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High-achieving rural middle-school students' academic self-efficacy and attributions in relationship to gender

Susan G. Assouline[a], Duhita Mahatmya[a], Lori Ihrig[a] and Erin Lane[b]

[a]The Connie Belin & Jacqueline N. Blank International Center for Gifted Education and Talent Development, College of Education, University of Iowa, Iowa City, IA, USA; [b]Counselor Education, Western Illinois University, Macomb, IL, USA

ABSTRACT

This research investigates high-achieving, rural middle-school students' academic attributions and self-efficacy. The study sample (n = 77) included middle-school students attending schools in rural districts in a predominately rural, Midwestern state in the United States (U.S.). There was high participation in the Free and Reduced Lunch (FRL) program in the sample (average of 45.1% among the 8 participating districts). Students attending rural, under-resourced schools in the U.S. are vulnerable with respect to full academic development. We identified academic potential through the administration of a nationally standardized above-level test. Although there were no differences in the study sample's female and male students' scores in any of the four subject areas on the above-level test, there were differences for some of the psychosocial variables. A greater percentage of high-achieving males attributed both general school success and math success to ability; a greater percentage of high-achieving female students attributed general school success and math success to effort. Students in rural school districts often lack access to advanced educational opportunities, which may shape their beliefs about academic potential and self-efficacy and impact decisions regarding advanced coursework. Implications for school practitioners to foster the immediate and long-term talent development of high-achieving rural students are discussed.

KEYWORDS
High-achieving; rural; attribution; self-efficacy; adolescence

1. Introduction

As is true with all societies, the United States (U.S.) educational system serves a critical role in the academic and social development of children. In particular, the Kindergarten – Grade 12 (K-12) years (the terminal grade prior to students entering the workforce, college, university, or technical school) aims to prepare students for postsecondary life. The importance of postsecondary educational completion in the U.S. is related to subsequent career pursuits

CONTACT Susan G. Assouline susan-assouline@uiowa.edu The Connie Belin & Jacqueline N. Blank Center for Gifted Education and Talent Development, College of Education, University of Iowa, 600 Blank Honors Center, Iowa City, IA 52242, USA

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and ultimately to financial attainment (Mahatmya & Smith, 2017). Although beyond the scope of this study, an underlying fact, reported by the Aspen Institute College Excellence Program Report on labor market trends, reveals that, "graduating from college results in higher employment rates and earnings … for example, … over a lifetime college graduates earn 2.3 USD million on average, compared to 1.3 USD million for high school graduates" (2015, p. 8). The most current data from the *National Center for Education Statistics* (National Center for Education Statistics [NCES], 2015a, Table B.3.b-1) reveal a large disparity in the rate of 18–24-year-old individuals who enroll in postsecondary institutions by locale: students from cities or suburbs are much more likely to attend a postsecondary institution compared to students from rural areas (45% versus 29.3%, respectively; NCES, 2015a). Assuming a normal distribution of academic ability, and therefore academic achievement, regardless of zip code (Fan & Chen, 1999), the discrepancy should be minimal. However, location, especially rurality, matters when it comes to access and opportunities for postsecondary success (Backman, 2014; Bouck, 2004; Friesen & Purc-Stephenson, 2016, 2013; NCES, 2007).

Approximately half of all U.S. public-school districts are rural, and more than nine million students attend rural schools (NCES, 2013). Rurality is defined by "… all population, housing, and territory not included within an urbanized area or urban cluster" (Ratcliffe, Burd, Holder, & Fields, 2016, p. 3). Schools in rural communities tend to have higher rates of poverty and fewer resources (Hardré, Sullivan, & Crowson, 2009). Students in rural schools are also less likely to attain advanced levels of education compared to their urban peers – even after accounting for high academic achievement (Kittleson & Morgan, 2012). These statistics highlight the importance of understanding access to educational opportunities for rural students (Johnson & Strange, 2007; Provasnik et al., 2007). In addition to the disparities in postsecondary attendance by rurality, there are differences between male students and female students with respect to the rate of degree attainment in science, technology, engineering, and mathematics (STEM; National Research Council, 2006). As reported by NCES (2015b), data from 2013–14 reveal that a higher percentage (57%) of bachelor's degrees were awarded to female students than male students (43%); however, in the STEM fields, 35% of the degrees were awarded to female students and 65% to male students.

The observed postsecondary gaps related to rurality and gender notwithstanding, U.S. researchers also have documented a K–12 phenomenon known as the excellence gap, which is an achievement gap that exists at advanced levels of performance for under-represented and low-income students (Plucker, Hardesty, & Burroughs, 2013; Plucker & Harris, 2015; Plucker & Peters, 2018). The postsecondary gaps coupled with the K–12 excellence gaps make salient the need to further understand what other factors may contribute to student success, especially for at-risk students who are high-achievers (Libbey, 2004; McKellar, Marchand, Diemer, Malanchuk, & Eccles, 2018).

Our research addresses the critical need to better understand equity and gender issues in rural educational contexts (Biddle & Azano, 2016) by investigating the key psychosocial characteristics of high-achieving middle school students who demonstrate the potential to enroll and succeed in college yet are considered at risk for full realization of their academic potential (Plucker & Peters, 2018). Specifically, we investigated the relationships between the psychosocial characteristics of attribution choices and self-efficacy for female and male students who demonstrate high academic achievement and attend rural school districts in under-resourced communities.

1.1. Academic talent development

Educators and psychologists invested in the academic success of students also are familiar with the impact on student learning of individual differences in the physical, cognitive, and psychosocial realms. Typically-developing students' academic needs are addressed through the regular classroom curriculum. Students with delayed development have access to special education services; whereas students with advanced achievement may access school-based gifted education services or university-based talent development programs. Talent development has a robust research-base and educators and psychologists use talent development as a theoretical framework from which to conduct research and create student programs (Subotnik, Olszewski-Kubilus, & Worrell, 2011).

There are a variety of talent development models (Subotnik et al., 2011) and one of the more well-known and extensively researched models is the Talent Search Model (Stanley, 1976). Academic talent discovery and development are the primary aims this model, which includes a two-step identification process. The first step in the process is to determine which students are considered high achievers, i.e. those who earn scores in the upper percentiles (e.g. at the 95th percentile) on a grade-level standardized achievement test (Lupkowski-Shoplik & Swiatek, 1999). Because high-achieving students have reached the ceiling on grade-level tests, an above-level test is needed to discover high-achieving students with the aptitude for advanced academic content. Therefore, the second step in the process is the administration of a standardized, above-level test to academically high-achieving students (Assouline & Lupkowski-Shoplik, 2012; Olszewski-Kubilius, 2015; Stanley, 2005; Swiatek, 2007) in order to find, among the high-achievers, students with high aptitude in a specific content area and readiness for advanced challenges. The first step of the model, administration of the grade-level achievement test and identifying the high achievers, takes place in schools; however, it is traditionally parents who are responsible for enrolling their students in the next step, above-level testing. Traditionally (Olszewski-Kubilius, 2015), above-level testing occurs through university-based talent search organizations, which offer excellent services to gifted students; however, these services, including the above-level testing, are typically available only outside of the K-12 classroom setting (Assouline, Ihrig, & Mahatmya, 2017; Assouline, Lupkowski-Shoplik, & Colangelo, 2018; Olszewski-Kubilius, 2015; Olszewski-Kubilius & Lee, 2004, 2005).

Whereas talent searches annually serve tens of thousands of students, their university-based administration means that their services and programs are largely inaccessible to rural students, which perpetuates the discrepancy between rural and non-rural students with respect to access to resources and opportunities in rural school districts. There are multiple ways of addressing a lack of access to services and our study included three specific procedures designed to broaden the talent pool and increase access. First, we brought the concept of above-level testing into the school setting, which addressed the issue of access. Second, we encouraged teachers to recommend students at the 85^{th} percentile on any one of the grade-level achievement subtests so that services and programming were accessible to more high-achieving students. Finally, the assessment process included measures of academic content as well as measures of psychosocial factors with an aim of better understanding the role of psychosocial characteristics, specifically academic attribution and self-efficacy, when developing the academic talents of high-achieving students.

1.2. Psychosocial factors

Viewing rural education through a deficit approach neglects factors that often are strengths of rural schools, including high expectations for students and a supportive learning environment (Barley & Beesley, 2007). Scholars recognize the important role that a supportive school environment has on students' perceptions of their academic successes and failures, and academic self-efficacy (Eccles, 2004; Eccles & Wigfield, 2002; Forsyth, Story, Kelley, & McMillan, 2009; Graham, 1991; Libbey, 2004). Attributions for academic success and failure and self-efficacy are the psychosocial factors of interest in this study. How individuals explain a result (e.g. success due to luck or ability) is known as an attribution (Weiner, 1974, 1985, 2010). How individuals perceive their ability to achieve a desired outcome (e.g. better than most) is sense of self-efficacy (Bandura, 1977, 1994). Academic attributions and self-efficacy begin developing well before high school and have relevance for high-achieving students (Assouline, Colangelo, Ihrig, & Forstadt, 2006; Casillas et al., 2012; Csikszentmihalyi, Rathunde, & Whalen, 1993; Dixon, Worrell, Olszewski-Kubilius, & Subotnik, 2016; Subotnik et al., 2011).

1.2.1. Attribution

Attributions can be thought of as the perceived causes behind certain outcomes; this definition relies on the assumption that humans are interested in understanding and seeking mastery of their environment (Weiner, 1985). Attribution theory initially categorized perceived causes of achievement outcomes – success or failure – which include ability, effort, task difficulty, and luck along two dimensions: 1) fixed or variable stability, and 2) internal or external locus (Weiner, 1974, 1985, 2010). Ability and effort are the most common attributions (Weiner, 1974). Controllability added a third dimension to the model as a way of correcting for the possible confounding variable of locus of control (Pintrich & Schunk, 1996). The full three-dimensional attribution model is presented in Table 1.

The attributions of ability and effort are internal to individuals. Ability is most commonly perceived as stable and uncontrollable, while effort is perceived as controllable and varies according to the stability dimension. The attribution choices of "I work hard," or "I don't work hard enough" correspond to long-term effort, which is considered internal, controllable, and stable. Long-term effort is regarded as a stable characteristic because it represents industriousness and persistence, a factor more recently referred to as grit (Dixon et al., 2016). The attribution choices of, "I did my work the right way," or, "I did not do my work the right way," correspond to situational effort. Situational effort, like long-term effort, is also internal and controllable, but it may vary according to the activity.

The attributions of effort and ability represent crucial psychosocial factors for high-achieving students because they may be at risk of forming a misguided understanding of giftedness as being equated to a combination of little effort and natural ability (Muratori & Smith, 2018). There is some evidence that when high-achieving students encounter obstacles – despite having evidence of ability – they attribute their difficulty to lack of ability (Dweck, 1986; Licht & Dweck, 1984; Nokelainen, Tirri, & Merenti-Välimäki, 2007; Stipek & Hoffman, 1980; Ziegler & Stoeger, 2004). Furthermore, some scholars have expressed concern that an individual's belief that success is dependent upon ability may result in negative academic achievement outcomes (Dai, Moon, & Feldhusen, 1998; Dweck, 1986; McNabb, 1997; Muratori & Smith, 2018). There is a great deal of research documenting the negative consequences of attributing failure to ability, including expecting future failure and creating impediments that make failure more likely (Graham & Taylor, 2016).

Earlier investigations of attributional choice by sex and academic subject yielded equivocal results. In two separate studies (Ryckman & Peckham, 1987; Stipek & Gralinski, 1991), researchers looked at attributional choice according to sex and subject area and found that female students attributed failure to lack of ability and success to effort while male students attributed

Table 1. Dimensions of Attribution Choices and Corresponding Survey Items.

	Locus of Control			
	Internal		External	
Stability	Controllable	Uncontrollable	Controllable	Uncontrollable
Fixed(Stable)	**Effort** (Long-term) I work hard (success) I don't work hard enough (failure)	**ABILITY** I am smart (success) I am not smart enough (failure)	**Instructor Favoritism** My teachers like me (success) My teachers don't like me (failure)	***TASK DIFFICULTY*** The work is easy (success) The work is hard (failure)
Variable (Unstable)	**EFFORT** (Situational, e.g. Did work the right way) I don't do my work the right way (failure) I don't do my work the right way (failure)	Mood No item on survey	Help from teacher, tutor, or classmates No item on survey	**LUCK** **I am lucky (success)** **I have bad luck (failure)**

Original dimensions and attribution causes (ability, situational effort, task difficulty, luck) adapted from (Weiner, 1974, pp. 6 and 147), are in **BOLD UPPERCASE**; expanded attribution causes and dimension of controllability (Long-term effort, instructor favoritism) are **bold lowercase**, adapted from (Pintrich & Schunk, 1996, p. 134.) The six corresponding survey items are listed below the attribution cause; two causes (mood and help) did not have survey items.

success to ability and failure to effort. In contrast, and with an investigation specifically in math, Cramer and Oshima (1992) found that both male students and female students attributed success in math to effort and failure in math to lack of ability. Evidence from a large sample of academically high-achieving students demonstrated that they do not attribute academic failure to lack of ability (Assouline et al., 2006). This latter study aligns with a review of research on personality factors and giftedness that suggests gifted students attribute success to their ability and effort and failure to bad luck or inappropriate strategies (Olszewski-Kubilius, Kulieke, & Krasney, 1988). Scholarship to inform our understanding of academic attributions of academically high-achieving rural students is important to educators and students alike; however, the current state of this scholarship has yielded equivocal results.

1.2.2. Self-efficacy

Self-efficacy is an individual's belief regarding the ability to succeed at a task (Bandura, 1977). Self-efficacy and motivation are intricately connected (Schunk & Meece, 2006) and Schunk's (1991) extensive discussion of motivation and self-efficacy lends support for comprehensively considering these psychosocial factors. In particular, Schunk suggested that sense of self-efficacy impacts activity choice and effort. In rural students, self-efficacy has been shown to significantly predict attitudes about both academic and career opportunities (Ali & McWhirter, 2006; Wettersten et al., 2005).

Gender differences in academic self-efficacy within the general population have been extensively studied. A meta-analysis of these studies (Huang, 2013) demonstrates that male students show greater self-efficacy in math, female students indicate a higher self-efficacy in language arts, and no gender differences are present in science self-efficacy. However, as reported by Huang, math self-efficacy did not reach peak divergence between male students and female students until late adolescence. When studying gifted math students, a different trend emerges and math self-efficacy is equally high in male and female middle and high school students (McCormick, 1996). As Schunk (1991) suggests, there is evidence that math self-efficacy is a particularly important variable in the academic and career choices of gifted female middle and high school students – especially when considering math and science-related careers (McCormick, 1996). However, by high school, female students in Advanced Placement (AP) courses reported lower academic self-efficacy and higher task motivation than their male counterparts (Allio, 2017).

1.3. Intersection of rurality, psychosocial factors, sex, and academic achievement

Rural education is often presented in scholarly research within the context of disadvantage (Byun, Meece, & Irvin, 2012) and rural education research is generally limited (Arnold, Newman, Gadd, & Ceri, 2005). Fewer still are studies that examine the intersection of rural education, gifted education, and gender. While not specifically an investigation of rural, gifted, and gender, Preckel, Goetz, Pekrun, and Kleine (2008) included rural students in their sample of sixth graders for research on gender differences in achievement, academic self-concept, interest, and motivation in mathematics. Students in both the average and gifted subsamples demonstrated gender differences. Male students out-performed female students on math achievement tests, measures of academic self-concept, interest, and motivation. The differences between male students and female students were greatest in the gifted sample. Lamb and Daniels (1993) studied the feasibility of improving gifted female students' attitudes toward mathematics while also determining if there were differences related to school setting (urban or rural). They found that the 18-week intervention positively impacted female students regardless of locale.

In another study seeking to understand student aspirations in rural communities, the authors found that students who are highest achieving are the most attached to their communities with a strong desire to stay, or return, to their communities (Petrin, Schafft, & Meece, 2014). In short, it appears that educators and psychologists have little best-practice evidence to guide their understanding of the intersections of rurality with academic attributions, self-efficacy, high-achievement, and gender.

1.4. The current study

Access to talent discovery and talent development opportunities is a major issue for high-achieving students in rural schools. Another concern relates to psychosocial factors necessary to support the learning, academic success, and aspirations of high-achieving students (Uno, Mortimer, Kim, & Vuolo, 2010). For high-achieving students in rural schools, limited access to academic experiences that are appropriately challenging may impact these factors (Hardré & Reeve, 2003). Thus, studying the role of psychosocial characteristics – such as attributions and self-efficacy – to understand how best to support the learning and academic success of high-achieving rural students to promote equitable development of postsecondary aspirations is important (Uno et al., 2010).

Within our sample of rural middle-school students with high academic achievement, the current study explores gender differences in attribution choices for academic success and failure and academic self-efficacy. Drawing from the theoretical and empirical literature, we studied three research questions: 1) to what extent do similarly performing high-achieving male and female students in rural schools indicate different attribution choices for their success and failures in school; 2) to what extent do high-achieving male and female students indicate different perceptions of academic self-efficacy compared to their peers; and 3) how are different attribution choices and perceptions of self-efficacy associated with achievement? Attending to differences in psychosocial factors, considering similar academic achievement in a rural context, may provide educators, psychologists, and guidance counselors with more effective academic and career programming options to increase students' career and college aspirations.

2. Methods

2.1. Participants

The study sample drew from a talent pool of high-achieving sixth-grade students who participated in an intensive extracurricular STEM program designed for rural schools in the U.S. To participate in the STEM program, rural school districts from a predominately rural Midwestern state in the United States were invited to apply. Selection of participating districts was based upon: (a) program commitment as exhibited through the application process, (b) location (implementation sites throughout state), and (c) free and reduced priced lunch (FRL) status (The United States Department of Agriculture (n.d.) reports that European countries, e.g. Germany and France among others, were conducting extensive food services for children-in-need as far back as the late 1700s).

Participating schools received funds to support the implementation of the program; participants did not pay fees to participate. At the time of this study, the STEM program was in its second year of implementation in 8 school districts across the state. The data were collected at the conclusion of the first year of the program's implementation. The total number of students who completed Year 1 of the STEM program was 136; 56.6% (n = 77) of students consented to the research portion of the study and completed all research (participating in research was independent and voluntary from participation in the STEM program). Most students in the sample were white (90.9%), with 1.3% identifying as Hispanic or Latinx, 3.9% as multiracial, and 2.6% preferring not to report their race. Due to privacy, we were not able to obtain individual Free and Reduced Lunch (FRL) data; however, the average FRL rate for the eight schools was 45.1% (range 27.1%-60.4%). The sample included 51% male students (n = 39) and 49% female students (n = 38).

2.2. Procedure

In the spring of students' fifth-grade year (the year prior to STEM program participation), students were invited to enroll in the Talent Search Model of above-level testing within their school setting. Teachers registered high-achieving (defined by the performance of one standard deviation or higher on a grade-level standardized achievement test) students for the above-level test. All the above-level tests and answer sheets were returned to the researchers and sent to the U.S. testing company, ACT, for scoring. The scores from the above-level tests were used by teachers to recommend students for participation in the STEM program commencing in the fall of the following year, which would be grade six for students who chose to participate.

At the conclusion of the first year of implementation (end of sixth grade year), participating students (N = 136) took a parallel form of the above-level test as a posttest. A subset of the 136 students (n = 77) voluntarily consented to research participation and completed an online survey, which collected information about their satisfaction and experiences with the program, their attribution choices for success and failure, and the sense of academic self-efficacy. Approval from the university's human subjects review board was granted for this research.

2.3. Measures

2.3.1. Student aptitude

Students took the eighth-grade test, Explore (ACT, 2013) as part of the extracurricular program identification (pretest) and evaluation (posttest). The study uses students' posttest Explore scores. Explore uses a multiple-choice format with responses indicated on a machine-scored answer form. All tests and answer forms were scored by ACT. Explore included four tests: English (40 items), Math (30 items), Reading (30 items), and Science (28 items). Each test is comprised of content developed for the average eighth grader. Explore was administered as an above-level test to high-achieving sixth graders in the sample at the conclusion of the first year of the STEM extracurricular program. ACT (2013) reports that ACT Explore reliability coefficients and average standard errors of measurement (SEM) are weighted frequency distributions. Kuder–Richardson 20 (KR-20) internal consistency reliability coefficients for Form A, Grade 8 ACT Explore scale scores are English, 0.84 (SEM = 1.66); Math, 0.76 (SEM = 1.71); Reading, 0.86 (SEM = 1.44); and Science, 0.79 (SEM = 1.53). Raw scores are converted to a scale score; scale score ranges are 1–25. Our analyses used students' scale scores.

2.3.2. Student attribution and self-efficacy

At the end of the first year of program implementation, students completed a 62-item online survey, of which 23 questions were related to students' psychosocial characteristics. Eight questions focused on student choice of attributions for success or failure in three content areas: math, science, language arts, as well as school in general. Items related to students' attribution of success asked, "When you do well in [math/science/language arts/school in general] it is usually because." Items related to students' attribution of failure asked, "When you DON'T do well in [math/science/language arts/school in general] it is usually because." There were six forced-choice responses for each item. The forced-choice responses were grounded in the three-dimensional attribution model presented in Table 1 and have been validated and used in previous studies (Assouline et al., 2006; McClure et al., 2011; Vispoel & Austin, 1995). Eight questions asked about students' self-efficacy; students were asked to rate themselves about their ability relative to male and female students in their grade on mathematics, science, and school in general.

2.4. Data analysis protocol

We performed a series of chi-square analyses as well as factorial Multivariate Analysis of Variance (MANOVA) tests to examine gender differences in attributional choices and academic self-efficacy. Because the main study variables were measured at a nominal level we used chi-square ($\chi 2$) tests of independence to examine gender differences. Given the number of cells in the comparisons, adjusted standardized residuals were calculated in the chi-square tests to determine the cells whose observed and expected frequencies varied beyond chance (adjusted standardized residual > |2|) (Bishop, Fienberg, & Holland, 1975; Haberman, 1973; Saewyc et al., 2009). We used factorial MANOVAs to examine main and interaction effects of gender, attribution choice, and self-efficacy on student aptitude. Given that the measure of students' aptitude (Explore) was comprised of several correlated subtests, the use of factorial MANOVA helped to account for the linear dependence among the variables and guard against Type I error (Huberty & Morris, 1989); Wilk's Lambda (λ) and partial eta-squared ($\eta 2$) are reported in tables. To account for the number of tests we performed in this study, we used a corrected, experiment-wise p-value of 0.016 ($p = 0.05/3$ research questions) to assess significance.

3. Results

3.1. Descriptive overview of the sample

Prior to running inferential statistics on the study variables with the analytic sample (n = 77), we examined the distribution of Explore scores on all students who completed the first year of the STEM program (N = 136). This analysis was conducted to operationalize high-aptitude (the second step of the Talent Search Model, above-level testing) among the high-achievers (the first step of the Talent Search Model, grade-level tests) for this study. We also inspected the data regarding meeting assumptions for conducting multivariate, inferential statistics.

As aforementioned, Explore was created for typically developing eighth graders and was used as an above-level measure for differentiation among high-achieving students and identification of high-aptitude students for an extracurricular STEM talent development program. Scores for typically-developing eighth graders (the normative group for whom the test was developed) are reported as well as the scores for all of the program participants and the study sample in Table 2. Both the program participant sample of sixth graders (N = 136) as well as the analytical study sample of sixth graders (n = 77) out-performed the normative sample eighth graders, a strong indication of the students' academic potential. Although there was a statistically significant difference between the study sample average score compared to the program participants' average score for science (the study sample's scores were higher), this difference had no bearing on the results for this investigation. There were no statistically significant differences between study sample male students and study sample female students on the four Explore tests. These results confirm the assumption that the sample is comprised of high-achieving students, who have demonstrated high aptitude for advanced content and male students and female students exhibit similar academic aptitude. The data also met statistical assumptions necessary to conduct inferential statistics: the dependent variables of interest, Explore scores, were correlated with coefficients ranging from r = 0.15–0.66, p <.05; Bartlett's test of sphericity indicated a significant correlation between the dependent variables. The

Table 2. Mean Explore Scores by Respondent Gender.

		Math	Science	English	Reading
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
National 8th grade norm		15.5 (3.5)	16.6 (3.3)	14.7 (4.2)	14.6 (3.9)
6th grade program participants (N = 136)		17.46 (2.78)	18.00 (2.94)	15.80 (5.56)	16.27 (3.13)
Study sample (n = 77)	Total	17.78 (2.78)	18.66 (3.04)	15.92 (6.31)	16.73 (3.15)
	Male	18.13 (2.75)	18.72 (3.36)	15.51 (6.17)	16.72 (2.90)
	Female	17.42 (2.73)	18.61 (2.72)	16.34 (6.50)	16.74 (2.90)

scores on each subtest demonstrated a normal distribution with no extreme outliers, skewness and kurtosis within the acceptable range, and homogeneity of variance-covariance matrices (i.e. non-significant Box's M tests).

3.2. Differences in attributions

Table 3 illustrates students' attribution choices for success and failure in general school and three academic areas, mathematics, science, and language arts. Students most commonly attributed success in school in general, mathematics, and science to ability; long-term effort was the most common attribution for success in language arts. Students' choice of long-term effort was the most common attribution for failures in school in general, mathematics, science, and language arts. In some areas – math failure, science failure, and language arts failure – task difficulty was also a commonly selected attribution. Luck and teacher favoritism were rarely selected across all academic areas. In general, with respect to attributions for failure for school in general or in any of the specific content areas, the number of students attributing failure to lack of ability was very small (n = 1 to 3 for any attribution of lack of ability to failure).

Observed differences among the six attribution choices were most striking when comparing attributions for success in school in general and math. For the overall comparison between male and female students for success in school, a greater percentage of male students (48.7%) attributed their success to ability compared to 18.4% of female students; female students (28.9%) were more likely than male students (10.3%) to attribute general school success to situational effort. Given the number of cells, Cramer's V was calculated to determine the effect size. For these comparisons, Cramer's V = 0.36, which is interpreted as a medium effect size; however, the chi-square test statistic had a p-value = 0.02, which did not meet the experiment-wise adjusted p-value to be considered statistically significant. A similar pattern was detected for the overall comparison between male and female students for math success; this finding was statistically significant at the adjusted p-value (p = .014). Compared to 21.1% of female students, 53.8% of male students attributed their success in math to ability. Female students attributed their math success to task ease (15.8%) at a higher rate than male students (2.6%). For these comparisons, Cramer's V = 0.37, which suggests a medium effect size.

A series of two-way MANOVA tests was conducted to test the main and interaction effects of attribution choice and gender on the four Explore subtests. Separate two-way MANOVAs were tested for the attribution choices by academic area (e.g. general school, math, science, language

Table 3. Percentage of Respondent Attributions for Success and Failure for Total Sample (n = 77) and by Gender.

		Ability	Long-Term Effort	Task Difficulty	Luck	Instructor Favoritism	Situational Effort	
Academic Area	Sample	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	$\chi2$ (df)
General School Success	Total	33.8	37.7	9.1	0.0	0.0	19.5	9.80*
	Male (n = 39)	**48.7 (19)**	30.8 (12)	10.3 (4)	0.0 (0)	0.0 (0)	**10.3 (4)**	(3)
	Female (n = 38)	**18.4 (7)**	44.7 (17)	7.9 (3)	0.0 (0)	0.0 (0)	**28.9 (11)**	
General School Failure	Total	5.2	46.8	24.7	3.9	1.3	18.2	6.70
	Male	2.6 (1)	59.0 (23)	17.9 (7)	2.6 (1)	2.6 (1)	15.4 (6)	(5)
	Female	7.9 (3)	34.2 (13)	31.6 (12)	5.3 (2)	0.0 (0)	21.1 (8)	
Math Success	Total	37.7	33.8	9.1	0.0	0.0	19.5	10.60**
	Male	**53.8 (21)**	28.2 (11)	**2.6 (1)**	0.0 (0)	0.0 (0)	15.4 (6)	(3)
	Female	**21.1 (8)**	39.5 (15)	**15.8 (6)**	0.0 (0)	0.0 (0)	23.7 (9)	
Math Failure	Total	3.9	29.9	39.0	6.5	1.3	19.5	4.78
	Male	2.6 (1)	33.3 (13)	30.8 (12)	5.1 (2)	2.6 (1)	25.6 (10)	(5)
	Female	5.3 (2)	26.3 (10)	47.4 (18)	7.9 (3)	0.0 (0)	13.2 (5)	
Science Success	Total	29.9	31.2	9.1	2.6	0.0	27.3	6.29
	Male	35.9 (14)	23.1 (9)	5.1 (2)	5.1 (2)	0.0 (0)	30.8 (12)	(4)
	Female	23.7 (9)	39.5 (15)	13.2 (5)	0.0 (0)	0.0 (0)	23.7 (9)	
Science Failure	Total	2.6	37.7	32.5	6.5	1.3	19.5	5.25
	Male	0.0 (0)	35.9 (14)	28.2 (11)	7.7 (3)	2.6 (1)	25.6 (10)	(5)
	Female	5.3 (2)	39.5 (15)	36.8 (14)	5.3 (2)	0.0 (0)	13.2 (5)	
Language Arts Success	Total	22.1	31.2	15.6	2.6	0.0	28.6	3.20
	Male	17.9 (7)	33.3 (13)	12.8 (5)	5.1 (2)	0.0 (0)	30.8 (12)	(4)
	Female	26.3 (10)	28.9 (11)	18.4 (7)	0.0 (0)	0.0 (0)	26.3 (10)	
Language Arts Failure	Total	1.3	40.3	36.4	2.6	1.3	18.2	5.74
	Male	2.6 (1)	38.5 (15)	30.8 (12)	5.1 (2)	0.0 (0)	23.1 (9)	(5)
	Female	0.0 (0)	42.1 (16)	42.1 (16)	0.0 (0)	2.6 (1)	13.2 (5)	

*p <.05. **p < 016. Chi-square statistics represent the difference among the attribution choices by gender. Cells with percentages in bold represent the attribution choices for which differences between males and females were statistically significant.

arts). Across the models (Table 4), the multivariate effects were not significant by attribution choice or gender.

3.3. Differences in self-efficacy

As reported in Table 5, most of the students perceived themselves to be better than most of their same-grade peers in all academic areas. When comparing by gender, high-achieving male students were more likely to rate themselves as better than most of their grade-level male and female peers in math (p = 0.04); however, this finding did not meet statistical significance using the adjusted p-value. Although not statistically significant, there was a general, descriptive trend of relatively fewer high-achieving female students compared to high-achieving male students rating themselves as "better" than their grade-level peers in mathematics. Nearly 1 out of 3 high-achieving female students rated themselves as the same as most grade-level male students in mathematics; however, only 1 out of 10 high-aptitude male students see themselves as the same.

A series of two-way MANOVA tests also was conducted to test the main and interaction effects of self-efficacy and gender on the four Explore subtests. Separate two-way MANOVAs were tested for self-efficacy by academic area (e.g. general school, math, science, language arts). Across the

Table 4. Summary of Results for Two-Way MANOVA to Examine Effects of Attribution and Gender on Explore Scores.

		Multivariate Test			
Model	Effect	λ	F (df)	P	$\eta 2$
1	General school success	0.89	0.68 (12)	0.77	0.04
	Gender	0.94	1.04 (4)	0.39	0.59
	Interaction	0.86	0.86 (12)	0.59	0.05
2	General school failure	0.70	1.21 (2)	0.25	0.09
	Gender	0.94	0.98 94)	0.43	0.06
	Interaction	0.77	1.11 (16)	0.35	0.06
3	Math success	0.89	0.69 (12)	0.76	0.04
	Gender	0.98	0.37 (4)	0.83	0.02
	Interaction	0.87	0.80 (12)	0.65	0.05
4	Math failure	0.75	0.94 (20)	0.53	0.07
	Gender	0.96	0.66 (4)	0.62	0.04
	Interaction	0.85	0.64 (16)	0.84	0.04
5	Science success	0.82	0.81 (16)	0.68	0.05
	Gender	0.96	0.76 (4)	0.55	0.04
	Interaction	0.89	0.63 (12)	0.81	0.04
6	Science failure	0.78	0.83 (20)	0.68	0.06
	Gender	0.95	0.78 (4)	0.54	0.05
	Interaction	0.83	1.03 (12)	0.42	0.06
7	Language arts success	0.80	0.96 (16)	0.50	0.06
	Gender	0.98	0.42 (4)	0.79	0.02
	Interaction	0.85	0.93 (12)	0.52	0.05
8	Language arts failure	0.77	0.67 (20)	0.63	0.06
	Gender	0.95	0.82 (4)	0.52	0.05
	Interaction	0.94	0.50 (8)	0.86	0.03

Table 5. Percentages and Chi-square Values of Respondent Academic Self-Efficacy for Total Sample (n = 77) and by Gender.

		Compared to Boys				Compared to Girls			
		Better than most	Same as most	Not as good as most		Better than most	Same as most	Not as good as most	
Academic Area	Sample	% (n)	% (n)	% (n)	$\chi 2$ (df)	% (n)	% (n)	% (n)	$\chi 2$ (df)
General School	Total	77.9	20.8	1.3	0.36	72.7	26.0	1.3	1.26
	Male (n = 39)	64.1 (31)	30.8 (8)	0 (0)	(1)	69.2 (27)	28.2 (11)	2.6 (1)	(2)
	Female (n = 38)	73.7 (28)	26.3 (10)	0 (0)		76.3 (29)	23.7 (9)	0 (0)	
Mathematics	Total	77.9	20.8	1.3	6.66*	79.2	20.8	0.00	3.04
	Male	**89.7 (35)**	**10.3 (4)**	0 (0)	(2)	87.2 (34)	12.8 (5)	0 (0)	(1)
	Female	**65.8 (25)**	**31.6 (12)**	2.6 (1)		71.1 (27)	28.9 (11)	0 (0)	
Science	Total	68.8	29.9	1.3	1.20	61.0	35.1	3.9	0.85
	Male	71.8 (28)	28.2 (11)	0 (0)	(2)	64.1 (25)	30.8 (12)	5.1 (2)	(2)
	Female	65.8 (25)	31.6 (12)	2.6 (1)		57.9 (22)	39.5 (15)	2.6 (1)	
Language Arts	Total	62.3	37.7	0.0	1.18	53.2	45.5	1.3	5.28
	Male	56.4 (22)	43.6 (17)	0 (0)	(1)	41.0 (16)	56.4 (22)	2.6 (1)	(2)
	Female	68.4 (26)	31.6 (12)	0 (0)		65.8 (25)	34.2 (13)	0 (0)	

*p < .05, **p < 016. Chi-square statistics represent the difference among the peer comparison choices by gender. Cells with percentages in bold represent the choices for which differences between males and females were significant.

Table 6. Summary of Results for Two-Way MANOVA to Examine Effects of Self-Efficacy and Gender on Explore Scores.

		Multivariate Test			
Model	Effect	λ	F (*df*)	*P*	η2
1	General school ability – compared to boys	0.94	1.12 (4)	0.35	0.06
	Gender	0.98	0.45 (4)	0.77	0.02
	Interaction	0.97	0.58 (4)	0.68	0.03
2	Math ability – compared to boys	0.95	0.46 (8)	0.88	0.03
	Gender	0.97	0.57 (4)	0.68	0.03
	Interaction	0.98	0.28 (4)	0.89	0.02
3	Science ability – compared to boys	0.93	0.65 (8)	0.74	0.04
	Gender	0.97	0.52 (5)	0.72	0.03
	Interaction	0.96	0.78 (4)	0.54	0.04
4	Language arts ability – compared to boys	0.91	1.81 (4)	0.14	0.09
	Gender	0.98	0.34 (4)	0.85	0.02
	Interaction	0.96	0.76 (4)	0.55	0.04
5	General school ability – compared to girls	0.92	0.78 (8)	0.62	0.04
	Gender	0.97	0.58 (4)	0.68	0.03
	Interaction	0.97	0.50 (4)	0.74	0.03
6	Math ability – compared to girls	0.98	0.42 (4)	0.80	0.02
	Gender	0.94	1.91 (4)	0.32	0.06
	Interaction	0.92	1.59 (4)	0.19	0.08
7	Science ability – compared to girls	0.97	0.27 (8)	0.97	0.02
	Gender	0.99	0.04 (4)	0.99	0.00
	Interaction	0.93	0.62 (8)	0.76	0.04
8	Language arts ability – compared to girls	0.85	1.49 (8)	0.17	0.08
	Gender	0.98	0.32 (4)	0.86	0.02
	Interaction	0.94	1.03 (4)	0.40	0.06

models (Table 6), the multivariate effects were not significant by self-efficacy or gender.

4. Discussion

High-achieving U.S. rural middle-school students with high academic aptitude may experience environmental and psychosocial vulnerabilities, which place them at risk of joining the permanent talent under-class and perpetuating the excellence gap (Plucker et al., 2013; Plucker & Peters, 2018). This may be due to lack of access to appropriately challenging coursework (environmental) and/or psychosocial factors that have the potential to influence decision-making about advanced coursework in high school. Previous studies (e.g. Dweck, 1986) yielded equivocal results with respect to attributions for failure and success as well as gender differences. Attributions to ability or effort (Pintrich, 2003) were of importance in our study to better understand high-achieving female and male students who attend under-resourced, rural middle schools. Understanding psychosocial factors such as attribution and self-efficacy can guide us in framing academic decision-making so that students' academic experiences are maximized and relevant to post-secondary decision-making, e.g. taking advanced coursework that prepares them for college or university.

The research questions guiding this study examined the extent to which high-achieving male and female students differed in their attributions of their success and failure in school and their academic self-efficacy. The results from the study showed that the high-achieving male and female students in our sample performed similarly on an above-level test, which suggests similar aptitude in content domains measured, i.e. math, science, and language arts. However, there were significantly different attributions for success between male and female students in school in general, and in math in particular. Male students tended to attribute their success to their ability, with greater percentages of male students attributing general school success to ability (48.7%) and math success to ability (53.8%) when compared to female students (18.4% and 21.1%, respectively). This finding comports with the attribution literature demonstrating the male students are more likely to attribute their success to ability (Cramer & Oshima, 1992; Ryckman & Peckham, 1987). Academically high-achieving middle-school male students' attributions of success to ability, coupled with their strong sense of self-efficacy, may be psychosocial features that support decisions to take more advanced coursework, which, in turn could impact postsecondary decisions.

Female students in our sample tended to attribute their success to their effort with greater percentages of female students (28.9%) attributing general school success to situational effort when compared to male students (10.3%). Very few male students (2.6%) attributed math success to task ease, which was a statistically significant difference from the percent of female students (15.8%) who attributed math success to task ease. Therefore, whereas the high-achieving female students and male students in this study have similar aptitude, female students are more likely to attribute their success to situational effort, which is internal, but not stable, or external factors such task ease, rather than to their ability. The concern is that female students' aptitude, which is similarly high compared to their male student counterparts – may not recognize their aptitude or how that aptitude contributes to achievement. Due to their attributions for success, female students are possibly expending time and effort beyond what is necessary for successful task completion, potentially leading to differences in taking advanced coursework, which could have life-long career impacts.

The results about the female students in the study expand upon the literature on high school academic achievement and self-efficacy among gifted, rural students. As Allio (2017) found, in high school, female students in AP courses report higher task motivation than their male peers. However, female students' sense of academic self-efficacy decreases throughout middle school and high school (McCormick, 1996; Schunk, 1991). These decreases may be exacerbated in rural settings given that rural schools already are more limited in the opportunities for students to access and complete advanced coursework. As well, Preckel et al. (2008) found, there were differences in the math achievement as well as motivation for male and female students in rural contexts. Given the gender differences in attribution and self-efficacy in our rural study sample of high-achieving students, intentional efforts must be made to mitigate the disparities in both psychosocial and academic outcomes for high-achieving students.

Although we hypothesized that if high-achieving students attributed academic success to academic ability, then failure would also be attributed to ability, this was not the case. Virtually no student in our sample attributed failure of any kind to lack of ability. This finding corresponds to the observation that both male and female students have strong self-efficacy relative to their perceptions of their ability compared to their age-peers, regardless of gender. Both the male and female students in this study see themselves as "better than most" in all academic areas. The only statistically significant difference was with respect to math. While 89.7% of the high-achieving male students in this study saw themselves as better in math than most male students, only 65.8% of the high-achieving female students in this study saw themselves as better in math than most male students. However, 31.6% of high-achieving female students see themselves as the "same as most" male students, compared to only 10.3% of high-achieving male students seeing themselves as "the same" as male students. Understanding the impact of these differences in self-efficacy may be crucial to understanding gendered differences in collaborative learning environments, leadership, and academic risk-taking among gifted and talented students. The current literature has limited scholarship on these variables in high-achieving rural populations, such as the current study's sample.

The high-achieving rural female and male students in our sample demonstrated equally high academic aptitude yet varied with respect to their attribution patterns as well as their commitment to school. More female students than male students attributed academic success to effort and female students had greater commitment to school. Motivation for succeeding in school, recognition of the role of ability and effort with respect to success, and the impact of self-efficacy represent psychosocial factors that should be addressed with male and female students as they consider decisions about taking challenging high school courses. Achievement, attribution, and self-efficacy are important for certain STEM college majors and ultimately careers, which may result in lifelong impacts on academic performance. These variables are particularly important to consider in rural contexts given the deficit view that is often taken when describing the achievement and attainment of rural students (Barley & Beesley, 2007).

4.1 Limitations

A strength of the investigation is the use of a nationally standardized measure, the Explore assessment, which reports validity and reliability data (ACT, 2013) and the implications for identifying young students with high aptitude are grounded in that information. In contrast, the psychosocial items, specifically the eight items measuring attributions and the eight items measuring self-efficacy, were part of a broader student program self-report survey; therefore, nationally normed reliability or validity data were not available, which is a study limitation. Another limitation is that participants completed a forced-choice questionnaire that did not have items relating to students' rationale for their attributions for success or failure or their choices related to academic self-efficacy. Further, while we drew our study sample from a rural population, our students represented one type of rural setting (Midwestern U.S., agrarian). Diversity exists within rurality in the U.S. as well as in other countries. In the U.S. that diversity is associated with race, socioeconomic status, and geographic location. Therefore, and our results cannot be generalized to all rural populations in the U.S. or in the rest of the world. For example, in the U.S., Bennett (2008) reports that rural Appalachian female students have higher academic aspirations and are more satisfied with school than male students but have lower self-efficacy for employment following high school and lower educational attainment.

Another limitation concerns the nonexperimental nature of the study. When conducting a sensitivity analysis of the data, the sample size was underpowered to detect the small effect sizes ($\eta 2$ = 0.02–0.09) in the MANOVA (power = 0.13–0.51), but had sufficient power (0.80) to detect significant differences with the chi-square tests. We mitigated power issues by using an experiment-wise error rate that used a stricter criteria to meet statistical significance. Further, we did not have a non-rural comparison group with which to evaluate the pervasiveness of these differences in other high-achieving populations. Perhaps the observed gender differences in the investigation also exist for non-rural high-achieving students or are found among rural students who are not high-achieving in math and science.

4.2 Implications for research and practice

Differences between high-achieving female and male students' attributions for success and failure in math, science, and school in general seem to have persisted across decades. Higher percentages of male students recognize their ability and this likely bodes well for their future. Female students recognize the role of effort in their success but seem to have a relative lack of recognition of their ability; these findings might impact their futures. We do not know if the observed differences in psychosocial factors translate into differences for course selection with respect to advanced coursework in high school or college. Furthermore, due to the forced choice nature of the items, we do not know students' reasoning for choosing the various attributions. The participants in this study are in academic settings that would lend themselves to qualitative research that could determine students' reasoning for their selections of various attributions. This line of research would perhaps help practitioners to be more informed in creating evidence-based interventions to effectively assist students as they plan for high school and beyond.

Future practitioner interventions with high-achieving rural students should include discussions of academic attributions as well as the influence attributions may have on students' current and future academic and career success. Bandura, Barbaranelli, Caprara, and Pastorelli (1996) lay out the logic for the connections between academic self-efficacy and aspirations, positing "efficacy beliefs shape career aspirations and pursuits during early formative years. The stronger the students' beliefs in their efficacy, the more occupational options they consider possible, the greater the interest they show in them, the better they prepare themselves educationally . . .." (p. 1206). Given that career and college readiness is a primary goal of K–12 education (American School Counselor Association [ASCA], 2014; National Consortium for School Counseling and Postsecondary Success [NCSCPS], 2017; United States Department of Education, 2017), research exploring self-efficacy in rural middle school students who are high-achievers and have high academic aptitude may provide educators, guidance counselors, and career psychologists with more effective academic and career programming options to increase students' career and college aspirations.

For example, academic and career interventions with female, rural, high-achieving students should highlight the equity of their academic ability in relation to their male counterparts, especially in an effort to build stronger academic self-efficacy. Female students may benefit from interventions that emphasize increasing recognition of academic aptitude, as well as intentionally building higher academic self-efficacy in female students. Interventions toward rural, high-achieving students must also help female students determine how to find appropriate levels of effort to expend on a task, as well as recognize the influence natural ability has on their academic and career outcomes. Additionally, interventions should address establishing an effective balance between how much they rely on their natural ability and their effort to complete assignments. Female students should learn to recognize, and accept, when they can trust their ability level to complete assignments with ease, and when they need to use more of their effort to help them understand more challenging content. By doing this, female students may begin to feel they have more self-efficacy and energy to take on difficult coursework and succeed at the level of their high-achieving male student counterparts.

Conversely, academic and career interventions with high-achieving rural male students should capitalize on their high self-efficacy to encourage them to engage consistently in challenging coursework. When doing so, educators and counselors should proactively address academic, career, and psychosocial concerns that may arise as material becomes more difficult than students can handle with natural ability alone. Male students may need help in recognizing that additional effort is necessary to find success when material is more challenging. Additionally, interventions should address students' high-achieving identity and support them if they are wrestling with an evolving identity as a high-achiever. Regardless of gender, academic, and career interventions with high-achieving rural students, educators should allow students to voice concerns when their attributions create challenges to achieving academic and career goals. Educators and guidance counselors can use the current study results to proactively address possible concerns of rural, high-achieving students, as well as create evidence-based practices and interventions.

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