


# Similarities and Differences Between Intellectually Gifted and Average-Ability Students in School Performance, Motivation, and Subjective Well-Being

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## Abstract

Terman's study was the first to systematically document the lives of the intellectually gifted. This cross-sectional study replicates and extends some of Terman's findings on characteristics of the gifted in childhood, comparing largely unselected samples of gifted ( $n = 50$ ) and average-ability ( $n = 50$ ) adolescents matched by means of propensity score matching. Students were compared on their school performance (standardized math and reading tests and grades), motivation (math ability self-concept, intrinsic motivation, vocational interests, and educational aspirations), parental educational expectations, students' evaluation of school instruction (perceived quality and pressure), and subjective well-being. The gifted scored higher on math performance (rank-biserial  $r = .66/.81$ ), math ability self-concept (.71), intrinsic motivation (.62), and investigative vocational interests (.65). Some smaller differences were found for realistic (.42) and social interests (–.37) and for pressure in math lessons (–.52). Results support Terman's findings on gifted individuals' psychological functioning and contradict negative stereotypes about the gifted.

## Keywords

giftedness, ability self-concept, vocational interests, academic achievement

For as long as people have thought of intellectually gifted individuals, the “mad genius” stereotype has been present, originally linking giftedness with deficits in areas such as mental health, personality, or physique (Becker, 1978). Elements of the “mad genius” stereotype (e.g., social-emotional problems caused by giftedness) continue to operate under the term *disharmony hypothesis* (e.g., Baudson, 2016; Neihart, 1999). In fact, negative stereotypic representations of the gifted are still prevalent in the media, in the public, and among teachers as well (Baudson, 2016; Matheis et al., 2017; O'Connor, 2012).

Lewis Terman was the first to systematically scrutinize the validity of the disharmony hypothesis when he launched his seminal *Genetic Studies of Genius* in the early 1920s. In doing so, he hoped to dispel the negative stereotypic picture of gifted individuals that was prevalent (also) at that time (see also Jolly, 2008a, 2008b). Indeed, his study revealed support for the *harmony hypothesis* (Sternberg & Davidson, 2005), which proposes that gifted individuals are superior compared

to the general population regarding mental health or educational success (e.g., Terman & Oden, 1947).

Terman's work has inspired a large body of subsequent research. In the present study, we refer to the most relevant childhood variables investigated in Terman's study. Specifically, we reinvestigate the similarities and differences between intellectually gifted and average-ability students in school performance, motivational constructs (ability self-concept and intrinsic motivation in math, vocational interests, and future educational goals), and subjective well-being (SWB). The reasons for choosing these variables were twofold. First, they are cornerstones of students' lives and therefore important indicators of the (in)validity of the

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disharmony hypothesis. Second, negative stereotypes about the gifted often refer to these characteristics (e.g., Baudson, 2016; Matheis et al., 2017; Moon & Brighton, 2008; O'Connor, 2012). Moreover, we focus on two other areas that have, up until now, received much less attention although they might also contribute to students' SWB. These include students' perceptions of parental educational expectations and valuing of school, and students' perceptions of teaching quality and pressure during instruction.

### *Giftedness as High General Intelligence*

There are many different ways to define giftedness (see Sternberg & Davidson, 2005). Terman (1925) defined giftedness as high intelligence as measured by IQ. Doing so still yields several theoretical, operational, and practical benefits today (e.g., Robinson, 2005; Rost, 2009; Warne, 2016). For example, intelligence is one of the most often studied and best understood constructs in psychology; during elementary school ages, it becomes very stable so that long-term prognoses of many important life outcomes become possible; there are many well-constructed, reliable, and well-validated tests to assess intelligence; and knowledge about inter-individual differences in intelligence and its subordinate factors can help implement differentiation practices and find the right approach for intervention.

These advantages of course do not mean that the reliance on intelligence is perfect. This is especially true when coming from a talent development perspective (e.g., Lubinski, 2016; Lubinski & Benbow, 2020; Subotnik et al., 2011; Terman, 1954; see also Warne, 2016). For example, the *g* factor alone might be too broad to predict differential developmental pathways of gifted individuals, to correctly nominate students for certain gifted programs or interventions, or to effectively nurture more specific talents. However, the present study does not focus on talent development but on characteristics of the gifted in general (i.e., irrespective of intra-individual specific strengths and weaknesses). Therefore, the reliance on intelligence in the present study with all its advantages appears well justified to us, while the caveats with this approach must of course not be forgotten.

### *“Genetic Studies of Genius”*

The interest in Terman's *Genetic Studies of Genius* has not diminished over time (Hodges et al., 2020, this issue). This might be because his study was groundbreaking at the time of its publication. It was the first large longitudinal study in psychology, and remains one of the longest psychological longitudinal studies ever conducted (e.g., Warne, 2019). Terman's main purposes were twofold. The first aim was to describe the development of

gifted individuals. The second aim was to support his belief that gifted individuals would not exhibit especially negative characteristics or problems (e.g., Burks et al., 1930; Terman, 1925; Terman & Oden, 1947; see also Warne, 2019). To this end, he and his colleagues collected a multitude of data, including school performance, life satisfaction, personality, achievement motivation, interests, social skills, social integration, mental health, and physical constitution, from about 1,500 gifted Californian students with an IQ  $\geq 140$  (although some students with an IQ  $\geq 135$  were admitted to the study). When investigating characteristics of the gifted, Terman compared their data with norm samples, official statistics, or with convenient samples of average-ability children (Subotnik & Arnold, 1994; Terman & Oden, 1947).

He found that the gifted children were more successful in school and regarding their educational career. For example, more than 70% of the gifted men and 67% of the gifted women achieved a university degree (Terman & Oden, 1947). The gifted group was also highly motivated toward achievement and physically and mentally well-adjusted (e.g., regarding nutrition or personality; Terman & Oden, 1947). Gifted children were found to read more books (with more varied topics) and to spend more time in reading than other children (Terman, 1925; see also Jolly, 2008b). They were also more interested in activities and school subjects that require abstract thinking, and were quieter (Burks et al., 1930). Results remained essentially the same in later stages of life. The gifted reported, on average, “outstanding health, social adjustment, freedom from delinquency and mental illness, educational attainment, and vocational achievement” (Subotnik & Arnold, 1994, p. 6). At the same time, Terman and Oden (1947) also noted that most, but not all participants excelled in their jobs but lived quite “normal” lives. Women especially had difficulties in exhibiting outstanding vocational achievement, due to societal barriers at that time (see also Warne, 2019).

### *Methodological Criticism of Terman's Study*

As pioneering as his research was, Terman's work was also faced with some criticism (see, e.g., Freeman, 2006; Subotnik & Arnold, 1994), although most of these critiques must be put into perspective (see Warne, 2019). One of these critiques related to the fact that most of the gifted participants were Caucasian, male, and stemmed from households with an above-average socioeconomic status (SES; Jolly, 2008b; Subotnik & Arnold, 1994). Although Terman had also included a nonverbal intelligence test, some critics felt that verbal abilities had still been overemphasized in the diagnostic process (see Subotnik & Arnold, 1994), working to the disadvantage of children with an immigrant background or who

were coming from underprivileged homes. Therefore, Terman's findings might have painted too positive a picture of gifted individuals' lives, neglecting more troubled ones growing up under more precarious conditions. However, Warne (2019) noted that Terman's sample composition was not notably biased, as the population of California at that time was mostly Caucasian, and the overrepresentation of middle- and upper-class families was expected given the positive correlation between intelligence and SES. The same is true for the overrepresentation of males, given males' larger variability in intelligence (e.g., Johnson et al., 2008; Warne, 2019).

Another critique was that the gifted were sometimes compared with norm samples or official statistics, which might be problematic because norm samples and statistics might not be comparable with regard to a variety of background variables, and because the variance in norm samples is often markedly larger than the variance in gifted samples (e.g., Freund-Braier, 2009; Olszewski-Kubilius et al., 1988). In some cases, comparisons with a group of average-ability individuals were made. Yet these groups were taken from previous studies and were not explicitly matched on potential confounds, possibly leading to distorted findings (Freeman, 2006). It should be noted, however, that Terman did not intend to compare gifted and nongifted individuals when he planned his study. Instead, he aimed to describe characteristics of the gifted and their developmental trajectories (Warne, 2019).

Many criticisms of Terman's work must be qualified. Nevertheless, there are some points which pose a stronger threat to the significance of Terman's findings (Warne, 2019; Warne & Liu, 2017). One of these points is that Terman "meddled in his subjects' lives. He wrote letters of recommendation, pulled strings to get them admitted to college [ . . . ], and gave [them] vocational and education advice" (Warne, 2019, p. 10). Other points became limitations only as time went by: Terman's participants were born in the beginning of the 20th century and grew up under conditions that differ from present life circumstances. Cohort effects thus threaten the generalizability of Terman's data to today's conditions. Furthermore, some assessments, although up to date then, are considered deficient following today's methodological standards. Altogether, these limitations warrant further contemporary research on characteristics of the gifted.

### *Subsequent Research on Characteristics of the Intellectually Gifted*

Terman's work was the starting point for a large body of subsequent systematic research on the characteristics of the gifted including other longitudinal studies (see, e.g., Lubinski, 2016; Lubinski & Benbow, 2020;

Subotnik & Arnold, 1994). For example, in Project Talent (Flanagan et al., 1962) more than 400,000 students were assessed, inter alia, on their academic abilities, interests, personality, and health, and reassessed several years after high school graduation. The Study of Mathematically Precocious Youth launched in 1971 was directly inspired by Terman's work (Stanley, 1996; Warne, 2019). Meanwhile five cohorts of more than 5,000 gifted students have been tracked (e.g., Lubinski, 2016; Lubinski & Benbow, 2006, 2020).

Similar to the Terman study, both Project Talent and the Study of Mathematically Precocious Youth do not focus on explicit comparisons between gifted and nongifted individuals. Although interesting, this approach does not allow one to determine any differences between the gifted and the nongifted or to decide whether any identified characteristics are in fact specific to the gifted. The Marburg Giftedness Project (Rost, 1993), a German longitudinal study, has tracked 151 gifted and 136 parallel average-ability students since third grade in 1987/1988 to the present day (see also Wirthwein & Rost, 2011). The study focuses on noncognitive variables including SWB, personality, motivational constructs, social behavior, social integration, and family characteristics.

Apart from these longitudinal studies, there are also cross-sectional studies directly comparing gifted and non-identified individuals on a variety of variables. In the following, we review the research on the variables we focus on in the current study, namely school performance, motivational constructs, parents' educational expectations, students' evaluation of school instruction, and SWB.

**School Performance.** General intelligence ( $g$ ) is the ability to reason logically, to learn quickly and efficiently, and to solve complex problems (e.g., Gottfredson, 1997; Neisser et al., 1996). As such, it should facilitate successful work on academic tasks. Empirical research has indeed established a strong relation between  $g$  and academic achievement. The associations between  $g$  and the performance on standardized academic achievement tests often approach  $r \approx .80$ , especially when regarding achievement in math and when modeled at the latent level (e.g., Deary et al., 2007; Frey & Detterman, 2004; Kaufman et al., 2012). Since grades, by contrast, are not pure performance indicators, the associations of  $g$  with grades are smaller but still substantial. Again, the strongest relations are usually found with math grades ( $r \approx .50$ ), whereas relationships with grades in other subjects such as languages or social sciences are on average  $r \approx .40$  (Roth et al., 2015).

Accordingly, previous studies have found that gifted students outperform average-ability students in school in terms of standardized test performance, grades, and finally also in educational attainment, especially in the

STEM (science, technology, engineering, and mathematics) domains (e.g., Lubinski, 2016; Rost, 2009; Roznowski et al., 2000; Wirthwein et al., 2019).

**Motivation.** One motivational construct substantially related to school performance is ability self-concept. Ability self-concepts represent the beliefs about one's own ability in a certain domain (e.g., in a certain school subject). Since school performance (especially grades) influences ability self-concept formation (e.g., Marsh et al., 2005; Weidinger et al., 2018), gifted students should have higher ability self-concepts than average-ability students, especially in the STEM domains. Previous research has confirmed this hypothesis (e.g., Wirthwein et al., 2019; Zeidner & Shani-Zinovich, 2015; see also Hoge & Renzulli, 1993; Litster & Roberts, 2011, for meta-analyses).

Another motivational construct related to achievement is intrinsic motivation, which is often operationalized as a composite of interest in a task and joy when working on this task (e.g., Ryan & Deci, 2000). Since the gifted have higher cognitive abilities, they should have higher intrinsic motivation for cognitively challenging tasks (Schick & Phillipson, 2009). Previous studies have indeed revealed higher intrinsic motivation or interest of the gifted, again especially in STEM domains (e.g., Gottfried & Gottfried, 1996; Preckel et al., 2008; Wirthwein et al., 2019).

Vocational interests might be seen as a special case of intrinsic motivation. Vocational interests have been elaborated in the RIASEC (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional) model by Holland (1997). In this model, persons and environments can be more or less realistic (R; working with objects and machines; working outdoors), investigative (I; mental, scientific work), artistic (A; creative work), social (S; working with people), enterprising (E; working in a leadership; economics), and conventional (C; working with well-structured materials). Holland (1997) proposed that individuals seek vocational environments that fit best to their abilities. He therefore concluded that investigative individuals should be most intellectual and interested in science. Sparfeldt (2007) used unselected samples of gifted and average-ability students from the Marburg Giftedness Project. Drawing on the RIASEC model, he found that—irrespective of gender—the gifted adolescents had higher investigative ( $d = 0.43$ ), realistic ( $d = 0.36$ ) and lower social ( $d = -0.57$ ) and enterprising ( $d = -0.40$ ) interests than the average-ability adolescents coming from the same (academic) school track. A study by Vock et al. (2013) revealed similar results.

One might also assume that gifted individuals have higher educational aspirations, due to their higher academic achievement. However, there is surprisingly little

research focusing on the educational aspirations of gifted students, and existing studies frequently focus on the gifted group without referring to a comparison group (Mendez & Crawford, 2002). Roznowski et al. (2000) investigated a large sample of high-school students with various ability levels. The gifted students reported higher educational goals and expectations than did the nongifted. Research focusing on more external criteria such as income or job prestige found that gifted individuals were more successful than nongifted (e.g., Rinn & Bishop, 2015).

**Parents' Educational Expectations and Parental Values.** Parents' school involvement and its impact on educational success have frequently been investigated (Benner et al., 2016). Parental educational expectations have been found to be an important predictor of adolescents' educational choices and success (e.g., Lazarides et al., 2016). However, parents' educational expectations and values as perceived by their intellectually gifted children have received less attention, although there is some speculation that the gifted might be faced with unrealistically high expectations by their parents, hampering their social-emotional development (e.g., Peterson, 2009).

Schilling et al. (2006) investigated adolescents and their parents within the Marburg Giftedness Project regarding different family characteristics, including achievement orientation (e.g., importance within the family of striving for performance). Compared with families of average-ability adolescents, no significant differences were found from the perspectives of the adolescents, their mothers, or their fathers. However, parents of gifted children more often expected their children to obtain a university (38% vs. 22%) or a doctoral degree (13% vs. 4%; Tettenborn, 1996). Campbell and Mandel (1990) compared students from gifted and regular classes regarding parental involvement in math achievement (parental pressure, parental support, parental help, etc.). Descriptively, these gifted students reported somewhat lower parental pressure ( $d \approx -0.38$ , own calculation) but also less parental help ( $d \approx -0.26$ ). To our knowledge, there are no other studies comparing perceived parental expectations and values comparing gifted and average-ability individuals.

**Perceptions of Teaching Quality and Instruction.** Evaluating students' perceptions of teaching quality (e.g., teachers' explanation of the teaching material, teachers' advice how to learn school material best) is important in the context of teaching effectiveness and shows substantial associations with educational outcomes such as academic achievement (Scherer et al., 2016). As higher levels of cognitive ability are beneficial for learning and understanding new information quickly and efficiently (e.g., Cattell, 1987), one might hypothesize that the gifted

rate teaching quality higher than do the nongifted. For the same reason, one might also assume that the gifted perceive less pressure during instruction.

Although there have been several studies focusing on the relevance of specific instructional practices for the gifted (e.g., Hockett, 2009; VanTassel-Baska, 2003), there is a lack of studies asking the gifted themselves how they evaluate instruction and teaching quality. However, some studies have focused on the subjective evaluation of specific instructional programs for the gifted (e.g., Kitsantas et al., 2017). Chae and Gentry (2011; see also Gentry et al., 2002) found the gifted to perceive classroom quality to be higher than the nongifted with regard to challenge, meaningfulness, and choice. Focusing on gifted and nongifted students in biology classes, Rita and Martin-Dunlop (2011) found that the gifted students evaluated their learning environments as more positive than the nonidentified students with regard to, for example, teacher support, investigation, task orientation, and cooperation.

*Subjective Well-Being.* Some research on characteristics of the gifted has been devoted to SWB (Bergold et al., 2018; Zeidner, 2020). Although SWB has been defined in various ways, current research mainly focuses on life satisfaction and different affective components (such as joy, enthusiasm; see Diener, 2012). According to the disharmony hypothesis, giftedness is the cause of many social-emotional problems and, therefore, a risk factor for impaired SWB. In this view, being different from others, developmental asynchrony, exuberant perfectionism and sensitivity combined with unrealistic performance expectations and misfits between the needs of the gifted and their environment might cause higher stress levels, increasing the risk of developing low SWB (see Gallagher, 1990; Neihart, 1999, for review). On the other hand, according to the harmony hypothesis, the gifted should be at least as well-adjusted as average-ability individuals, because high intelligence should help them better cope with (or avoid) stress and problems in life, which should be supportive of SWB (Diener & Fujita, 1995).

Studies using comparison groups of average-ability students found either no or small differences ( $d < 0.25$ ) in favor of the gifted (e.g., Ash & Huebner, 1998; Shaunessy et al., 2006; see also Bergold et al., 2018, and Zeidner, 2020, for review). This is also true for studies in which the comparisons were made on the basis of explicitly matched samples instead of convenience comparison groups (Bergold et al., 2015; Wirthwein & Rost, 2011; Zeidner & Shani-Zinovich, 2011).

### *Aims of the Present Study and Hypotheses*

Terman pioneered the systematic empirical investigation of characteristics of the intellectually gifted to scrutinize

critically the disharmony hypothesis. His study was extraordinary and progressive and he found the first hints of positive development among intellectually gifted individuals, although his study also was flawed in having some methodological problems, and its generalizability to today's conditions is questionable. A substantial body of subsequent research has confirmed many of Terman's key findings. Yet many of these studies have suffered from methodological problems themselves. Samples of the gifted were often pre-selected or biased in some regard, stemming, for example, from special gifted classes or academic tracks only, receiving special education during the study, or having selected themselves for participation. Often, matched control groups of average-ability children were missing, too. In the present study, we investigate characteristics of intellectually gifted adolescents, drawing on unselected samples of gifted and average-ability students from homes with diverse socioeconomic and ethnic backgrounds who have been tested with a culturally fair intelligence test. To ensure comparability, we matched both groups on SES, immigration background, gender, and school environment.

As the gifted have higher cognitive abilities than the nongifted, we expect that (1) the gifted achieve better outcomes in school than the nongifted, especially in math. Due to their higher cognitive abilities, which should pay off in better performance especially in math, we expect that (2) the gifted have higher ability-related self-concept and intrinsic motivation in math than the nongifted. Based on both Holland's (1997) propositions and empirical findings on the relation between general intelligence and vocational interests, we expect that (3) the gifted report higher investigative and realistic and lower social and enterprising interests. We further anticipate that (4) there are no notable differences in artistic and conventional interests. Because of their higher academic achievement, we expect that (5) the gifted display higher educational aspirations than the nongifted. As there is a lack of study regarding perceived parental expectations and values we did not formulate specific hypotheses but inspected these data on an exploratory basis. Regarding perceived teaching quality, we assume that (6) gifted students evaluate their learning environment as more positive than do average-ability students (i.e., less pressure during instruction and higher teaching quality). Finally, we expect that (7) there is no notable difference between the gifted and the nongifted in SWB.

## **Method**

### *Participants*

This study draws on the secondary student data from the project FA(IR)BULOUS, a German research project on social inequality in school transitions (Steinmayr et al., 2017). Schools had been randomly chosen from an

Internet data base covering all schools in the Rhine-Ruhr area (except for special needs schools) in North Rhine-Westphalia, a federal state in Germany. However, the project focused especially on students from lower and middle-track schools (Hauptschule, Realschule, and Gesamtschule).<sup>1</sup> Thus, additional data from a further project investigating students from the academic track (Gymnasium) of the same age and using the same measures were also included. The data were collected between 2015 and 2016. Altogether, the sample comprised  $N = 2,100$  students ( $n = 1,032$  female,  $n = 1,063$  male,  $n = 5$  students did not indicate their gender) in 9th and 10th grade from 22 schools (mean age:  $M = 15.31$ ,  $SD = 0.74$ ; range: 13-18). Indeed, 229 students (10.9%) attended the Hauptschule, 669 (31.9%) the Realschule, 480 (22.9%) the Gesamtschule, and 722 (34.4%) the Gymnasium. Six students from the academic track were excluded as the study protocols indicated they had to leave during testing and thus their intelligence scores were not valid. However, 800 of the remaining students (38.2%) reported an immigrant background.<sup>2</sup>

Inspection of the valid students' intelligence test scores showed that the IQ values were roughly normally distributed. Skewness was  $-0.04$  (standard error [ $SE$ ] =  $0.53$ ) and kurtosis was  $0.14$  ( $SE = 0.11$ ), both being close to zero. Mean intelligence was  $M = 100.80$  IQ points ( $SD = 15.35$ ); 2.4% were gifted, 68.0% were in the average range, 15.6% had an IQ between 116 and 130, 11.9% had an IQ between 70 and 84, and 2.1% had an IQ < 70.

### Measures and Procedure

In the following, we provide a short overview of the measures. Detailed information on all measures and on the procedure can be found in the Supplementary Material (available online).

**General Intelligence.** We assessed  $g$  with the German short version of the revised Culture Fair Intelligence Test Scale 2 (Weiß, 2006).

**School Performance.** Mathematical skills were assessed with the Knowledge of Conventions and Rules test (KRW; Schmidt et al., 2012). Reading skills were assessed with the Reading Speed and Comprehension Test for Grades 6 to 12 (LGVT; Schneider et al., 2007). We also used grades from the last report cards. Grades ranged from 1 (*excellent performance*) to 6 (*insufficient performance*) and were recoded so that higher values indicated better achievement.

### Motivation

**Math ability self-concept.** We applied four modified items from the Scales for the Assessment of Academic Self-Concept (Schöne et al., 2012). Internal consistency was  $\alpha = .95$ .

**Intrinsic motivation in math.** We applied four items, one of which was taken from the intrinsic value subscale of the Scale for the Assessment of Subjective School-Related Task Values (Steinmayr & Spinath, 2010). The other three items were taken from the Programme for International Student Assessment (Prenzel et al., 2013). Internal consistency was  $\alpha = .93$ .

**Vocational interests.** We assessed students' vocational interests according to Holland's (1997) model, using the General Structure of Interests Tests (Bergmann & Eder, 1999). Internal consistencies ranged from  $\alpha = .83$  to  $\alpha = .88$ .

**Educational goals.** We asked the students, what are you going to do after leaving school? (1 = *go to work without occupational qualification*, 2 = *apprenticeship*, 3 = *study*).

**Parents' educational expectations and valuing of school.** We asked the students to share the extent to which their parents value achievement in school and how interested their parents are in school. Both questions were answered on a 5-point scale (1 = *very little*, 5 = *very great*).

The students also indicated their parents' educational expectations regarding school (1 = *very low*, 5 = *very high*) and occupational level (1 = *no occupational education*, 2 = *apprenticeship*, 3 = *university of applied sciences*, 4 = *university*, 5 = *doctorate*).

**Perceptions of teaching quality and instruction.** Students rated teaching quality on three items from the Linz Questionnaire for School and Class Climate for Grades 8 to 13 (Eder, 1998). Students also rated perceived pressure during math or German lessons on another three modified items from this instrument. Internal consistency was  $\alpha = .74$  (math) and  $\alpha = .70$  (German) for perceptions of teaching quality and  $\alpha = .79/.78$  for pressure during instruction. Students from one Hauptschule and from two Gymnasiums were not administered the items. Therefore, this information was available for 1,835 students.

**Subjective well-being.** We applied the Scale of Habitual Subjective Well-Being (Dalbert, 2003), measuring mood ( $\alpha = .82$ ) and life satisfaction ( $\alpha = .89$ ).

Students from one Hauptschule, one Realschule, and four Gymnasiums were not administered these items. Therefore, scores were available for 1,555 students.

## Analyses

**Propensity Score Matching.** We used propensity score matching (PSM; Rosenbaum & Rubin, 1983) to build comparable groups of gifted ( $IQ > 130$ ) and average-ability ( $85 \leq IQ \leq 115$ ) students. Simulation studies have shown that PSM is feasible and appropriate even for small samples (i.e.,  $\alpha$  errors are not substantially altered and biases of the estimated treatment effect remain relatively low; Holmes, 2013; Pirracchio et al., 2012).

To calculate the propensity scores, we performed a logistic regression analysis with giftedness (0 = average intelligence, 1 = gifted) as the dependent variable (method: inclusion). As predictors, we considered confounders which have been shown previously to be related to both giftedness and the dependent variables under study (i.e., “true” confounders; see Austin et al., 2007). This approach to PSM has been shown to lead to a strong balance between the groups and to allow for a relatively large number of cases being successfully matched while preventing over-parametrization (all of which is especially important in light of the small gifted sample at hand), leading to essentially unbiased estimates of the treatment effect (Austin et al., 2007).

**Considered covariates.** SES was indicated by parents’ highest educational level and number of books in the home. Educational level is considered as the broadest single proxy for SES (Sirin, 2005). We additionally considered number of books in the home as a proxy for parents’ cultural capital to achieve an even broader assessment of SES. On average, the intellectually gifted tend to come from above-average SES households (e.g., Rost, 2013). This was also true for the present sample,  $t(1,472) = 3.11$ ,  $p = .003$ ,  $d = 0.52$  (educational level),  $t(1,472) = 3.84$ ,  $p < .001$ ,  $d = 0.72$  (number of books). Importantly, previous research has documented differences in motivation, school performance, and parents’ educational aspirations related to SES (e.g., Ditton et al., 2005; Organization for Economic Cooperation and Development, 2016; Steinmayr et al., 2012; Stubbe et al., 2016). Therefore, we used SES as a covariate when computing the propensity scores.

Students with an *immigration background* were underrepresented among the gifted but not among the average-ability students,  $\chi^2(1) = 9.17$ ,  $p = .002$ ,  $\phi = -.08$  (immigrants:  $M_{IQ} = 96.58$ ; natives:  $M_{IQ} = 103.40$ ). This association between giftedness and migration background was mainly accounted for by differences in SES (note that SES itself is most likely not a fully

explanatory factor). In most countries (among them Germany), students with an immigrant background tend to do worse on standardized achievement tests, sometimes even after controlling for SES (Organization for Economic Cooperation and Development, 2016; Wendt & Schwippert, 2017). At the same time, these students tend to have a higher school-related motivation (in most subjects) and also higher educational aspirations (e.g., Shajek et al., 2006; Stanat et al., 2010). In Germany, most studies also found immigrant parents to have higher educational aspirations for their children than nonimmigrant parents (e.g., Ditton et al., 2005; Paulus & Blossfeld, 2007). Therefore, we also considered immigration background as a covariate.

In line with research on gender differences in intelligence variance (e.g., Johnson et al., 2008), there were more boys than girls in our gifted sample, whereas there were somewhat more girls than boys among the average-ability students,  $\chi^2(1) = 5.59$ ,  $p = .018$ ,  $\phi = -.06$ . Since there have been documented gender differences in school performance, motivational constructs, and SWB (e.g., Huebner & Diener, 2008; Sparfeldt, 2007; Steinmayr & Spinath, 2008; Voyer & Voyer, 2014), we also used *gender* as a covariate.

**Matching procedure.** After propensity score calculation, we used 1:1 nearest neighbor caliper matching without replacement. This procedure matched exactly one student of the average-ability group to a gifted student who had (at least approximately) the same propensity score (and once an average-ability student had been matched, he or she could not serve as another match; e.g., Morgan & Winship, 2015; Thoemmes & Kim, 2011). The maximum allowed propensity score discrepancy between the two units of a matched pair is the caliper. As recommended (e.g., Austin, 2009), the caliper width was set at  $c = .2$  standard deviations of the logit of the propensity score.

Nearest neighbor matching has the advantage that an exact matching can be performed. This was crucial for the present study because the gifted were more likely to attend an academic than a vocational track, whereas this pattern was less evident for the students of average intelligence,  $\chi^2(3) = 9.92$ ,  $p = .019$ ,  $\phi = .08$  (Gymnasium:  $M_{IQ} = 106.19$ ; Gesamtschule:  $M_{IQ} = 95.72$ ; Realschule:  $M_{IQ} = 102.10$ ; Hauptschule:  $M_{IQ} = 90.74$ ). The school types strongly differ in their demands on the students, possibly impacting on their motivation, educational aspirations, well-being, judgment of teaching quality, and so on (e.g., Sparfeldt, 2007). Furthermore, grades are not comparable across school types. Therefore, we performed an exact matching on school type. Additionally, some of the constructs under study might

not only be affected by school type but also by classroom characteristics. For example, ability self-concepts are known to be influenced by the classmates' abilities (e.g., Marsh et al., 2018). In the same vein, teachers tend to make social comparisons between the students of the same class when assigning grades (e.g., Südkamp & Möller, 2009). Relying on students from the same classroom should also be optimal when comparing objective school performance, because students' achievements rely, *inter alia*, on instructional quality (e.g., Lekwa et al., 2019). For the evaluation of instruction, too, it appears crucial that students whose evaluations are being compared actually judge the same lessons. Therefore, we additionally conducted another PSM with exact matching on students' classroom. As this method is quite strict, potentially leading to many lost cases (e.g., Morgan & Winship, 2015), we allowed for replacement of comparison group students to keep the number of matched cases as high as possible.

Afterward, we analyzed the degree to which multivariate and univariate balance of the covariates was achieved, that is, how closely related students' giftedness status was to the covariates and their combination. To inspect multivariate balance, we used the overall balance  $\chi^2$  test (Hansen & Bowers, 2008) and the  $L_1$  statistic (e.g., Iacus et al., 2012). Good multivariate balance is indicated by a nonsignificant  $\chi^2$  value. For relative multivariate balance,  $L_1$  after matching should be smaller than  $L_1$  before matching (Iacus et al., 2012). To test univariate balance, we inspected mean differences (Cohen's  $d$ ) between the covariates (which should be close to 0) as well as variance ratios (which should be close to 1).

As a last step of PSM, we inspected the area of common support, which is the overlap of the propensity score distributions of the two groups. If the area of common support is small, the results are only valid for a small part of the sample at hand and therefore probably not generalizable to the entire population the sample was drawn from. A large area of common support, by contrast, indicates that the results are probably valid for the entire population represented by the sample (Thoemmes & Kim, 2011).

**Group Comparisons.** We made group comparisons by means of Wilcoxon signed-rank tests (accounting for the dependence of the matched samples). We chose a nonparametric approach because most variables did not follow a normal distribution when we compared only small samples (see below). Furthermore, there were some variables that were rather ordinal in nature (i.e., students' educational goals, parents' occupational expectations). Matched cases in which data from only one student were available, were excluded from the analyses. We used the rank-biserial correlation  $r_{rb}$  as effect

size, calculated from the simple difference formula by Kerby (2014). According to this formula,  $r_{rb}$  is the difference between two ratios: the proportion of pairs in which Group 1 has higher ranks than Group 2 and the proportion of pairs in which Group 2 has higher ranks than Group 1. As opposed to other effect sizes that can be used with the Wilcoxon signed-rank test,  $r_{rb}$  is relatively easy to interpret and its sign indicates the direction of the difference (Kerby, 2014). Due to multiple testing, we performed Bonferroni corrections. The adjusted level of statistical significance was therefore  $\alpha < .0022$  (.05/23).

**Considering the Small Sample Size and Nonpreregistration.** As already mentioned, the current sample of gifted students was small, reducing test power. We therefore also focused on the effect sizes. However, it should be kept in mind that small samples per se limit the generalizability of the findings. Therefore, the results from this study should be interpreted with caution. Furthermore, our findings should be understood as rather exploratory, given that our study was not preregistered.

**Handling Missing Data.** There were two types of missing data. Some data were missing because the instruments had not been administered to all students (see above) and some were missing although the instruments had been administered. For the latter, the missing rate was 1.73% (gifted students) and 3.07% (average-ability students). We handled these by means of multiple imputation (whereas we did not impute the values that missed due to nonadministration, because these data were missing systematically and because the rate of missing values was substantial). We estimated the number of needed imputations according to von Hippel (2018). We first imputed five data sets (using the entire sample) to calculate the fraction of missing information (FMI) for all study variables. We used five imputations as a starting point, because five imputations were seen as optimal in terms of efficiency (more than five imputations usually result in only marginally greater measurement accuracy of the point estimate; Schafer, 1999) and because FMI was expected to be low given the low rates of missing values (see von Hippel, 2018). We chose the upper bound of the 95% confidence interval of the highest FMI and a coefficient of variation (CV) of .05, as recommended by Royston (2004). The CV reflects the variation of the *SE* around the point estimate across the imputations. A  $CV \leq .05$  means that the *SD* of the *SE* will be 5% (or less) of the mean *SE*. This procedure resulted in a target number of six imputations. Given that the rate of missing values was low, we expected no notable effects of six versus five imputations on the results. We therefore did not perform additional imputations.



## Results

### Intercorrelations

The intercorrelations of the study variables in the gifted and in the average-ability sample can be found in Table S1 in the Supplementary Material (available online). Most correlations were in line with what would be theoretically expected. However, the intercorrelations among the performance tests and grades were quite low ( $-.04 \leq r \leq .40$ ), especially in the gifted sample. Performance data also displayed lower correlations with the SES indicators than expected ( $-.10 \leq r \leq .31$ ), again especially in the gifted sample. This might partly be explained by variance restrictions due to splitting the sample into a gifted and an average-ability group. Additionally, both academic achievement tests, especially the reading comprehension test, were not particularly difficult but had a pronounced speed component. Furthermore, the SES indicators were self-reported by the students, which limits their validity. We will return to this point in the limitations.

### Propensity Score Matching (Exact Matching on School Type)

By means of 1:1 nearest neighbor matching with exact matching on school type, 50 of the 51 gifted students could be matched. The overall balance  $\chi^2$  test indicated excellent multivariate balance,  $\chi^2(4) = 0.16, p = .997$ . The  $L_1$  statistic also indicated relative multivariate balance ( $L_1$  before matching = .71,  $L_1$  after matching = .56). Table 1 displays mean and variance differences between both groups on the covariates before and after matching. There were no group differences left larger than  $|d| = 0.05$  after the matching and most of the variance ratios were closer to 1 than before matching. The matched

groups did not differ in age either,  $t(98) = -0.70, p = .483, d = -0.14$ . The mean IQ was  $M = 136.98$  ( $SD = 5.23$ ) for the matched gifted group and  $M = 101.88$  ( $SD = 7.33$ ) for the matched average-ability group. Twenty-five of the matched gifted (and average-ability) students attended the Gymnasium, seven the Gesamtschule, 17 the Realschule, and one the Hauptschule.

The area of common support was large (see Figure 1). In summary, the matching procedure found a counterpart for all gifted but one, and revealed excellent multivariate and univariate balance on the covariates. The overlap of propensity scores between the gifted and the average-ability group was high. Therefore, both groups were comparable and the results can be considered generalizable to the population represented by the sample.

### Group Comparisons (Exact Matching on School Type)

The medians of the gifted and the average-ability students' scores on the dependent variables as well as the Wilcoxon test results are shown in Table 2.

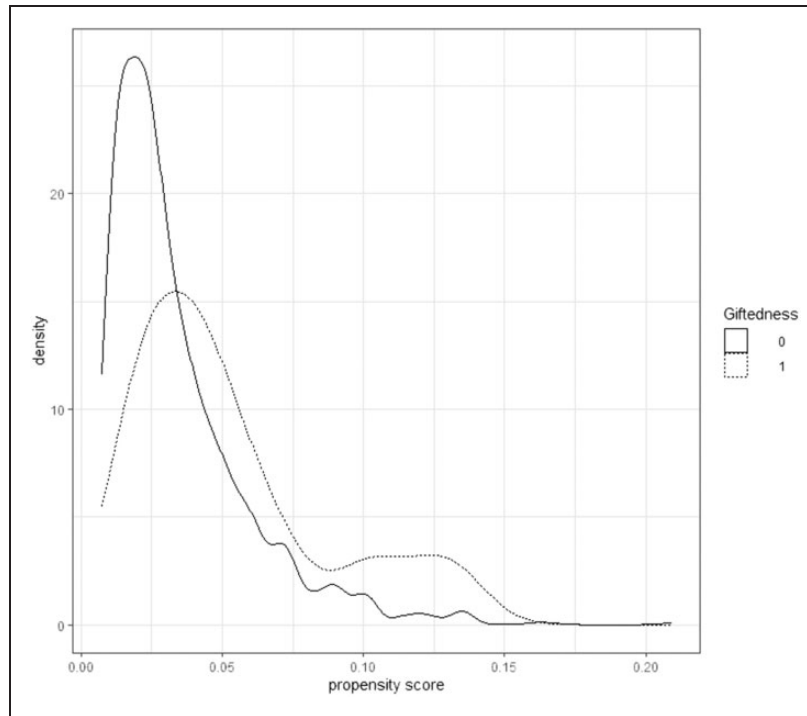
**School Performance.** The gifted achieved better results in the math achievement test ( $r_{rb} = .66, p < .001$ ) and better math grades ( $Mdn = 5.00$  vs.  $4.00; r_{rb} = .81, p < .001$ ) than did the students with average intelligence. Although there was a tendency toward the same pattern in reading comprehension and in the German grade, respectively, the differences here were markedly smaller and statistically not significant. In sum, Hypothesis 1 was supported.

**Motivation.** The gifted displayed markedly higher values than the average-ability students in mathematical ability self-concept ( $r_{rb} = .71, p < .001$ ) and intrinsic motivation ( $r_{rb} = .62, p < .001$ ), supporting Hypothesis 2.

**Table 1.** Means ( $M$ ) and Standard Deviations ( $SD$ ) of Gifted and Average-Ability Students as Well as Variance Ratios ( $VR$ ) in the Covariates before and after 1:1 Nearest Neighbor Matching with Exact Matching on School Type (Caliper = .2).

	Gifted		Average ability		VR	t	p	d
	M	SD	M	SD				
Before matching								
Parents' educational level (0-6 scale)	3.10	1.46	2.33	1.48	0.97	3.11	.003	0.52
Books in the home (1-6 scale)	3.70	1.46	2.96	1.35	1.17	3.84	<.001	0.72
Immigration background (0 = no, 1 = yes)	0.18	0.39	0.39	0.49	0.63	-3.78	<.001	-0.47
Gender (0 = boy, 1 = girl)	0.33	0.48	0.50	0.50	0.91	-2.48	.013	-0.34
After matching								
Parents' educational level (0-6 scale)	3.09	1.47	3.04	1.56	0.89	0.14	.888	0.03
Books in the home (1-6 scale)	3.66	1.44	3.66	1.40	1.06	-0.01	.989	<-0.01
Immigration background (0 = no, 1 = yes)	0.18	0.39	0.20	0.40	0.92	-0.25	.801	-0.05
Gender (0 = boy, 1 = girl)	0.34	0.48	0.36	0.49	0.98	-0.21	.836	-0.04

Note. Before matching:  $n = 51$  (gifted group;  $M_{IQ} = 136.96$ ),  $n = 1,423$  (average-ability group;  $M_{IQ} = 99.86$ ). After matching:  $n = 50$  for both groups ( $M_{IQ}$  gifted = 136.98,  $M_{IQ}$  average ability = 101.88).  $VR = SD_{gifted}^2 / SD_{average\ ability}^2$ . Positive  $t$  and  $d$  values: Greater values of the gifted students.



**Figure 1.** Distributions of the propensity scores in the gifted (“1”) and in the average-ability (“0”) group.

There were also some notable differences in vocational interests. The gifted showed higher investigative interests than did the average-ability students ( $r_{rb} = .65$ ,  $p < .001$ ). By tendency, the gifted also showed higher realistic ( $r_{rb} = .42$ ,  $p = .011$ ) and lower social interests ( $r_{rb} = -.37$ ,  $p = .022$ ), but these differences were less substantial and not statistically significant after Bonferroni correction. Thus, there was some support for Hypothesis 3, although it was limited for realistic and social interests and not confirmed whatsoever for enterprising interests ( $r_{rb} = -.21$ ,  $p = .212$ ). There were only small differences in artistic and conventional interest, supporting Hypothesis 4. The difference in educational goal was in favor of the gifted, but statistically not significant. Thus, there was little support for Hypothesis 5.

**Parents' Educational Expectations and Valuing of School.** There was no statistically significant effect of giftedness. If anything, there was a slight tendency that the parents of the gifted showed somewhat less interest in school than did the parents of the average-ability students ( $r_{rb} = -.37$ ,  $p = .053$ ).

**Perceptions of Teaching Quality and Instruction.** The gifted perceived somewhat less pressure during the math lessons than the average-ability students did, although this effect was not statistically significant after Bonferroni correction ( $r_{rb} = -.52$ ,  $p = .011$ ). There were no differences in perceived pressure in German lessons or perceived

quality of teaching in either math or German. Thus, support for Hypothesis 6 was very limited.

**Subjective Well-Being.** Although the gifted reported slightly higher levels of life satisfaction ( $r_{rb} = .25$ ,  $p = .314$ ) and a slightly lower mood ( $r_{rb} = -.22$ ,  $p = .353$ ), both differences were small and not statistically significant. Thus, there was support for Hypothesis 7.

### **Propensity Score Matching (Exact Matching on Classroom)**

Detailed results for the PSM with exact matching on classroom can be found in the Supplementary Material (available online). In summary, the results mostly resembled those reported above when comparing the effect sizes, with three exceptions. The difference in investigative interests was smaller than after the first PSM ( $r_{rb} = .32$  vs.  $r_{rb} = .65$ ); the difference in pressure in math lessons vanished ( $r_{rb} = -.13$  vs.  $r_{rb} = -.52$ ); and the difference in parents' interest in school was larger ( $r_{rb} = -.66$  vs.  $r_{rb} = -.37$ ).

## **Discussion**

Terman's (1925) *Genetic Studies of Genius* were the starting point for the systematic empirical investigation of the lives of the intellectually gifted. Terman exposed the myth of the “mad genius.” However, his study has been subjected to several critiques. In the present

**Table 2.** Medians (Mdn) and Group Differences Between Gifted and Average-Ability Students (Exact Matching on School Type).

	$n_{\text{group}}$	Mdn		Z	p	$r_{\text{rb}}$
		Gifted	Average ability			
<i>School performance</i>						
Standardized achievement tests						
Math (KRW)	50	27.50	22.00	3.99	<.001*	.66
Reading comprehension (LGVT)	50	14.50	13.00	1.40	.161	.23
Grades						
Math	50	5.00	4.00	4.42	<.001*	.81
German	50	4.00	4.00	1.34	.180	.25
<i>Motivation</i>						
Ability self-concept in math	50	4.13	3.25	4.22	<.001*	.71
Intrinsic motivation in math	50	4.00	3.00	3.61	<.001*	.62
<i>Vocational interests</i>						
Realistic	50	3.10	2.55	2.54	.011	.42
Investigative	50	3.20	2.50	3.92	<.001*	.65
Artistic	50	2.80	2.73	0.16	.873	-.03
Social	50	2.55	2.80	2.28	.022	-.37
Enterprising	50	2.75	2.90	1.25	.212	-.21
Conventional	50	2.55	2.30	1.56	.118	.26
Educational goal	50	3.00	3.00	1.16	.248	.33
<i>Perceived parents' valuing of school and educational expectations</i>						
Valuing of school	50	4.00	4.00	0.36	.722	-.07
Interest in school	50	4.00	4.00	1.94	.053	-.37
Expectation school performance	50	4.00	4.00	0.66	.511	-.14
Expectation vocational qualification	50	3.00	2.00	0.72	.470	.14
<i>Evaluation of school instruction</i>						
Perceived pressure						
Math	36	2.00	2.83	2.54	.011	-.52
German	36	2.00	2.00	1.42	.156	.29
Perceived quality						
Math	36	3.67	3.33	1.70	.089	.34
German	36	3.58	3.33	0.69	.489	-.14
<i>Subjective well-being</i>						
Life satisfaction	27	5.29	5.00	1.01	.314	.25
Mood	27	4.50	5.17	0.93	.353	-.22

Note.  $M_{IQ}^{\text{gifted}} = 136.98$ ,  $M_{IQ}^{\text{average ability}} = 101.88$ .  $r_{\text{rb}}$ : rank-biserial correlation. Positive  $r$  values indicate more positive than negative rank scores (i.e., rank scores in favor of the gifted).

\*Statistically significant after Bonferroni correction.

study, we (re)investigated the characteristics of the gifted regarding school performance, motivational variables, parents' educational expectations, students' perceptions of teaching and instruction, and SWB. In doing so, we drew on a largely unselected sample of adolescents, applied a culturally fair intelligence test, and built a comparison group of average-ability students by means of PSM.

### Summary and Interpretation of the Findings

**School Performance.** In accordance with previous research (e.g., Rost, 2009; Roznowski et al., 2000; Wirthwein et al., 2019), the gifted outperformed the average-ability students, especially in mathematics (grades:  $r_{\text{rb}} = .81$  [school matching]/.64 [classroom matching],

test performance:  $r_{\text{rb}} = .66/.51$ ). This was not as much the case for reading comprehension ( $r_{\text{rb}} = .23/.29$ ) or for grade in German ( $r_{\text{rb}} = .25/-.04$ ). This is in line with previous findings showing that performance in STEM fields is more strongly associated with intelligence than is performance in humanities (e.g., Roth et al., 2015; Wirthwein et al., 2019). It should be noted, however, that the reading comprehension test in particular has a pronounced speed component and its items are not very difficult, especially for adolescents. Therefore, the impact of intelligence on performance in this test is probably limited.

**Motivation.** In line with previous research (e.g., Hoge & Renzulli, 1993; Litster & Roberts, 2011;

Wirthwein et al., 2019), the gifted displayed a higher ability self-concept ( $r_{rb} = .71/.66$ ) and intrinsic motivation ( $r_{rb} = .62/.60$ ) in math than did their average-ability counterparts. Similar findings have also been reported by Wirthwein et al. (2019) for motivational orientations related to math. Due to the limitations in our data, we could not test whether the motivational differences observed were due to differences in performance. In Wirthwein et al. (2019), the motivational differences were partly due to differences in mathematical skills, but the gifted still had higher self-concept and intrinsic motivation when performance differences were taken into account. There seems to be a difference in mathematical self-concept and intrinsic motivation that is not explainable by differences in performance. Tasks in mathematics are mostly more cognitively challenging than tasks in other subjects. Gifted students might more strongly seek out challenging tasks because they experience more joy when learning from them (Gottfried & Gottfried, 1996; Schick & Phillipson, 2009), or because challenging tasks offer them more informational value for evaluating their ability level than do easy tasks (Neitzke & Röhr-Sendmeier, 1992). These might be reasons why the gifted show higher intrinsic motivation for math (partly) irrespective of performance differences.

Although there was some variation in effect sizes across the matching procedures, the gifted reported higher realistic ( $r_{rb} = .42/.47$ ) and investigative ( $r_{rb} = .65/.32$ ) interests than did the average-ability students. The gifted also reported somewhat lower social interests, although the effects were rather small ( $r_{rb} = -.37/-.33$ ). This pattern is largely in line with previous research investigating the vocational interests of gifted and average-ability students from the same school track (Sparfeldt, 2007; see also Vock et al., 2013). As there has been much debate about a lack of specialists in times of continued globalization and digitization, nurturing gifted students could be a way to meet these demands. One possibility to nurture gifted students might be to increase the fit between vocational interests and the students' educational and vocational goals, potentially resulting in more successful educational and occupational pathways.

There has been surprisingly little research focusing on educational aspirations comparing the gifted with a parallel control group of nonidentified students (Roznowski et al., 2000). Regardless of the matching procedure, we found no significant difference between the two groups. As most of the matched students attended the Gymnasium (i.e., the highest school track in the German school system, typically leading to university enrollment) the variance of educational aspirations was restricted and this might explain the nonsignificant results.

*Parents' Educational Expectations and Valuing of School.* Our study is one of the first to focus on the comparison of gifted and average-ability students' perceptions of their parents' educational expectations and values. We found hints that the gifted compared with average-ability students perceive their parents to have a lower interest in school ( $r_{rb} = -.37/-.66$ ). Our study corresponds with the results from Campbell and Mandel (1990) who also found less perceived parental involvement of students of gifted classes compared to students from regular classes. One explanation might be that the parents do not need to support their gifted children as much as their average-ability children because gifted students are more autonomous concerning school work and achieve better outcomes in school. Parental involvement might thus be less necessary for the gifted, if their parents worry less about their children's educational prospects and therefore show less interest in school. What also has to be kept in mind is that we assessed parents' interest in school as perceived by the students. When working on these items, students might have compared their parents' interest with their own interest in school. As gifted students seem to have a comparatively high interest in school (see also Wirthwein et al., 2019), they might have perceived their parents' interest as relatively low, quite in contrast to the average-ability students.

We found, however, no difference in parents' educational expectations. The fact that most matched students attended the Gymnasium might have restricted the variance of parental expectations. In sum, there are no hints that there is a heightened pressure from parents on gifted students regarding school as is sometimes discussed (e.g., Peterson, 2009).

*Perceptions of Teaching Quality and Instruction.* Descriptively and in line with the studies by Chae and Gentry (2011) and Rita and Martin-Dunlop (2011), these gifted students evaluated their learning environments somewhat more positively than the average-ability students did. The effects were mostly small and suggest that there are no substantial systematic differences in how gifted and average-ability adolescents experience the lessons in school.

*Subjective Well-Being.* There was only a small descriptive advantage of the gifted in life satisfaction and a small descriptive disadvantage in mood. None of these differences were meaningful. These findings largely concur with previous research on SWB of the gifted (e.g., Bergold et al., 2015; Wirthwein & Rost, 2011). It appears that giftedness is no risk factor for poor SWB.

### *Disharmony or Harmony?*

All in all, our findings speak against the disharmony hypothesis: There were no notable differences in SWB, and there was no indication of a heightened pressure on the gifted students in terms of higher performance expectations by parents or the gifted themselves or increased pressure during the lessons. Overall, only two consistent differences emerged: The gifted students were more highly motivated and achieved better in math than their average-ability counterparts. These results underline the major results Terman found in his longitudinal study. In this regard, our study (like other studies in the field) demonstrates that the shortcomings of Terman's work that many have criticized (see Freeman, 2006; Jolly, 2008b; Subotnik & Arnold, 1994; see also Warne, 2019) did not notably bias his key findings. We used a culturally fair intelligence test not predominantly focused on verbal intelligence and identified a gifted sample that was more diverse regarding SES and immigration background (or ethnicity) than was Terman's. We applied psychometrically established assessments and used an explicitly matched comparison group; and finally, the present sample was a current one and therefore not influenced by cohort effects. Despite all these differences, Terman's findings were confirmed, which speaks for their robustness and their topicality still today.

Importantly, these results were found while many potential confounders were controlled for by means of matching. The covariates can therefore be ruled out as possible causes of the observed differences. This means that it is very unlikely that most of the gifted individuals in Terman's study excelled just because they grew up in comparatively privileged homes or were academically supported. The differences seem rather to apply to giftedness itself, irrespective of social and ethnic background. Thus, there are important noncognitive differences between gifted and average-ability adolescents that can for example serve as justifications for gifted programs. For instance, the fact that the gifted display an especially high intrinsic motivation for math and a particularly high interest in investigative occupations justifies special gifted programs focusing on math or investigative activities. It was also Terman (1954) who argued for the special academic promotion of the gifted identified by means of IQ tests, irrespective of their social or ethnic background (see Warne, 2019). The findings from our comparatively diverse sample underscore his claim.

The falsification of the disharmony hypothesis, however, does not imply that the gifted cannot be affected by negative stereotypes that still exist about them. Importantly, most of the gifted students (and their parents) in our sample were probably not aware of

their giftedness. They might have been immune to negative stereotyping effects, as they had not been assigned the gifted label. Things might be different if they had. In general, the gifted label can have negative implications such as being stereotyped or exploited by classmates, receiving less support from teachers, or being faced with increased expectations from others (e.g., Berlin, 2009; Moulton et al., 1998; Robinson, 1990). These factors might indeed be detrimental for the development of at least some of the gifted (e.g., Freeman, 2006). On the other hand, most of Terman's participants *were* aware of their giftedness, as they were aware of being part of the study and many of them received support and advice from Terman in different ways (Warne, 2019; Warne & Liu, 2017). In any case, there is a continued need to dispel negative stereotypes about the gifted. In line with Terman's endeavor, it is essential to scrutinize alleged effects of giftedness and stereotypes about the gifted empirically.

### **Limitations and Future Directions**

Our study has several strengths but it also comes with some limitations. We drew on a relatively unselected sample of students from all school types (except for special needs schools) within the German tracked school system, and identified the level of giftedness with a culturally fair intelligence test. Therefore, students from diverse backgrounds were included. We applied a rigorous method for matching the students according to the most important covariates. Nevertheless, there surely are further variables (e.g., family status, friends) we could not control for although they might also have an impact on the dependent variables under study. As beneficial as PSM is, matching methods can never bring about conditions that equal a randomized experiment (see also, e.g., Fan & Nowell, 2011; Graham & Kurlaender, 2011).

The study is also limited in its scope when directly compared with Terman's study. Although we assessed a variety of variables, our study did not comprise all variables Terman and his colleagues had considered. In addition, the reading and the math test were speeded tests measuring rather basic academic skills. Future studies could include power tests with more difficult tasks. We would expect that differences between gifted and average-ability students should be higher on such tests. Maybe even more important, our sample was only cross-sectional in nature. We were therefore not able to answer questions that were important to Terman such as the stability of giftedness across the lifespan. Our study represents just a snapshot on selected childhood (or adolescence) variables.

It should also be noted that our findings probably only apply to adolescents from regular schools (i.e., students not coming from gifted schools or gifted classes).

As already mentioned, at least some students with the “gifted” label might differ in important respects from those without. This might not only apply to stereotyping effects possibly leading to poorer performance, increased feelings of performance pressure, lower SWB, or parents being more concerned about their children (e.g., Coleman et al., 2015). It might also apply to consequences of ability grouping. For example, ability grouping is sometimes found to negatively influence academic or intellectual self-concept (e.g., Preckel et al., 2010, 2016), although this effect is often counterbalanced by an assimilation effect (i.e., awareness of belonging to a high-ability group produces a positive effect on self-concept; e.g., Herrmann et al., 2016). More (quantitative) research on the characteristics of labeled gifted individuals is needed.

Another problem was the small size of the matched samples. Small samples limit the generalizability of the findings, so the present findings should be interpreted with caution. In addition, we performed a large number of statistical tests, raising the problem of  $\alpha$  error inflation. However, first, we adjusted  $\alpha$  to counteract this problem; second, the results were largely in line with other studies (including Terman’s work, see above), pointing to the reliability of the sample and to the trustworthiness of the results. Another limitation is that we only relied on self-reported data gathered from the students. We cannot determine whether the students’ perceptions were congruent with their parents’ actual views. Yet the decisive point is that the gifted *felt* not more, but rather fewer, performance expectations from their parents than did the other students. Data provided by other sources (e.g., parents, teachers, classmates, siblings) nevertheless have the potential to add incremental information on characteristics of the gifted (e.g., Wirthwein et al., 2019). This should be all the more true for SES indicators.

Finally, we relied solely on IQ when defining giftedness. We did so because it is in the tradition of Terman’s approach and because it has several theoretical, operational, and practical advantages (e.g., Warne, 2016). We might have found different results if we had applied an alternative conception of intellectual giftedness (e.g., Renzulli, 1978). Therefore, it should be borne in mind that our findings exclusively apply to intellectual giftedness defined as high intelligence.

## Conclusions

Despite its limitations, this study provides an overview of differences between gifted and average-ability adolescents in school performance and motivation. It also shows that there are many similarities between both groups, for example in educational aspirations, perception of teaching quality, SWB, and parents’ educational

expectations and valuing of school. This pattern indicates that there are many more similarities between the gifted and the general population than the followers of the “mad genius” stereotype have assumed (Becker, 1978). Most of the differences we found tended to be in favor of the gifted even after matching for social and ethnic background variables, supporting Terman’s initial findings, challenging negative stereotypes, and providing justification for gifted programs. Therefore, our study is a further step toward debunking the disharmony hypothesis—a goal that Terman began pursuing over 100 years ago.

## Declaration of Conflicting Interests

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

## Editors’ Note

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## Supplemental Material

Supplemental material for this article is available online.

## Notes

1. The secondary school system in Germany is a multitracked system. After leaving elementary school at about age 10, students are assigned to one of several different school types according to their academic achievement. These school types (tracks) put different demands on their students. The lower track (Hauptschule) aims at providing students with basic general education preparing them for apprenticeship. The middle track (Realschule) provides an extended general education, preparing the students for either apprenticeship or enrollment in the Gymnasium. The highest track (Gymnasium) is the academic track preparing the students for university enrollment. The Gesamtschule is a comprehensive school which combines all of these tracks. Most intellectually gifted students attend the Gymnasium (e.g., Sparfeldt, 2007).
2. An immigrant background was indicated if students or at least one of their parents were not born in Germany, or students did not learn German as their first language or mostly spoke another language than German at home.

Parents' countries of birth were not available for the Gymnasium students. Therefore, the immigration background rate among students from the Gymnasium was probably underestimated. As we strictly matched for school type or classroom (see below) this does not affect the findings.

## References

- Ash, C., & Huebner, E. S. (1998). Life satisfaction reports of gifted middle-school children. *School Psychology Quarterly*, 13(4), 310–321. <https://doi.org/10.1037/h0088987>
- Austin, P. C. (2009). Some methods of propensity-score matching had superior performance to others: results of an empirical investigation and Monte Carlo simulations. *Biometrical Journal*, 51(1), 171–184. <https://doi.org/10.1002/bimj.200810488>
- Austin, P. C., Grootendorst, P., & Anderson, G. M. (2007). A comparison of the ability of different propensity score models to balance measured variables between treated and untreated subjects: A Monte Carlo study. *Statistics in Medicine*, 26(4), 734–753. <https://doi.org/10.1002/sim.2580>
- Baudson, T. G. (2016). The mad genius stereotype: Still alive and well. *Frontiers in Psychology*, 7, Article 368. <https://doi.org/10.3389/fpsyg.2016.00368>
- Becker, G. (1978). *The mad genius controversy: A study in the sociology of deviance*. Sage.
- Benner, A. D., Boyle, A. E., & Sadler, S. (2016). Parental involvement and adolescents' educational success: The roles of prior achievement and socioeconomic status. *Journal of Youth and Adolescence*, 45(6), 1053–1064. <https://doi.org/10.1007/s10964-016-0431-4>
- Bergmann, C., & Eder, F. (1999). *Allgemeiner Interessen-Struktur-Test* [General Structure of Interests Tests]. Beltz.
- Bergold, S., Wirthwein, L., Rost, D. H., & Steinmayr, R. (2015). Are gifted adolescents more satisfied with their lives than their non-gifted peers? *Frontiers in Psychology*, 6, Article 1623. <https://doi.org/10.3389/fpsyg.2015.01623>
- Bergold, S., Wirthwein, L., & Steinmayr, R. (2018). Subjective well-being of intellectually gifted children and adolescents. In I. González-Burgos (Ed.), *Psychobiological, clinical, and educational aspects of giftedness* (pp. 143–165). Nova.
- Berlin, J. E. (2009). It's all a matter of perspective: Student perceptions on the impact of being labeled gifted and talented. *Roeper Review*, 31(4), 217–223. <https://doi.org/10.1080/02783190903177580>
- Burks, B. S., Jensen, D. W., & Terman, L. M. (1930). *The promise of youth: Follow-up studies of a thousand gifted children*. Stanford University Press.
- Campbell, J. R., & Mandel, F. (1990). Connecting math achievement to parental influences. *Contemporary Educational Psychology*, 15(1), 64–74. [https://doi.org/10.1016/0361-476X\(90\)90006-M](https://doi.org/10.1016/0361-476X(90)90006-M)
- Cattell, R. B. (1987). *Intelligence: Its structure, growth and action*. North-Holland.
- Chae, Y., & Gentry, M. (2011). Gifted and general high school students' perceptions of learning and motivational constructs in Korea and the United States. *High Ability Studies*, 22(1), 103–118. <https://doi.org/10.1080/13598139.2011.577275>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum. <http://www.utstat.toronto.edu/~brunner/oldclass/378f16/readings/CohenPower.pdf>
- Coleman, L. J., Micko, K. J., & Cross, T. L. (2015). Twenty-five years of research on the lived experience of being gifted in school: Capturing the students' voices. *Journal for the Education of the Gifted*, 38(4), 358–376. [10.1177/0162353215607322](https://doi.org/10.1177/0162353215607322)
- Dalbert, C. (2003). Habituelle Subjektive Wohlbefindensskala (HSWBS) [Scale of habitual subjective well-being]. In J. Schumacher, A. Klaiberg, & E. Brähler (Eds.), *Diagnostische Verfahren zu Lebensqualität und Wohlbefinden* (pp. 319–323). Hogrefe.
- 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>
- Diener, E. (2012). New findings and future directions for subjective well-being research. *American Psychologist*, 67(8), 590–597. <https://doi.org/10.1037/a0029541>
- Diener, E., & Fujita, F. (1995). Resources, personal strivings, and subjective well-being: A nomothetic and idiographic approach. *Journal of Personality and Social Psychology*, 68(5), 926–935. <https://doi.org/10.1037/0022-3514.68.5.926>
- Ditton, H., Krüsken, J., & Schauenberg, M. (2005). Bildungsungleichheit—der Beitrag von Familie und Schule [Educational disparities and the contribution of family and school]. *Zeitschrift für Erziehungswissenschaft*, 8(2), 285–304. <https://doi.org/10.1007/s11618-005-0138-x>
- Eder, F. (1998). *Linzer Fragebogen zum Schul- und Klassenklima für die 8. bis 13. Klasse* [LINZ Questionnaire for school and class climate for Grades 8 to 13]. Hogrefe.
- Fan, X., & Nowell, D. L. (2011). Using propensity score matching in educational research. *Gifted Child Quarterly*, 55(1), 74–79. <https://doi.org/10.1177/0016986210390635>
- Flanagan, J. C., Dailey, J. T., Shaycoft, M. F., Gorham, W. A., Orr, D. B., & Goldberg, I. (1962). *Design for a study of American youth*. Houghton Mifflin.
- Freeman, J. (2006). Giftedness in the long term. *Journal for the Education of the Gifted*, 29(4), 384–403. <https://doi.org/10.4219/jeg-2006-246>
- Freund-Braier, I. (2009). Persönlichkeitsmerkmale [Personality traits]. In D. H. Rost (Ed.), *Hochbegabte und hochleistende Jugendliche* (2nd ed., pp. 161–210). Waxmann.
- Frey, M. C., & Detterman, D. K. (2004). Scholastic assessment or g? The relationship between the Scholastic Assessment Test and general cognitive ability. *Psychological Science*, 15(6), 373–378. <https://doi.org/10.1111/j.0956-7976.2004.00687.x>
- Gallagher, J. J. (1990). The public and professional perception of the social and emotional status of gifted children. *Journal for the Education of the Gifted*, 13(3), 202–211. <https://doi.org/10.1177/016235329001300302>
- Gentry, M., Rizza, M. G., & Owen, S. V. (2002). Examining perceptions of challenge and choice in classrooms: The relationship between teachers and their students and comparisons among gifted students and other students. *Gifted Child Quarterly*, 46(2), 145–155. <https://doi.org/10.1177/001698620204600207>

- Gottfredson, L. S. (1997). 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](https://doi.org/10.1016/S0160-2896(97)90011-8)
- Gottfried, A. E., & Gottfried, A. W. (1996). A longitudinal study of academic intrinsic motivation in intellectually gifted children: Childhood through early adolescence. *Gifted Child Quarterly*, 40(4), 179–183. <https://doi.org/10.1177/001698629604000402>
- Graham, S. E., & Kurlaender, M. (2011). Using propensity scores in educational research: General principles and practical applications. *Journal of Educational Research*, 104(5), 340–353. <https://doi.org/10.1080/00220671.2010.486082>
- Hansen, B. B., & Bowers, J. (2008). Covariate balance in simple, stratified and clustered comparative studies. *Statistical Science*, 23(2), 219–236. <https://doi.org/10.1214/08-STS254>
- Herrmann, J., Schmidt, I., Kessels, U., & Preckel, F. (2016). Big fish in big ponds: Contrast and assimilation effects on math and verbal self-concepts of students in within-school gifted tracks. *British Journal of Educational Psychology*, 86(2), 222–240. <https://doi.org/10.1111/bjep.12100>
- Hockett, J. A. (2009). Curriculum for highly able learners that conforms to general education and gifted education quality indicators. *Journal for the Education of the Gifted*, 32(3), 394–440. <https://doi.org/10.4219/jeg-2009-857>
- Hodges, J., Mun, R., Oveross, M., & Ottwein, J. (2020). Assessing the scholarly reach of Terman's work. *Gifted Child Quarterly*.
- Hoge, R. D., & Renzulli, J. S. (1993). Exploring the link between giftedness and self-concept. *Review of Educational Research*, 63(4), 449–465. <https://doi.org/10.3102/00346543063004449>
- Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments* (3rd ed.). Psychological Assessment Resources.
- Holmes, W. M. (2013). *Using propensity scores in quasi-experimental designs*. Sage.
- Huebner, E. S., & Diener, C. (2008). Research on life satisfaction of children and youth. In M. Eid & R. J. Larsen (Eds.), *The science of subjective well-being* (pp. 376–392). Guilford Press.
- Iacus, S. M., King, G., & Porro, G. (2012). Causal inference without balance checking: Coarsened exact matching. *Political Analysis*, 20(1), 1–24. <https://doi.org/10.1093/pan/mpr013>
- Johnson, W., Carothers, A., & Deary, I. J. (2008). Sex differences in variability in general intelligence: A new look at the old question. *Perspectives on Psychological Science*, 3(6), 518–531. <https://doi.org/10.1111/j.1745-6924.2008.00096.x>
- Jolly, J. L. (2008a). A paradoxical point of view: Lewis M. Terman. *Gifted Child Today*, 31(2), 36–37. <https://doi.org/10.4219/gct-2008-757>
- Jolly, J. L. (2008b). Lewis Terman: Genetic study of genius: Elementary school students. *Gifted Child Today*, 31(2), 27–33. <https://doi.org/10.4219/gct-2008-689>
- Kaufman, S. B., Reynolds, M. R., Liu, X., Kaufman, A. S., & McGrew, K. S. (2012). Are cognitive *g* and academic achievement *g* one and the same *g*? An exploration on the Woodcock–Johnson and Kaufman tests. *Intelligence*, 40(2), 123–138. <https://doi.org/10.1016/j.intell.2012.01.009>
- Kerby, D. S. (2014). The simple difference formula: An approach to teaching nonparametric correlation. *Comprehensive Psychology*, 3, Article 1. <https://doi.org/10.2466/11.IT.3.1>
- Kitsantas, A., Bland, L., & Chirinos, D. S. (2017). Gifted students' perceptions of gifted programs: An inquiry into their academic and social-emotional functioning. *Journal for the Education of the Gifted*, 40(3), 266–288. <https://doi.org/10.1177/0162353217717033>
- Lazarides, R., Viljaranta, J., Aunola, K., Pesu, L., & Nurmi, J.-E. (2016). The role of parental expectations and students' motivational profiles for educational aspirations. *Learning and Individual Differences*, 51(October), 29–36. <https://doi.org/10.1016/j.lindif.2016.08.024>
- Lekwa, A. J., Reddy, L. A., Dudek, C. M., & Hua, A. N. (2019). Assessment of teaching to predict gains in student achievement in urban schools. *School Psychology*, 34(3), 271–280. <https://doi.org/10.1037/spq0000293>
- Litster, K., & Roberts, J. (2011). The self-concepts and perceived competencies of gifted and non-gifted students: A meta-analysis. *Journal of Research in Special Education Needs*, 11(2), 130–140. <https://doi.org/10.1111/j.1471-3802.2010.01166.x>
- Lubinski, D. (2016). From Terman to today: A century of findings on intellectual precocity. *Review of Educational Research*, 86(4), 900–944. <https://doi.org/10.3102/0034654316675476>
- Lubinski, D., & Benbow, C. P. (2006). Study of mathematically precocious youth after 35 years: Uncovering antecedents for the development of math-science expertise. *Perspectives on Psychological Science*, 1(4), 316–345. <https://doi.org/10.1111/j.1745-6916.2006.00019.x>
- Lubinski, D., & Benbow, C. P. (2020). Intellectual precocity: What have we learned since Terman? *Gifted Child Quarterly*.
- Marsh, H. W., Pekrun, R., Murayama, K., Arens, A. K., Parker, P. D., Guo, J., & Dicke, T. (2018). An integrated model of academic self-concept development: Academic self-concept, grades, test scores, and tracking over 6 years. *Developmental Psychology*, 54(2), 263–280. [http://centaur.reading.ac.uk/71299/3/Marsh%20et%20al\\_inpress\\_DP.pdf](http://centaur.reading.ac.uk/71299/3/Marsh%20et%20al_inpress_DP.pdf)
- Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2005). Academic self-concept, interest, grades, and standardized test scores: Reciprocal effects models of causal ordering. *Child Development*, 76(2), 397–416. <https://doi.org/10.1111/j.1467-8624.2005.00853.x>
- Matheis, S., Kronborg, L., Schmitt, M., & Preckel, F. (2017). Threat or challenge? Teacher beliefs about gifted students and their relationship to teacher motivation. *Gifted and Talented International*, 32(2), 134–160. <https://doi.org/10.1080/15332276.2018.1537685>
- Mendez, L. M. R., & Crawford, K. M. (2002). Gender-role stereotyping and career aspirations: A comparison of gifted early adolescent boys and girls. *Journal of Secondary Gifted Education*, 13(3), 96–107. <https://doi.org/10.4219/jsge-2002-375>
- Moon, T. R., & Brighton, C. M. (2008). Primary teachers' conceptions of giftedness. *Journal for the Education of the Gifted*, 31(4), 447–480. <https://doi.org/10.4219/jeg-2008-793>



- Morgan, S. L., & Winship, C. (2015). *Counterfactuals and causal inference: Methods and principles for social research*. Cambridge University Press.
- Moulton, P., Moulton, M., Housewright, M., & Bailey, K. (1998). Gifted & talented: Exploring the positive and negative aspects of labeling. *Roeper Review*, 21(2), 153–154. <https://doi.org/10.1080/02783199809553950>
- Neihart, M. (1999). The impact of giftedness on psychological well-being: What does the empirical literature say? *Roeper Review*, 22(1), 10–17. <https://doi.org/10.1080/02783199909553991>
- Neisser, U., Boodoo, G., Bouchard, T. J., Jr., Boykin, A. W., Brody, N., Ceci, S. J., Halpern, D. F., Loehlin, J. C., Perloff, R., Sternberg, R. J., & Urbina, S. (1996). Intelligence: Knowns and unknowns. *American Psychologist*, 51(2), 77–101. [https://www.researchgate.net/publication/232430439\\_Intelligence\\_Knowns\\_and\\_Unknowns/link/02e7e5266edcb3cfa800000/download](https://www.researchgate.net/publication/232430439_Intelligence_Knowns_and_Unknowns/link/02e7e5266edcb3cfa800000/download)
- Neitzke, C., & Röhr-Sendlmeier, U. M. (1992). Achievement motivation of intellectually gifted students when confronted with challenging and unchallenging tasks. *European Journal of High Ability*, 3(2), 197–205. <https://doi.org/10.1080/0937445920030208>
- O'Connor, J. (2012). Is it good to be gifted? The social construction of the gifted child. *Children & Society*, 26(4), 293–303. <https://doi.org/10.1111/j.1099-0860.2010.00341.x>
- Olszewski-Kubilius, P. M., Kulieke, M. J., & Krasney, N. (1988). Personality dimensions of gifted adolescents: A review of the empirical literature. *Gifted Child Quarterly*, 32(4), 347–352. <https://doi.org/10.1177/001698628803200403>
- Organization for Economic Cooperation and Development. (2016). *PISA 2015 results: Excellence and equity in education (Vol. 1)*. Author.
- Paulus, W., & Blossfeld, H.-P. (2007). Schichtspezifische Präferenzen oder sozioökonomisches Entscheidungskalkül? Zur Rolle elterlicher Bildungsaspirationen im Entscheidungsprozess beim Übergang von der Grundschule in die Sekundarstufe [Class-specific preferences or socio-economic calculations in decision-making? On the role of parents' educational aspirations in decision-making at the point of transition from elementary to secondary school]. *Zeitschrift für Pädagogik*, 53(4), 491–508.
- Peterson, J. S. (2009). Myth 17: Gifted and talented individuals do not have unique social and emotional needs. *Gifted Child Quarterly*, 53(4), 280–282. <https://doi.org/10.1177/0016986209346946>
- Pirracchio, R., Resche-Rigon, M., & Chevret, S. (2012). Evaluation of the propensity score methods for estimating marginal odds ratios in case of small sample size. *BMC Medical Research Methodology*, 12, Article 70. <https://doi.org/10.1186/1471-2288-12-70>
- Preckel, F., Götz, T., & Frenzel, A. (2010). Ability grouping of gifted students: Effects on academic self-concept and boredom. *British Journal of Educational Psychology*, 80(3), 451–472. <https://doi.org/10.1348/000709909X480716>
- Preckel, F., Götz, T., Pekrun, R., & Kleine, M. (2008). Gender differences in gifted and average-ability students: Comparing girls' and boys' achievement, self-concept, interest, and motivation in mathematics. *Gifted Child Quarterly*, 52, 146–159. <https://doi.org/10.1177/0016986208315834>
- Preckel, F., Rach, H., & Scherrer, V. (2016). Self-concept changes in multiple self-concept domains of gifted students participating in a summer residential school. *Gifted and Talented International*, 31(2), 88–101. <https://doi.org/10.1080/15332276.2017.1304781>
- Prenzel, M., Sälzer, C., Klieme, E., & Köller, O. (Eds.). (2013). *PISA 2012: Fortschritte und Herausforderungen in Deutschland [PISA 2012: Progress and challenges in Germany]*. Waxmann.
- Renzulli, J. S. (1978). What makes giftedness? Reexamining a definition. *Phi Delta Kappan*, 92(8), 81–88. <https://doi.org/10.1177/003172171109200821>
- Rinn, A. N., & Bishop, J. (2015). Gifted adults: A systematic review and analysis of the literature. *Gifted Child Quarterly*, 59(4), 213–235. <https://doi.org/10.1177/0016986215600795>
- Rita, R. D., & Martin-Dunlop, C. S. (2011). Perceptions of the learning environment and associations with cognitive achievement among gifted biology students. *Learning Environments Research*, 14(1), 25–38. <https://doi.org/10.1007/s10984-011-9080-4>
- Robinson, A. (1990). Does that describe me? Adolescents' acceptance of the gifted label. *Journal for the Education of the Gifted*, 13(3), 245–255. <https://doi.org/10.1177/016235329001300305>
- Robinson, N. M. (2005). In defense of a psychometric approach to the definition of academic giftedness: A conservative view from a die-hard liberal. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (2nd ed., pp. 280–294). Cambridge University Press.
- Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), 41–55. <https://doi.org/10.1093/biomet/70.1.41>
- Rost, D. H. (Ed.). (1993). *Lebensumweltanalyse hochbegabter Kinder [Life-environmental analysis of gifted children]*. Hogrefe.
- Rost, D. H. (Ed.). (2009). *Hochbegabte und hochleistende Jugendliche. Befunde aus dem Marburger Hochbegabtenprojekt [Gifted and high achieving youths: Findings from the Marburg Giftedness Project]*. Waxmann.
- Rost, D. H. (2013). *Handbuch Intelligenz [Handbook of intelligence]*. Beltz.
- Roth, B., Becker, N., Romeyke, S., Schäfer, S., Domnick, F., & Spinath, F. M. (2015). Intelligence and school grades: A meta-analysis. *Intelligence*, 53(November-December), 118–137. <https://doi.org/10.1016/j.intell.2015.09.002>
- Royston, P. (2004). Multiple imputation of missing values. *Stata Journal*, 4(3), 227–241. <https://doi.org/10.1177/1536867X0400400301>
- Roznowski, M., Reith, J., & Hong, S. (2000). A further look at youth intellectual giftedness and its correlates: Values, interests, performance, and behavior. *Intelligence*, 28(2), 87–113. [https://doi.org/10.1016/S0160-2896\(99\)00032-X](https://doi.org/10.1016/S0160-2896(99)00032-X)
- Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, 25(1), 54–67. <https://doi.org/10.1006/ceps.1999.1020>
- Schafer, J. L. (1999). Multiple imputation: A primer. *Statistical Methods in Medical Research*, 8(1), 3–15. <https://doi.org/10.1191/096228099671525676>

- Scherer, R., Nilsen, T., & Jansen, M. (2016). Evaluating individual students' perceptions of instructional quality: An investigation of their factor structure, measurement invariance, and relations to educational outcomes. *Frontiers in Psychology, 7*, Article 110. <https://doi.org/10.3389/fpsyg.2016.00110>
- Schick, H., & Phillipson, S. N. (2009). Learning motivation and performance excellence in adolescents with high intellectual potential: What really matters? *High Ability Studies, 20*(1), 15–37. <https://doi.org/10.1080/13598130902879366>
- Schilling, S. R., Sparfeldt, J. R., & Rost, D. H. (2006). Families with gifted adolescents. *Educational Psychology, 26*(1), 19–32. <https://doi.org/10.1080/01443410500340959>
- Schmidt, S., Ennemoser, M., & Krajewski, K. (2012). *Deutscher Mathematiktest für neunte Klassen* [German mathematics test for ninth grade]. Hogrefe.
- Schneider, W., Schlagmüller, M., & Ennemoser, M. (2007). *Lesegeschwindigkeits- und Verständnistest für die Klassen 6 bis 12* [Reading speed and comprehension test for Grades 6 to 12]. Hogrefe.
- Schöne, C., Dickhäuser, O., Spinath, B., & Stiensmeier-Pelster, J. (2012). *Skalen zur Erfassung des schulischen Selbstkonzepts* [Scales for the assessment of academic self-concept]. Hogrefe.
- Shajek, A., Lüdtke, O., & Stanat, P. (2006). Akademische Selbstkonzepte bei Jugendlichen mit Migrationshintergrund [Academic self-concepts of immigrant students]. *Unterrichtswissenschaft, 34*, 125–145. [https://www.pedocs.de/volltexte/2013/5512/pdf/UnterWiss\\_2006\\_2\\_Shajek\\_Luedtke\\_Stanat\\_Akademische\\_Selbstkonzepte\\_D\\_A.pdf](https://www.pedocs.de/volltexte/2013/5512/pdf/UnterWiss_2006_2_Shajek_Luedtke_Stanat_Akademische_Selbstkonzepte_D_A.pdf)
- Shaunnessy, E., Suldo, S. M., Hardesty, R. B., & Shaffer, E. J. (2006). School functioning and psychological well-being of international baccalaureate and general education students: A preliminary examination. *Journal of Secondary Gifted Education, 17*(2), 76–89. <https://doi.org/10.4219/jsge-2006-683>
- Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research, 75*(3), 417–453. <http://dx.doi.org/10.3102/00346543075003417>
- Sparfeldt, J. R. (2007). Vocational interests of gifted adolescents. *Personality and Individual Differences, 42*(6), 1011–1021. <https://doi.org/10.1016/j.paid.2006.09.010>
- Stanat, P., Segeritz, M., & Christensen, G. (2010). Schulbezogene Motivation und Aspiration von Schülerinnen und Schülern mit Migrationshintergrund [School-related motivation and aspiration of students with immigration background]. In W. Bos, E. Klieme, & O. Köller (Eds.), *Schulische Lerngelegenheiten und Kompetenzentwicklung: Festschrift für Jürgen Baumert* (pp. 31–57). Waxmann.
- Stanley, J. C. (1996). SMPY in the beginning. In C. P. Benbow & D. Lubinski (Eds.), *Intellectual talent: Psychometric and social issues* (pp. 225–235). Johns Hopkins University Press.
- Steinmayr, R., Dinger, F. C., & Spinath, B. (2012). Motivation as a mediator of social disparities in academic achievement. *European Journal of Personality, 26*(3), 335–349. <https://doi.org/10.1002/per.842>
- Steinmayr, R., Michels, J., & Weidinger, A. F. (2017). *FA(IR) BULOUS: Faire Beurteilung des Leistungspotenzials von Schülerinnen und Schülern* [FA(IR)BULOUS: Fair evaluation of students' academic potential]. Technische Universität Dortmund.
- Steinmayr, R., & Spinath, B. (2008). Sex differences in school achievement: What are the roles of personality and achievement motivation? *European Journal of Personality, 22*(3), 185–209. <https://doi.org/10.1002/per.676>
- Steinmayr, R., & Spinath, B. (2010). Konstruktion und erste Validierung einer Skala zur Erfassung subjektiver schulischer Werte (SESSW) [Construction and first validation of a scale assessing subjective educational task values]. *Diagnostica, 56*, 195–211. <https://doi.org/10.1026/0012-1924/a000023>
- Sternberg, R. J., & Davidson, J. E. (2005). *Conceptions of giftedness* (2nd ed.). Cambridge University Press.
- Stubbe, T. C., Schwippert, K., & Wendt, H. (2016). Soziale Disparitäten der Schülerleistungen in Mathematik und Naturwissenschaften [Social disparities in student achievement in mathematics and science]. In H. Wendt, W. Bos, C. Selter, O. Köller, K. Schwippert, & D. Kasper (Eds.), *TIMSS 2015: Mathematische und naturwissenschaftliche Kompetenzen von Grundschulkindern in Deutschland im internationalen Vergleich* (pp. 299–316). Waxmann.
- Subotnik, R. F., and Arnold, K. D. (Eds.). (1994). *Beyond Terman: Contemporary longitudinal studies of giftedness and talent*. Ablex.
- Subotnik, R. F., Olszewski-Kubilius, P., & Worrell, F. C. (2011). Rethinking giftedness and gifted education: A proposed direction forward based on psychological science. *Psychological Science in the Public Interest, 12*(1), 3–54. <https://doi.org/10.1177/1529100611418056>
- Südkamp, A., & Möller, J. (2009). Referenzgruppeneffekte im Simulierten Klassenraum. Direkte und indirekte Einschätzungen von Schülerleistungen [Reference-group-effects in a simulated classroom: Direct and indirect judgments]. *Zeitschrift für Pädagogische Psychologie, 23*, 161–174. <https://doi.org/10.1024/1010-0652.23.34.161>
- Terman, L. M. (1925). *Mental and physical traits of a thousand gifted children*. Stanford University Press.
- Terman, L. M. (1954). The discovery and encouragement of exceptional talent. *American Psychologist, 9*(6), 221–230. <https://doi.org/10.1037/h0060516>
- Terman, L. M., & Oden, M. H. (1947). *The gifted child grows up: twenty-five years' follow-up of a superior group*. Stanford University Press.
- Tettenborn, A. (1996). *Familien mit hochbegabten Kindern* [Families with gifted children]. Waxmann.
- Thoemmes, F. J., & Kim, E. S. (2011). A systematic review of propensity score methods in the social sciences. *Multivariate Behavioral Research, 46*(1), 90–118. <https://doi.org/10.1080/00273171.2011.540475>
- VanTassel-Baska, J. (2003). *Curriculum planning and instructional design for gifted learners*. Love.
- Vock, M., Köller, O., & Nagy, G. (2013). Vocational interests of intellectually gifted and highly achieving young adults. *British Journal of Educational Psychology, 83*(2), 305–328. <https://doi.org/10.1111/j.2044-8279.2011.02063.x>
- von Hippel, P. T. (2018). How many imputations do you need? A two-stage calculation using a quadratic rule. *Sociological*

- Methods & Research*. Advance online publication. <https://doi.org/10.1177/0049124117747303>
- Voyer, D., & Voyer, S. D. (2014). Gender differences in scholastic achievement: A meta-analysis. *Psychological Bulletin*, *140*(4), 1174–1204. <https://www.apa.org/pubs/journals/releases/bul-a0036620.pdf>
- Warne, R. T. (2016). 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. (2019). An evaluation (and vindication?) of Lewis Terman: What the father of gifted education can teach the 21st century. *Gifted Child Quarterly*, *63*(1), 3–21. <https://doi.org/10.1177/0016986218799433>
- Warne, R. T., & Liu, J. K. (2017). Income differences among grade skippers and non-grade skippers across genders in the Terman sample, 1936–1976. *Learning and Instruction*, *47*(February), 1–12. <https://doi.org/10.1016/j.learninstruc.2016.10.004>
- Weiß, R. H. (2006). *Grundintelligenztest Skala 2–Revision* [Culture Fair Intelligence Test Scale 2–revised]. Hogrefe.
- Weidinger, A. F., Steinmayr, R., & Spinath, B. (2018). Changes in the relation between competence beliefs and achievement in math across elementary school years. *Child Development*, *89*(2), e138–e156. <https://doi.org/10.1111/cdev.12806>
- Wendt, H., & Schwippert, K. (2017). Lesekompetenzen von Schülerinnen und Schülern mit und ohne Migrationshintergrund [Reading skills of students with and without immigration background]. In A. Hußmann, H. Wendt, W. Bos, A. Bremerich-Voss, D. Kasper, E.-M. Lankes, N. McElvany, T. Stubbe, & R. Valtin (Eds.), *IGLU 2016. Lesekompetenzen von Grundschulkindern in Deutschland im internationalen Vergleich* (pp. 219–234). Waxmann. [https://www.pedocs.de/volltexte/2018/15476/pdf/Hussmann\\_et\\_al\\_2017\\_IGLU\\_2016.pdf](https://www.pedocs.de/volltexte/2018/15476/pdf/Hussmann_et_al_2017_IGLU_2016.pdf)
- Wirthwein, L., Bergold, S., Preckel, F., & Steinmayr, R. (2019). Personality and school functioning of intellectually gifted and nongifted adolescents: Self-perceptions and parents' assessments. *Learning and Individual Differences*, *73*(July), 16–29. <https://doi.org/10.1016/j.lindif.2019.04.003>
- Wirthwein, L., & Rost, D. H. (2011). Giftedness and subjective well-being: A study with adults. *Learning and Individual Differences*, *21*(2), 182–186. <https://doi.org/10.1016/j.lindif.2011.01.001>
- Zeidner, M. (2020). “Don’t worry - be happy”: The sad state of happiness research in gifted students. *High Ability Studies*. Advance online publication. <https://doi.org/10.1080/13598139.2020.1733392>
- Zeidner, M., & Shani-Zinovich, I. (2011). Do academically gifted and nongifted students differ on the Big-Five and adaptive status? Some recent data and conclusions. *Personality and Individual Differences*, *51*(5), 566–570. <https://doi.org/10.1016/j.paid.2011.05.007>
- Zeidner, M., & Shani-Zinovich, I. (2015). A comparison of multiple facets of self-concept in gifted vs. non-identified Israeli students. *High Ability Studies*, *26*(2), 211–226. <https://doi.org/10.1080/13598139.2015.1095076>

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**Linda Wirthwein** received her PhD in 2010 from the Philipps-University Marburg, Germany, for her work on the subjective well-being of intellectually gifted adults. From 2006 to 2012, she worked as a psychologist at a counselling center with a focus on intellectual giftedness. Since 2012, she is a research associate at the TU Dortmund University. Besides intellectual giftedness her main research interests are motivational determinants of academic achievement (with a special focus on achievement goals) and determinants of students' subjective well-being. Her work has been published in refereed journals such as the *Journal of Educational Psychology*, *Educational Research Review*, *European Journal of Psychology of Education* and *Learning and Individual Differences*.

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