Note. Empirically supported responses are marked in bold. Positive Cohen's *d* values indicate that teachers endorsed the item more highly than nonteachers.

Of all the items in this table, the only consensus viewpoint that is not empirically supported was multiple intelligences (as indicated by the item "There are many kinds of intelligence, such as musical-rhythmic intelligence, verbal-linguistic intelligence, and bodily-kinesthetic intelligence"). This item was endorsed by 84.4% of participants, nearly equally by nonteachers and teachers. This is consistent with past surveys of educational professionals' beliefs about multiple intelligences (e.g., Schroth & Helfer, 2009).

Table 3 shows items with low levels of response uniformity, as indicated by the high standard deviation of each response. Many of these items are about life outcomes that are correlated with intelligence (e.g., health, mortality). Only 29.6% of individuals in the sample believed that IQ scores are useful measurements of practical outcomes, which may explain some of the disagreement and uncertainty surrounding life outcome survey items.

More generally, there was disagreement within our sample regarding the broader sense of what intelligence measures and what IQ scores represent. For example, only 41.7% of people believed intelligence can be compared cross-culturally, and only 35.6% of sample members believed that course grades in different subjects positively correlate with each other. Both of these statements are strongly supported by empirical research (Warne, in press).

One consistent trend we noticed in the survey data was a great confidence among our respondents in the impact of interventions to raise IQ, which is shown in Figure 1. This was most clearly seen in the intervention section of the survey, where the perceived mean IQ boost from 20 different interventions ranged from to 4.67 to 11.22 IQ points for nonteachers and 2.25 to 10.86 IQ points for teachers. These numbers indicate a belief among members of both subsamples about the malleability of IQ.

Although we did not search for systematic differences in the responses of teachers and nonteachers, we did notice when inspecting Figure 1 that teachers in our sample were generally less optimistic about the effectiveness of interventions to raise IQ scores. Teachers also more consistently endorsed environmental explanations of racial differences in mean intelligence test scores. Specifically, teachers believed more strongly in the impact of 12 of 13 environmental causes of mean differences in IQ across racial groups than nonteachers. Details about these findings are shown in Supplemental Tables S1 to S7.

Discussion

General Interpretation of Results

The results of our survey about teachers' and the general publics' views of intelligence show that empirically unsupported viewpoints are very common. Among the entire sample, 33.9% of teachers' responses and 29.4% of nonteachers' responses were empirically supported (using the information in Supplemental Table S8 as a standard). This is similar to the Heyder et al.'s (2018) study showing that teachers' viewpoints about intellectual giftedness were correct for 26.8% of items on their survey.

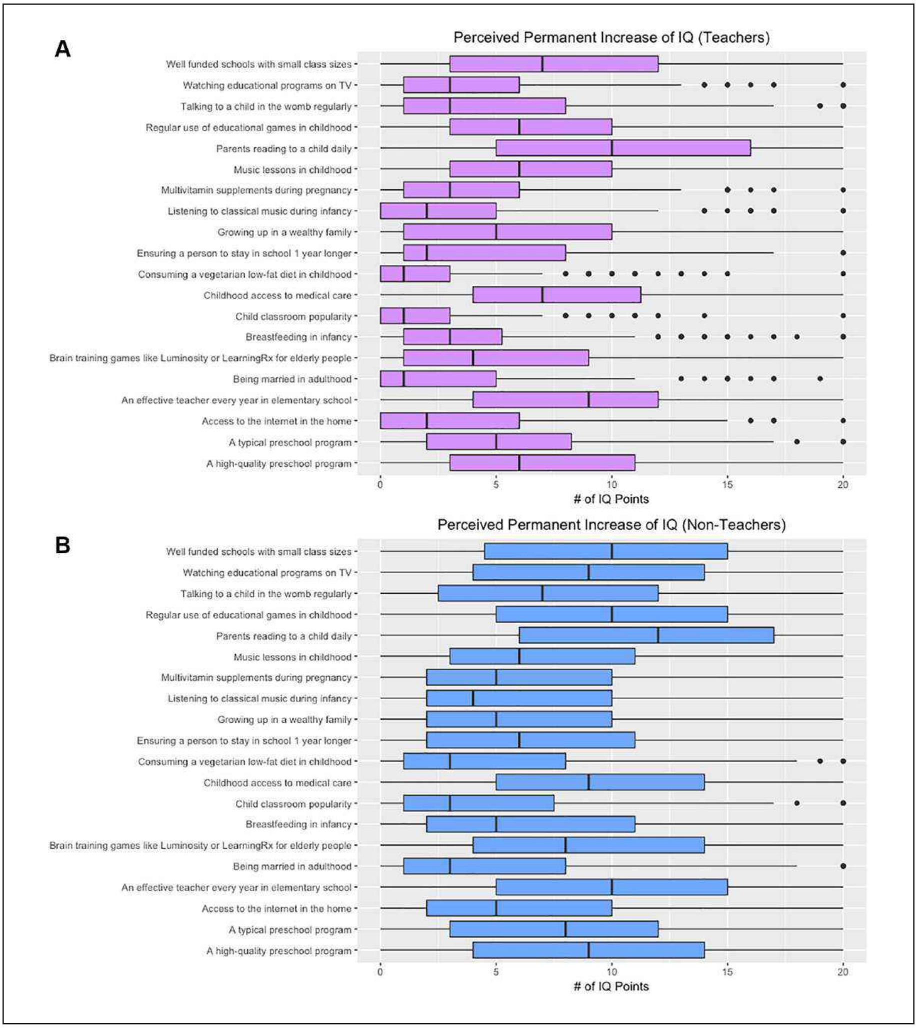

Figure 1. Box plots displaying the number of IQ points that sample members believed each stated intervention would permanently raise IQ: (A) Perceived permanent increase of IQ (teachers) and (B) perceived permanent increase of IQ (nonteachers).

Our results are largely in line with the prior surveys of nonexperts about intelligence and related topics. For example, prior surveys of teachers (e.g., Antonelli-Ponti et al., 2018; Crosswait & Asbury, 2019; Goslin, 1967; Walker & Plomin, 2005) have shown that they generally believe that intelligence can be influenced by genes and that a purely environmental "blank slate" perspective is not mainstream—a finding that matches Martschenko's (2019) survey of teacher beliefs about the genetics of intelligence and educational outcomes, which was published while our study was in peer review. In our study, the majority of both teachers (63.9%) and nonteachers (57.8%) agreed or strongly agreed with the statement that "Intelligence is influenced by people's genes."

Where there was more disagreement was in the comparisons of our results with surveys of experts (Reeve & Charles, 2008; Rindermann et al., 2016, 2017, 2020; Snyderman & Rothman, 1987, 1988). Experts in these prior surveys had stronger beliefs about the importance of intelligence outside of academic settings and that standardized tests were not biased against minority members (see also Gottfredson, 1997a, and Neisser et al., 1996, for other mainstream expert opinions). Our sample disagreed with these positions, with the average respondent being unaware of the negative correlation between IQ and crime, socioeconomic status, poor health, and mortality (see Supplemental Table S3). Similarly, only 12.5% of teachers and 25.1% of nonteachers (correctly) disagreed or strongly disagreed that test bias is a cause of average test score gaps between demographic groups. For these issues and others, the opinion of the teachers in our survey are distinctly at odds with expert opinions.

Other empirically unsupported beliefs were common among our respondents. For example, 84.4% of our sample agreed that there were many kinds of intelligence, which is an endorsement of Howard Gardner's (2011) theory of multiple intelligences. Although this theory is very popular in education circles (Gardner, 2016; Schroth & Helfer, 2009), many of its fundamental claims are not supported by empirical data (Castejon et al., 2010; Pyryt, 2000; Warne, in press). Similarly, we were surprised that only 35.6% of our convenience sample agreed that students who earn high grades in one subject tend to get high grades in other subjects—despite the fact that this finding goes back over 100 years (Spearman, 1904) and is one of the most replicated findings in all of educational psychology.

Most alarming, though, are the basic research findings about intelligence that most teachers in our convenience sample did not agree with. For example, only 33% of teachers disagreed with the statement that high-IQ students perform as well in school as the average student, which is somewhat similar to the 49% of Heyder et al.'s (2018) teachers who believed that intellectually gifted children had greater academic potential than the average student. In reality, academic performance has a positive linear relationship with IQ (Cucina et al., 2016; Guez et al., 2018; Zaboski et al., 2018). Likewise, a majority (59.5%) of teachers disagreed with the (empirically supported) statement that IQ tests are important measures of success in life outside of school (see Gordon, 1997; Gottfredson, 1997b; Lubinski, 2000; for explanations of the importance of intelligence in everyday life). It is not clear why teachers—who observe the effects of intelligence differences every day in their job—have such misunderstandings of some of the most fundamental manifestations of intelligence.

Still, not all is bad news. Table 2 shows that our respondents' understandings of general intelligence (e.g., its ability to help people learn or as an abstract reasoning ability) are in line with mainstream viewpoints (Gottfredson, 1997a). Also, the majority of respondents (76.0%) are skeptical that schools alone can equalize intelligence among children, which would agree with mainstream viewpoints about this topic (see Plomin, 2018, Chapter 9, for an accessible explanation). Most relevant for the gifted education perspective, three quarters of respondents agreed that high-IQ and low-IQ children had different educational needs, which is a basis for creating separate educational programs for both gifted students and struggling students.

Nevertheless, we do believe that the data show that respondents (both teachers and the general public) are generally unaware of many findings from intelligence research. Both groups hold certain empirically unsupported beliefs about intelligence that are widespread. For nonexperts, this is unsurprising because it is not realistic to expect them to be aware of the research in an interdisciplinary scholarly field. The results in the teacher subsample, though, are in line with Heyder et al.'s (2018) results that showed that most teachers had low levels of knowledge regarding the nature, manifestations, and correlates of intellectual giftedness.

Discussion of Specific Results

In regard to specific findings, items referencing correlations between intelligence and life outcomes were either not endorsed or elicited highly mixed responses (see items on criminal intelligence, intelligence and life expectancy, drugs/alcohol, health, and wealth/poverty). In our view, this lack of understanding indicates (if our convenience sample is typical) that teachers and the general public do not understand the ways in which general intelligence has consequences that extend far beyond the classroom. This may make teachers and the public less likely to see a child's giftedness as an integral part of her or his psychology that requires accommodations and planning in school.

The differences between nonteachers and teachers in our convenience sample were fairly noticeable. Although not hypothesized prior to data collection, we found it noteworthy that the average teacher did not believe that any intervention would be more effective than the average nonteacher did. Yet, an unplanned ad hoc correlation of the item averages in this section for teachers and nonteachers (r = .883) indicates that the relative rank order of effectiveness of interventions was very similar across groups. Where the two groups differed was that teachers saw the interventions as slightly less effective (by an average of 2.2 IQ points) than nonteachers did.

Still, both groups had generally unrealistic and inflated views of the effectiveness of interventions. Of the 20 interventions, only four have any research evidence supporting a permanent casual impact on IQ in people living in industrialized countries (see Supplemental Table S8). These are as follows:

- Ensuring a person stays in school 1 year longer (1–5 points; Ritchie & Tucker-Drob, 2018);
- Multivitamin supplements during pregnancy to raise a child's IQ (0–2 points; Protzko, 2017);
- Growing up in a wealthy family (1–5 points; Kendler et al., 2015); and
- Music lessons in childhood (0–6 points; Protzko, 2017; Sala & Gobet, 2017).

The estimated mean impacts for each of these interventions in our sample is greater than the highest value in these ranges. Respondents estimated that IQ would increase

6.19 points (for staying in school an extra year), 5.43 points (for multivitamins during pregnancy), 6.01 points (for growing up in a wealthy family), and 7.05 points (for music lessons in childhood). These estimates are only similar to the treatments' actual impact on IQ if one assumes that all four treatments' true effect is at or close to the maximum of the range.

Where the respondents' optimism about raising IQ is most apparent is in the other 16 items, all of which either have no known causal impact on IQ or are known to have zero impact on IQ in randomized control studies (see Supplemental Table S8 for references supporting this). Participants in our study believed that reading to a child daily would result in the largest impact on IQ: 11.09 points. Respondents even believed that the three "interventions" we invented without any empirical or theoretical basis—being popular with classmates as a child, consuming a vegetarian low-fat diet in childhood, and being married in adulthood—would raise IQ by an average of 3.77, 3.81, and 4.32 points, respectively. Given this optimism in "interventions" with no connection to cognition and no empirical support, we find it unsurprising that discredited interventions to raise IQ permanently, such as the Mozart effect (Waterhouse, 2006), brain training programs (Protzko, 2017; Simons et al., 2016), and typical preschool programs (Lipsey et al., 2018; U.S. Department of Health and Human Services, 2012), were also seen as being effective. On average, our respondents believed that these raised IQ by an average of 5.18, 7.52, and 7.42 points, respectively.

To be fair, though, the three fake "interventions" we invented were rated as having the lowest average permanent impact on IQ out of the 20 interventions in the survey. Using these as a relative baseline for minimum effectiveness, most of the interventions seemed only marginally more effective than these faux "interventions." For example, the Mozart effect's estimated IQ increase of 5.18 points is only 0.86 to 1.41 points higher than the estimated impacts of the three fake interventions. Although 5.18 points is much higher than the absolute impact of zero for the Mozart effect, saying that classical music raises IQ by a minuscule amount over a worthless placebo intervention is close to the truth and shows some degree of correct intuitive understanding among the nonexpert respondents.

A rosy view of the effectiveness of interventions has other important implications for giftedness. For example, if our results generalize and teachers believe that school-based interventions (such as small class sizes, an effective teacher, or preschool) can each raise a child's IQ by several points, then they may believe that gifted and nongifted children are fundamentally similar. There are potential ramifications of such a viewpoint, including the implication that gifted programs bestow further advantages upon children who have already experienced an advantageous environment.

A Tentative Hypothesis

Based on these responses and the responses to other sections (e.g., causes of group mean differences in IQ), we *tentatively* hypothesize that there *may* be a tendency for the public to support empirical scientific theories on intelligence when they support egalitarian ideals, but that the ideas are less accepted as they appear contrary to these principles. This proclivity appeared to be stronger for the teachers than nonteachers in our convenience sample. Concepts such as pattern-recognition and fluid intelligence do not threaten egalitarian values and found widespread acceptance in our survey. On the contrary, issues related to genetic influence on intelligence, the intransigence of IQ scores in the face of interventions, demographic group differences, or the relationship between intelligence and important life outcomes can be much more threatening to people who value egalitarian outcomes in society (e.g., Martschenko, 2019). The data about these issues showed much less agreement between our respondents' views and empirically supported positions, especially for teachers. For example, when empirical results suggest differences in intelligence between different human populations, the views were more contested. This pattern in the data was similar to the egalitarian bias in previous research on the presentation of intelligence in textbooks and journalistic reports (Pesta et al., 2015; Snyderman & Rothman, 1987, 1988; Warne et al., 2018). However, the nongeneralizable sample and tentative, post hoc nature of this hypothesis means that at this time the possible existence of an egalitarian bias in our respondents' beliefs is far from proven. We believe that the relationship between egalitarian views and accuracy of understanding of intelligence research is an important question for future research. Egalitarian ideals need not conflict with findings in intelligence research (Warne, in press), and helping teachers and the general public reconcile the research on giftedness and intelligence with a distaste for elitist or undemocratic viewpoints may be an important part of gaining public support for gifted programs.

Limitations

Major limitations. There are limitations to the methodology of the study and interpretation of these results. First, as an exploratory study with a convenience sample, generalizable claims are limited. Neither group is representative of their respective population, and the results may be statistically biased to an unknown degree. We do not want readers to extrapolate the results of any specific item to the population of teachers or the general public. This does not mean our data are without value; rather, we see the general pattern of responses—indicating a lack of knowledge about intelligence and a propensity toward egalitarian views—as providing a useful overall picture of nonexperts' knowledge about intelligence. We hope to conduct a follow-up study that is representative of both groups to improve the generalizability of these results.

Another drawback is that few of the survey items ask specifically about gifted education. Unlike the research on intelligence, there is little consensus among experts on the nature, theories, or main empirical findings on giftedness. Therefore, we did not find the gifted education research to be a productive source of items for our survey. Consequentially, the impact of teachers' and the public's beliefs about intelligence on their beliefs about giftedness can only be surmised. Implications for gifted education of the respondents' views of intelligence may seem logical to us, but these extrapolations must be checked empirically. Schroth and Helfer (2009), for example, found that gifted education practitioners accepted contradictory definitions and conceptualizations of giftedness. It is possible that our respondents may have similarly incompatible beliefs about gifted education and intelligence. Focus groups or additional surveys that delve into how beliefs about intelligence impact beliefs about gifted education would illuminate the implications of these beliefs.

Minor limitations. Another limitation is that all survey research relies on the honesty of the participants. Although we had no way of checking the truthfulness of the responses, there are reasons to believe that the respondents were truthful. First, the data collection was completely anonymous, thus eliminating social pressure to respond dishonestly. Second, the participation incentive was contingent upon completion only—not on any specific response(s). Finally, we tried to word the items as neutrally as possible, thereby eliminating any social desirability or agreement bias that could manifest itself.

One reviewer raised the possibility that the optimistic views of the impact of treatments to raise IQ could merely be due to nonexperts' unfamiliarity with the IQ scale. Although this is possible, we do not find it plausible. The background information (provided in Supplemental Table S5) is highly detailed and includes a normal distribution so that respondents understand what typical IQ differences in the population are. In addition, the maximum allowable IQ impact was 20 points, precisely to keep respondents' estimates somewhat reasonable. Finally, regardless of one's familiarity with the scale, it is clear that a response of 0 would correspond to no impact and that higher numbers would indicate greater impact. Even if the reviewer is correct and the responses to our survey merely indicate unfamiliarity with the IQ scale, it would still support our main interpretation that respondents—even in a sample with inflated levels of college education and teachers, who deal with intelligence differences on a regular basis—are not acquainted with intelligence research.

Conclusion

In our study, we found that empirically unsupported beliefs about intelligence were common among both a convenience sample of teachers and another sample of the general public. This has important consequences for gifted education. Erroneous beliefs about intelligence may result in decreased support for gifted programs, unrealistic expectations for interventions, or incomplete/inaccurate theories of giftedness. We urge readers to become familiar with mainstream views of intelligence to better inform not only their own views on education and giftedness but those of their colleagues as well. A good start would be to read some articles that explain basic intelligence research in an accessible manner (e.g., Gottfredson, 1997a, 1997b; Neisser et al., 1996; Nisbett et al., 2012). Warne (2016a) published an article that explains the most mainstream theory of intelligence and applies its principles to gifted education. Deary (2001) and Ritchie (2015) both wrote short, understandable books for a nonprofessional audience that serve as excellent introductions to intelligence.

Intelligence research is a highly relevant area of psychology that remains underappreciated in education—including gifted education. We believe that teachers, gifted education practitioners, and school administrators can benefit from learning more about human intelligence. This knowledge may be used to improve expectations of gifted programs, adopt empirically supported definitions of giftedness, and improve gifted identification procedures. We believe that incorporating research on intelligence into theory and practice can help gifted education in building ties to other fields and improving theories.

Authors' Note

A preprint of this article is available at https://osf.io/6xu25/

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

ORCID iD

Russell T. Warne https://orcid.org/0000-0003-4763-3625

Supplemental Material

Supplemental material for this article is available online.

References

Ambrose, D., Van Tassel-Baska, J., Coleman, L. J., & Cross, T. L. (2010). Unified, insular, firmly policed, or fractured, porous, contested, gifted education? *Journal for the Education of the Gifted*, *33*(4), 453–478. https://doi.org/10.1177/016235321003300402

Antonelli-Ponti, M., Versuti, F. M., & Da Silva, J. A. (2018). Teachers' perception about genes and behavior. *Estudios de Psicologia*, *35*(4), 421–431. https://doi.org/10.1590/1982-02752018000400009

Archambault, F. X., Westberg, K. L., Brown, S. W., Hallmark, B. W., Zhang, W., & Emmons, C. L. (1993). Classroom practices used with gifted third and fourth grade students. *Journal for the Education of the Gifted*, *16*(2), 103–119. https://doi.org/10.1177/016235329301600203

Batty, G. D., Deary, I. J., & Gottfredson, L. S. (2007). Premorbid (early life) IQ and later mortality risk: Systematic review. *Annals of Epidemiology*, *17*(4), 278–288. https://doi.org/10.1016/j.annepidem.2006.07.010

Baudson, T. G., & Preckel, F. (2016). Teachers' conceptions of gifted and average-ability students on achievement-relevant dimensions. *Gifted Child Quarterly*, *60*(3), 212–225. https://doi.org/10.1177/0016986216647115

Beaver, K. M., Schwartz, J. A., Nedelec, J. L., Connolly, E. J., Boutwell, B. B., & Barnes, J. C. (2013). Intelligence is associated with criminal justice processing: Arrest through incarceration. *Intelligence*, *41*(5), 277–288. https://doi.org/10.1016/j.intell.2013.05.001

Bouchard, T. J. Jr. (2004). Genetic influence on human psychological traits: A survey. *Current Directions in Psychological Science, 13*(4), 148-151. https://doi.org/ 10.1111/j.0963-7214.2004.00295.x

Canivez, G. L. (2016). Bifactor modeling in construct validation of multifactored tests: Implications for understanding multidimensional constructs and test interpretation. In K. Schwizer & C. DiStefano (Eds.), *Principles and methods of test construction: Standards and recent advancements* (pp. 247–271). Hogrefe Publishing.

Carman, C. A. (2013). Comparing apples and oranges: Fifteen years of definitions of giftedness in research. *Journal of Advanced Academics*, *24*(1), 52–70. https://doi.org/10.1177/1932202x12472602

Castejon, J. L., Perez, A. M., & Gilar, R. (2010). Confirmatory factor analysis of Project Spectrum activities. A second-order g factor or multiple intelligences? *Intelligence*, *38*(5), 481–496. https://doi.org/10.1016/j.intell.2010.07.002

Cross, T. L., & Cross, J. R. (2017). Challenging an idea whose time has gone. *Roeper Review*, *39*(3), 191–194. https://doi.org/10.1080/02783193.2017.1319000

Crosswaite, M., & Asbury, K. (2019). Teacher beliefs about the aetiology of individual differences in cognitive ability, and the relevance of behavioural genetics to education. *British Journal of Educational Psychology*, *89*(1), 95–110. https://doi.org/10.1111/bjep.12224

Cucina, J. M., Peyton, S. T., Su, C., & Byle, K. A. (2016). Role of mental abilities and mental tests in explaining high-school grades. *Intelligence*, *54*, 90–104. https://doi.org/10.1016/j.intell.2015.11.007

Deary, I. J. (2001). *Intelligence: A very short introduction*. Oxford University Press. https://doi.org/10.1093/actrade/9780192893215.001.0001

Deary, I. J., Strand, S., Smith, P., & Fernandes, C. (2007). Intelligence and educational achievement. *Intelligence*, *35*(1), 13–21. https://doi.org/10.1016/j.intell.2006.02.001

Deary, I. J., Whiteman, M. C., Starr, J. M., Whalley, L. J., & Fox, H. C. (2004). The impact of childhood intelligence on later life: Following up the Scottish Mental Surveys of 1932 and 1947. *Journal of Personality and Social Psychology*, *86*(1), 130–147. https://doi.org/10.1037/0022-3514.86.1.130

Dillman, D. A. (2007). *Mail and internet surveys: The tailored design method* (2nd ed.). John Wiley.

Education Week Research Center. (2019). *Gifted education: Results of a national survey*. https://www.edweek.org/media/2019/11/25/gt%20survey%20report-final%2011.25.19.pdf

Floyd, R. G., Reynolds, M. R., Farmer, R. L., & Kranzler, J. H. (2013). Are the general factors from different child and adolescent intelligence tests the same? Results from a five-sample, six-test analysis. *School Psychology Review*, *42*(4), 383–401.

Gale, C. R., Batty, G. D., Tynelius, P., Deary, I. J., & Rasmussen, F. (2010). Intelligence in early adulthood and subsequent hospitalization for mental disorders. *Epidemiology*, *21*(1), 70–77. https://doi.org/10.1097/EDE.0b013e3181c17da8

Gardner, H. (2011). *Frames of mind: The theory of multiple intelligences*. Basic Books.

Gardner, H. (2016). Multiple intelligences: Prelude, theory, and aftermath. In R. J. Sternberg, S. T. Fiske & D. J. Foss (Eds.), *Scientists making a difference: One hundred eminent behavioral and brain scientists talk about their most important contributions* (pp. 167–170). Cambridge University Press.

Gordon, R. A. (1997). Everyday life as an intelligence test: Effects of intelligence and intelligence context. *Intelligence*, *24*(1), 203–320. https://doi.org/10.1016/S0160-2896(97)90017-9

Goslin, D. A. (1967). *Teachers and testing*. Russell Sage Foundation.

Gottfredson, L. S. (1997a). Mainstream science on intelligence: An editorial with 52 signatories, history, and bibliography. *Intelligence*, *24*(1), 13–23. https://doi.org/10.1016/S0160-2896(97)90011-8

Gottfredson, L. S. (1997b). Why *g* matters: The complexity of everyday life. *Intelligence*, *24*(1), 79–132. https://doi.org/10.1016/S0160-2896(97)90014-3

Gottfredson, L. S. (2005). Implications of cognitive differences for schooling within diverse societies. In C. L. Frisby & C. R. Reynolds (Eds.), *Comprehensive handbook of multicultural school psychology* (pp. 517–554). John Wiley.

Gottfredson, L. S. (2009). Logical fallacies used to dismiss the evidence on intelligence testing. In R. P. Phelps (Ed.), *Correcting fallacies about educational and psychological testing* (pp. 11–65). American Psychological Association. https://doi.org/10.1037/11861-001

Guez, A., Peyre, H., Le Cam, M., Gauvrit, N., & Ramus, F. (2018). Are high-IQ students more at risk of school failure? *Intelligence*, *71*, 32–40. https://doi.org/10.1016/j.intell.2018.09.003

Haier, R. J. (2017). *The neuroscience of intelligence*. Cambridge University Press. https://doi.org/10.1017/9781316105771

Harris, J. J., III, & Ford, D. Y. (1991). Identifying and nurturing the promise of gifted Black American children. *The Journal of Negro Education*, *60*(1), 3–18. https://doi.org/10.2307/2295529

Heyder, A., Bergold, S., & Steinmayr, R. (2018). Teachers' knowledge about intellectual giftedness: A first look at levels and correlates. *Psychology Learning & Teaching*, *17*(1), 27–44. https://doi.org/10.1177/1475725717725493

Jensen, A. R. (1998). *The g factor: The science of mental ability*. Praeger.

Johnson, W., Bouchard, T. J., Jr., Krueger, R. F., McGue, M., & Gottesman, I. I. (2004). Just one *g*: Consistent results from three test batteries. *Intelligence*, *32*(1), 95–107. https://doi.org/10.1016/S0160-2896(03)00062-X

Johnson, W., te Nijenhuis, J., & Bouchard, T. J., Jr. (2008). Still just 1 *g*: Consistent results from five test batteries. *Intelligence*, *36*(1), 81–95. https://doi.org/10.1016/j.intell.2007.06.001

Jones, B. D., Rakes, L., & Landon, K. (2013). Malawian secondary students' beliefs about intelligence. *International Journal of Psychology*, *48*(5), 785–796. https://doi.org/10.1080/00207594.2012.716906

Keith, T. Z., Kranzler, J. H., & Flanagan, D. P. (2001). What does the Cognitive Assessment System (CAS) measure? Joint confirmatory factor analysis of the CAS and the Woodcock-Johnson Tests of Cognitive Ability (3rd edition). *School Psychology Review*, *30*(1), 89–119.

Kendler, K. S., Turkheimer, E., Ohlsson, H., Sundquist, J., & Sundquist, K. (2015). Family environment and the malleability of cognitive ability: A Swedish national home-reared and adopted-away cosibling control study. *Proceedings of the National Academy of Sciences*, *112*(15), 4312–4617. https://doi.org/10.1073/pnas.1417106112

Kuncel, N. R., & Hezlett, S. A. (2010). Fact and fiction in cognitive ability testing for admissions and hiring decisions. *Current Directions in Psychological Science*, *19*(6), 339–345. https://doi.org/10.1177/0963721410389459

Kuncel, N. R., Hezlett, S. A., & Ones, D. S. (2004). Academic performance, career potential, creativity, and job performance: Can one construct predict them all? *Journal of Personality and Social Psychology*, *86*(1), 148–161. https://doi.org/10.1037/0022-3514.86.1.148

Lipsey, M. W., Farran, D. C., & Durkin, K. (2018). Effects of the Tennessee Prekindergarten Program on children's achievement and behavior through third grade. *Early Childhood Research Quarterly*, *45*, 155–176. https://doi.org/10.1016/j.ecresq.2018.03.005

Lubinski, D. (2000). Scientific and social significance of assessing individual differences: "Sinking shafts at a few critical points." *Annual Review of Psychology*, *51*, 405–444. https://doi.org/10.1146/annurev.psych.51.1.405

Marland, S. P., Jr. (1971). *Education of the gifted and talented—Volume I: Report to the Congress of the United States by the U.S. Commissioner of Education* (ERIC No. ED056243). Department of Health, Education, and Welfare. https://files.eric.ed.gov/fulltext/ED056243.pdf

Martschenko, D. (2019). DNA dreams': Teacher perspectives on the role and relevance of genetics for education. *Research in Education*. Advance online publication. https://doi.org/10.1177/0034523719869956

McCoach, D. B., & Siegle, D. (2007). What predicts teachers' attitudes toward the gifted? *Gifted Child Quarterly*, *51*(3), 246–255. https://doi.org/10.1177/0016986207302719

Morelock, M. J. (1996). On the nature of giftedness and talent: Imposing order on chaos. *Roeper Review*, *19*(1), 4–12. https://doi.org/10.1080/02783199609553774

Neisser, U., Boodoo, G., Bouchard, T. J., Boykin, A. W., Brody, N., Ceci, S. J., . . . Urbina, S. (1996). Intelligence: Knowns and unknowns. *American Psychologist*, *51*(2), 77–101. https://doi.org/10.1037/0003-066X.51.2.77

Nisbett, R. E., Aronson, J., Blair, C., Dickens, W., Flynn, J., Halpern, D. F., & Turkheimer, E. (2012). Intelligence: New findings and theoretical developments. *American Psychologist*, *67*(2), 130–159. https://doi.org/10.1037/a0026699

Pesta, B. J., McDaniel, M. A., Poznanski, P. J., & DeGroot, T. (2015). Discounting IQ's relevance to organizational behavior: The "somebody else's problem" in management education. *Open Differential Psychology*, *35*, 1–11. https://doi.org/10.26775/ODP.2015.05.26

Peters, S. J., Matthews, M. S., McBee, M. T., & McCoach, D. B. (2014). *Beyond gifted education: Designing and implementing advanced academic programs*. Prufrock Press.

Plomin, R. (2018). *Blueprint: How DNA makes us who we are*. MIT Press.

Protzko, J. (2017). Raising IQ among school-aged children: Five meta-analyses and a review of randomized controlled trials. *Developmental Review*, *46*, 81–101. https://doi.org/10.1016/j.dr.2017.05.001

Pyryt, M. C. (2000). Finding "g": Easy viewing through higher order factor analysis. *Gifted Child Quarterly*, *44*(3), 190–192. https://doi.org/10.1177/001698620004400305

Reeve, C. L., & Charles, J. E. (2008). Survey of opinions on the primacy of g and social consequences of ability testing: A comparison of expert and non-expert views. *Intelligence*, *36*(6), 681–688. https://doi.org/10.1016/j.intell.2008.03.007

Renzulli, J. S. (1978). What makes giftedness? Reexamining a definition. *Phi Delta Kappan*, *60*(3), 180–184, 261. https://doi.org/10.1177/003172171109200821

Rindermann, H., Becker, D., & Coyle, T. R. (2016). Survey of expert opinion on intelligence: Causes of international differences in cognitive ability tests. *Frontiers in Psychology, 7*, Article 399. https://doi.org/10.3389/fpsyg.2016.00399

Rindermann, H., Becker, D., & Coyle, T. R. (2017). Survey of expert opinion on intelligence: The FLynn effect and the future of intelligence. *Personality and Individual Differences*, *106*, 242–247. https://doi.org/10.1016/j.paid.2016.10.061

Rindermann, H., Becker, D., & Coyle, T. R. (2020). Survey of expert opinion on intelligence: Intelligence research, experts' background, controversial issues, and the media. *Intelligence, 78*, Article 101406. https://doi.org/10.1016/j.intell.2019.101406

Ritchie, S. (2015). *Intelligence: All that matters*. John Murray Learning.

Ritchie, S. J., & Tucker-Drob, E. M. (2018). How much does education improve intelligence? A meta-analysis. *Psychological Science*, *29*(8), 1358–1369. https://doi.org/10.1177/0956797618774253

Robertson, S. G., Pfeiffer, S. I., & Taylor, N. (2011). Serving the gifted: A national survey of school psychologists. *Psychology in the Schools*, *48*(8), 786–799. https://doi.org/10.1002/pits.20590

Robinson, N. M. (2006). A report card on the state of research in the field of gifted education. *Gifted Child Quarterly*, *50*(4), 342–345. https://doi.org/10.1177/001698620605000407

Sala, G., & Gobet, F. (2017). When the music's over. Does music skill transfer to children's and young adolescents' cognitive and academic skills? A meta-analysis. *Educational Research Review*, *20*, 55–67. https://doi.org/10.1016/j.edurev.2016.11.005

Schmidt, F. L., & Hunter, J. E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychological Bulletin*, *124*(2), 262–274. https://doi.org/10.1037/0033-2909.124.2.262

Schroth, S. T., & Helfer, J. A. (2009). Practitioners' conceptions of academic talent and giftedness: Essential factors in deciding classroom and school composition. *Journal of Advanced Academics*, *20*(3), 384–403. https://doi.org/10.1177/1932202X0902000302

Siegle, D., Wilson, H. E., & Little, C. A. (2013). A sample of gifted and talented educators' attitudes about academic acceleration. *Journal of Advanced Academics*, *24*(1), 27–51. https://doi.org/10.1177/1932202x12472491

Simons, D. J., Boot, W. R., Charness, N., Gathercole, S. E., Chabris, C. F., Hambrick, D. Z., & Stine-Morrow, E. A. L. (2016). Do "brain-training" programs work? *Psychological Science in the Public Interest*, *17*(3), 103–186. https://doi.org/10.1177/1529100616661983

Snyderman, M., & Rothman, S. (1987). Survey of expert opinion on intelligence and aptitude testing. *American Psychologist*, *42*(2), 137–144. https://doi.org/10.1037/0003-066x.42.2.137

Snyderman, M., & Rothman, S. (1988). *The IQ controversy: The media and public policy*. Transaction Books.

Spearman, C. (1904). "General intelligence," objectively determined and measured. *American Journal of Psychology*, *15*(2), 201–293. https://doi.org/10.2307/1412107

Stauffer, J. M., Ree, M. J., & Carretta, T. R. (1996). Cognitive-components tests are not much more than *g*: An extension of Kyllonen's analyses. *The Journal of General Psychology*, *123*(3), 193–205. https://doi.org/10.1080/00221309.1996.9921272

Sternberg, R. J. (2017). ACCEL: A new model for identifying the gifted. *Roeper Review*, *39*(3), 152–169. https://doi.org/10.1080/02783193.2017.1318658

Terman, L. M. (1916). *The measurement of intelligence: An explanation of and a complete guide for the use of the Stanford revision and extension of the Binet-Simon Intelligence Scale*. Houghton Mifflin.

Terman, L. M. (1926). *Genetic studies of genius: Vol. I. Mental and physical traits of a thousand gifted children* (2nd ed.). Stanford University Press.

Thompson, L. A., & Oehlert, J. (2010). The etiology of giftedness. *Learning and Individual Differences*, *20*(4), 298–307. https://doi.org/10.1016/j.lindif.2009.11.004

Tomlinson, C. A., Coleman, M. R., Allan, S., Udall, A., & Landrum, M. (1996). Interface between gifted education and general education: Toward communication, cooperation and collaboration. *Gifted Child Quarterly*, *40*(3), 165–171. https://doi.org/10.1177/001698629604000308

U.S. Census Bureau. (2019, February 21). *Educational attainment in the United States*. https://www.census.gov/data/tables/2018/demo/education-attainment/cps-detailed-tables.html

U.S. Department of Health and Human Services. (2012). *Third grade follow-up to the Head Start impact study. Final report* (OPRE Report 2012-45). https://www.acf.hhs.gov/sites/default/files/opre/head_start_report.pdf

Vockell, E. L., & Conard, F. (1992). Sources of information in gifted education literature. *Gifted Child Quarterly*, *36*(1), 17–18. https://doi.org/10.1177/001698629203600104

von Károlyi, C., Ramos-Ford, V., & Gardner, H. (2003). Multiple intelligences: A perspective on giftedness. In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (pp. 100–112). Allyn & Bacon.

Walker, S. O., & Plomin, R. (2005). The nature–nurture question: Teachers' perceptions of how genes and the environment influence educationally relevant behaviour. *Educational Psychology*, *25*(5), 509–516. https://doi.org/10.1080/01443410500046697

Warne, R. T. (2016a). Five reasons to put the *g* back into giftedness: An argument for applying the Cattell–Horn–Carroll theory of intelligence to gifted education research and practice. *Gifted Child Quarterly*, *60*(1), 3–15. https://doi.org/10.1177/0016986215605360
Warne, R. T. (2016b). Testing Spearman's hypothesis with advanced placement examination data. *Intelligence*, *57*, 87–95. https://doi.org/10.1016/j.intell.2016.05.002
Warne, R. T., Astle, M. C., & Hill, J. C. (2018). What do undergraduates learn about human intelligence? An analysis of introductory psychology textbooks. *Archives of Scientific Psychology*, *6*(1), 32–50. https://doi.org/10.1037/arc0000038
Warne, R. T., & Burningham, C. (2019). Spearman's *g* found in 31 non-Western nations: Strong evidence that *g* is a universal phenomenon. *Psychological Bulletin*, *145*(3), 237–272. https://doi.org/10.1037/bul0000184
Warne, R. T. (in press). *In the know: Debunking 35 myths about human intelligence*. Cambridge University Press.
Waterhouse, L. (2006). Multiple intelligences, the Mozart effect, and emotional intelligence: A critical review. *Educational Psychologist*, *41*(4), 207–225. https://doi.org/10.1207/s15326985ep4104_1
Wolf, T. H. (1973). *Alfred Binet*. The University of Chicago Press.
Zaboski, B. A., II, Kranzler, J. H., & Gage, N. A. (2018). Meta-analysis of the relationship between academic achievement and broad abilities of the Cattell-horn-Carroll theory. *Journal of School Psychology*, *71*, 42–56. https://doi.org/10.1016/j.jsp.2018.10.001

Author Biographies

Russell T. Warne, PhD, is an associate professor of psychology at Utah Valley University. He is the author of the upcoming book *In the Know: Debunking 35 Myths About Human Intelligence* (due to be published in 2020 by Cambridge University Press).

Jared Z. Burton, BA, currently works as a research technician associate in the Hyde Lab at the University of Michigan. His interests are in neuroscience and biological psychology. This is his second article published in a peer-reviewed scholarly journal.