

Beliefs about Human Intelligence in a Sample of Teachers and Non-Teachers

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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. A preprint of this article is available at <https://psyarxiv.com/uctxp>.

Beliefs about Human Intelligence from a Sample of Teachers and Non-Teachers

One of the best predictors of academic performance is a child's level of general intelligence (e.g., Cucina, Peyton, Su, & Byle, 2016; Deary, Strand, Smith, & Fernandes, 2007; Zaboski, Kranzler, & Gage, 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 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 high 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, p. 8) 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" (Morelock, 1996, p. 8). Another team of scholars

(von Károlyi, Ramos-Ford & Gardner, 2003) defined giftedness as high developed ability in any of Howard Gardner's multiple intelligences—a theory which 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 non-intelligence 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 62.0% 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, Matthews, McBee, & McCoach, 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; Zaboski et al., 2018; Warne, 2016a). 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 forms a general intellectual ability (Jensen, 1998) that is stable across test batteries (Floyd, Reynolds, Farmer, & Kranzler, 2013; Johnson, Bouchard, Krueger, McGue, & Gottesman, 2004; Johnson, te Nijenhuis, & Bouchard, 2008; Keith, Kranzler, & Flanagan, 2001; Stauffer, Ree, & Carretta, 1996), the life span (Deary, Whiteman, Starr, Whalley, & Fox, 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), regardless of the population that a student belongs to—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, Deary, & Gottfredson, 2007) and criminal behavior (Beaver et al., 2013).

While 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 intelligence and other broad abilities working together (Canivez, 2016). The relative merits of these models is beyond the scope of this paper, 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, 2016b).

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, Astle, & Hill, 2018). A similar survey of organizational behavior textbooks showed that intelligence was neglected (Pesta, McDaniel, Poznanski, & DeGroot, 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. All of 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 acknowledged the academic aptitude of intellectually gifted students, but also believed that these students had more mental health problems than non-gifted students, a common incorrect belief about the gifted (Deary et al., 2004; Gale, Batty, Tynelius, Deary, & Rasmussen, 2010). Heyder, Bergold, and Steinmayr (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 knowledge about giftedness in school psychologists (Robertson, Pfeiffer, & Taylor, 2011) and teachers (Schroth & Helfer, 2009; Siegle, Wilson, & Little, 2013).

Though 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. While surveys of experts on intelligence theory are available (Snyderman & Rothman, 1987, 1988; Rindermann, Becker, & Coyle, 2016, 2017, 2020), 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. A lack of understanding, for example, 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, VanTassel-Baska, Coleman, & Cross, 2010; Robinson, 2006; Tomlinson, Coleman, Allan, Udall, & Landrum, 1996; Vockell & Conard, 1992), we believe that there is value in understanding the viewpoints of our respondents in regards to intelligence would also help connect gifted education to other fields of research.

Methods

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; Crosswait & Asbury, 2019; Goslin, 1967; Walker & Plomin, 2005), we chose to investigate the different aspects of intelligence broadly, with question blocks focused on (1) the existence of intelligence, (2) important components of intelligence, (3) biological and genetic influences, (4) education, (5) environmental interventions, and (6) group differences. Both teachers and the general public received the same questions.

A convenience sample ($n = 551$; 338 females, 212 males, and 1 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 publically 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 US ($n = 200$) and non-teachers ($n = 351$). 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 \$0-3.

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 pre-existing surveys related to topics on intelligence (Antonelli-Ponti, Versuit, & Da Silva, 2018; Crosswaite & Asbury, 2019; Goslin, 1967; Heyder et al., 2018; Jones, Rakes, & Landon, 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 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 items and the top two categories of the Likert 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 non-experts. 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 pre-requisite for creative work and that highly intelligent people learn information better and more quickly (Kuncel, Hezlett, & Ones, 2004). However, this theoretical chain of causality is too complex to describe in a brief survey item. Additionally, we recognize that experts draw an important distinction between “IQ” and

“intelligence” (e.g., Haier, 2017). However, non-experts do not (Jensen, 1998), and we sometimes used the terms interchangeably in order 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 pre-testing of the items by circulating drafts of the survey among eight individuals who were non-psychologists, including two K-12 teachers (all undergraduate students or acquaintances of the first author, none of whom had any expertise in intelligence or giftedness). Some pre-testing subjects explained their interpretation of the test items, while others took 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 in order 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 pre-test 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: (1) existence of intelligence, (2) components of intelligence, (3) biology of intelligence and life outcomes, (4) education and intelligence, (5) interventions to permanently raise IQ, (6) group differences, and (7) 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 components 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 non-teachers (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, in order to compare scores between the teacher and non-teacher 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 non-teachers, $\chi^2 = 30.03$, $p < .001$), to have taken a psychology course in college (83.0% of teachers and 36.0% of non-teachers, $\chi^2 = 113.47$, $p < .001$), to be White (95.5% of teachers and 89.5% of non-teachers, $\chi^2 = 6.08$, $p = .016$), and to be better educated (97.0% of teachers and 34.5% of non-teachers 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 to a general sample of Americans.

INSERT TABLE 1 ABOUT HERE.

Respondent Viewpoints and Accuracy

While some survey items are not discussed here, all descriptive statistics for all items are available from the supplemental files. Additionally, our data and materials are available to download at <https://osf.io/pa7rt/>. 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 non-teachers).

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.

INSERT TABLE 2 ABOUT HERE.

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

- “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.

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 non-teachers and teachers. This is consistent with past surveys of educational professionals’ beliefs about multiple intelligences (e.g., Schroth & Helfer, 2009).

INSERT TABLE 3 ABOUT HERE.

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).

INSERT FIGURES 1 & 2 ABOUT HERE.

One consistent trend we noticed in the survey data was a great confidence among our respondents in the impact of interventions to raise IQ. This was most clearly seen in the intervention section of the survey, where the perceived mean IQ boost from 20 different interventions ranged from 4.67 to 11.22 IQ points for non-teachers 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 non-teachers, we did notice 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 non-teachers. Details about these findings are shown in Tables S1-S7.

Discussion

General Interpretation of Results

The results of our survey about teachers' and the general public's views of intelligence show that empirically unsupported viewpoints are very common. Among the entire sample, 33.9% of teachers' responses and 29.4% of non-teachers' responses were empirically supported (using the information in 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.

Our results are largely in line with the prior surveys of non-experts 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) and 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 (in press) 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 non-teachers (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 Table S3). Similarly, only 12.5% of teachers and 25.1% of non-teachers (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. Though 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, Perez, & Gilar, 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 33.0% 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, Peyre, Le Cam, Gauthier, & Ramus, 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; and 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 are widespread. For non-experts, this is unsurprising because it is not realistic for them to be aware of the research in an interdisciplinary scholarly field. The results in the teacher sub-sample, 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 regards 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 non-teachers and teachers in our convenience sample were fairly noticeable. While 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 non-teacher did. Yet, an unplanned *ad hoc* correlation of the item averages in this section for teachers and non-teachers ($r = .883$) 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 non-teachers 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 Table S8). These are:

- 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, Turkheimer, Ohlsson, Sundquist, & Sundquist, 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 have either no known causal impact on IQ or are known to have zero impact on IQ in randomized control studies (see 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, Farran, & Durkin, 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 non-expert 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 non-gifted 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 non-teachers 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 other hand, 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, in press). 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 non-generalizable 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. Additionally, neither group is representative of their respective population, and the results we have may be statistically biased by an unknown amount. 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 towards egalitarian views—as providing a useful overall picture of non-experts’ 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. Therefore, 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 deductions 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 non-experts' unfamiliarity with the IQ scale. While this is possible, we do not find it plausible. The background information (provided in Table S5) is highly detailed and includes a normal distribution so that respondents understand what typical IQ differences in the population are. Additionally, 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. We interpret this to mean that both groups are generally unaware of many of the empirically supported findings from intelligence research. 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 in order 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 (2016b) 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 non-professional 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.

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Table 1
Demographic Data for Survey Sample

	Full Sample (<i>n</i> = 551)	Non-Teacher (<i>n</i> = 351)	Teacher (<i>n</i> = 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			
Mean	46.35	50.01	39.94
Standard Deviation	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%)

Table 2

Survey items with high respondent consensus

Likert Item	Teachers			Non-Teachers			Full Sample			Mean	SD	Cohen's <i>d</i>
	Disagree	Uncertain /Neutral	Agree	Disagree	Uncertain /Neutral	Agree	Disagree	Uncertain /Neutral	Agree			
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	5.5%	18.0%	76.5%	5.7%	20.8%	73.5%	5.6%	19.8%	74.6%	3.96	0.88	0.09

in IQ

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 Table S8 for references regarding each item.

Note. Positive Cohen's d values indicate that teachers endorsed the item more highly than non-teachers

Table 3

Survey items with low respondent consensus

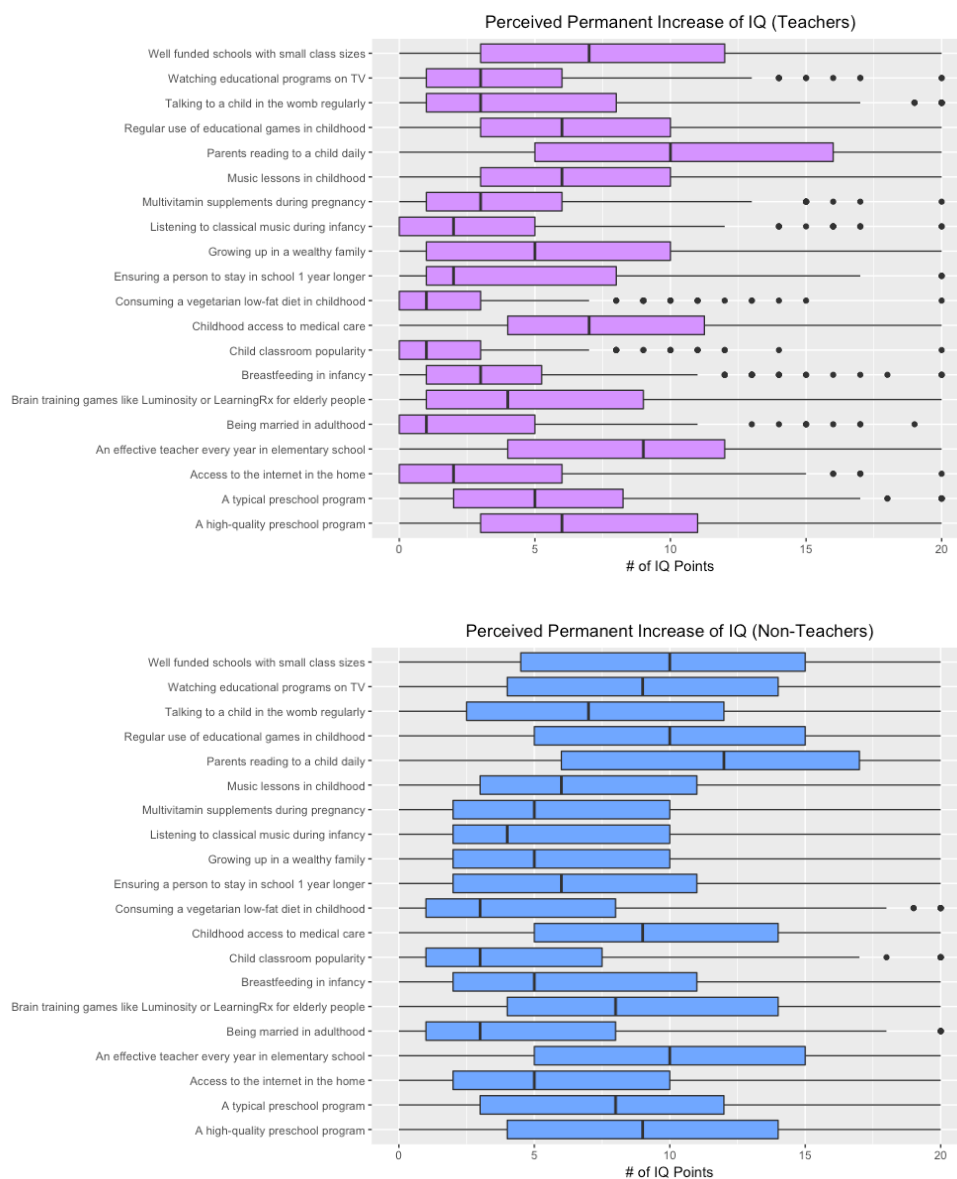
Likert Item	Teachers			Non-Teachers			Full Sample			Mean	SD	Cohen's <i>d</i>
	Disagree	Uncertain /Neutral	Agree	Disagree	Uncertain /Neutral	Agree	Disagree	Uncertain /Neutral	Agree			
Individuals with a higher IQ score are generally healthier	30.5%	39.0%	30.5%	29.6%	42.2%	28.2%	29.9%	41.0%	29.0%	2.97	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

BELIEFS ABOUT HUMAN INTELLIGENCE

4

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. Positive Cohen's *d* values indicate that teachers endorsed the item more highly than non-teachers



Figures 1 & 2. Box plots displaying the number of IQ points that sample members believed each stated intervention would permanently raise IQ.