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EMPIRICAL RESEARCH

The Role of Social Support in Students' Perceived Abilities and Attitudes Toward Math and Science

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Abstract Social cognitive models examining academic and career outcomes emphasize constructs such as attitude, interest, and self-efficacy as key factors affecting students' pursuit of STEM (science, technology, engineering and math) courses and careers. The current research examines another under-researched component of social cognitive models: social support, and the relationship between this component and attitude and self-efficacy in math and science. A large cross-sectional design was used gathering data from 1,552 participants in four adolescent school settings from 5th grade to early college (41 % female, 80 % white). Students completed measures of perceived social support from parents, teachers and friends as well as their perceived ability and attitudes toward math and science. Fifth grade and college students reported higher levels of support from teachers and friends when compared to students at other grade levels. In addition, students who perceived greater social support for math and science from parents, teachers, and friends reported better attitudes and had higher perceptions of their abilities in math and science. Lastly, structural equation modeling revealed that social support had both a direct effect on math and science perceived abilities and an indirect effect mediated through math and science attitudes. Findings suggest that students who perceive greater social support for math and science from parents, teachers, and friends have more positive attitudes toward math and science and a higher sense of their own competence in these subjects.

Keywords Social support · Math attitude · Science attitudes · Self-efficacy

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Introduction

The United States is experiencing a shortfall in students entering into science, technology, engineering, and math (STEM) careers, and there has been considerable research invested in understanding this shortage. In 2010, the President's Council of Advisors on Science and Technology called for improved math and science education to prepare more students to enter into STEM careers: "STEM education will determine whether the United States will remain a leader among nations and whether we will be able to solve immense challenges [ahead]" (p. v). Although primarily focused on what can be done to improve educational standards for STEM, the Council noted that "the problem is not just a lack of *proficiency* among American students; there is also a lack of *interest* in STEM fields among many students" (p. vi). Three factors that are hypothesized to affect students' willingness to pursue math and science coursework are the focus of this research: student attitudes, self-perceived abilities, and social support in math and science. Taking a social-cognitive perspective, this study examines the relationships among these factors for four adolescent age groups.

Educators studying social support for math and science often must rely on research that focuses on general academic indicators (e.g., GPA and academic self-concept). However, overall academic achievement (e.g., grades, GPA, test scores) is usually held in high regard, but students generally have more negative attitudes toward math and science compared to other academic areas. For girls, interest in math and science is counter to gender role norms, and women do not pursue advanced STEM courses or careers in proportion to their overall representation in college (e.g., Ceci et al. 2009; Fredricks and Eccles 2002). Furthermore, students who express interest in math and science can be subject to pejorative stereotyping that applies specifically to students in STEM (e.g., geeks, nerds). Social support in the form of encouragement and shared interests may be particularly important when so few students, especially girls, pursue math and science courses beyond basic educational requirements. Our research contributes to the field by focusing specifically on math and science.

Our operationalization of support for math and science follows one from previous research (e.g., Wilkins and Ma 2003) using the Longitudinal Study of American Youth (Miller et al. 2000) and includes the emotional and appraisal (or feedback) aspects of support described by Rueger et al. (2010). Sometimes referred to as "push," it includes encouragement, high expectations for math and science academic performance, and valuing math and science as an area of study. This definition is consistent with definitions used in many of the social-cognitive studies that are the basis of this research.

Social Cognitive Models of Academic and Career Choice Behaviors

The theoretical grounding of this study lays in social cognitive models of academic outcomes and career choice (e.g., Bandura et al. 2001; Fredricks and Eccles 2002; Lent et al. 2000) which emphasize that motivational constructs such as attitudes, interest, and value beliefs are key factors that affect students' self-efficacy and pursuit of STEM courses and careers. Two well-researched social cognitive models are Lent's *Social Cognitive Career Theory* (e.g., Lent et al. 1994, 2000) and the Eccles' *Expectancy Value Model* (Eccles et al. 1983). Although there are differences in terminology in how some constructs are parsed theoretically, *Social Cognitive Career Theory* and the *Expectancy Value Model* are very similar in their underlying theorizing of factors that affect academic and career outcomes: demographic characteristics, gender, and age influence learning and achievement in school, which in turn affect a number of social cognitive factors such as self-efficacy and outcome expectations. Self-perception factors such as self-efficacy, perceived ability, and self-concept are proposed to be related causally to later academic behaviors in achievement models or to interest in and intention to pursue specific careers in occupation choice models. Generally, self-perceptions of abilities have been found to be related more strongly to academic pursuits and occupation interest than previous achievement (Bandura et al. 2001; Ferry et al. 2000; Frome and Eccles 1998).

In social-cognitive models, social agents such as parents, teachers, and friends are hypothesized to influence academic and career outcomes indirectly through other elements in the models, especially self-perceptions of ability and interest/attitudes. In Lent's *Social Cognitive Career Theory* (Lent et al. 1994, 2000), social support is a distal background factor that affects self-efficacy and outcome expectations by impacting learning experiences. Social support and the absence of social barriers are thought to facilitate the process of translating interests and attitudes into career goals (Lent et al. 2000). More recent tests of this model, however, have not always included social support measures (e.g., Lent et al. 2008) or have not distinguished between different sources of support (e.g., Lent et al. 2003, 2005). Similarly, the Eccles' *Expectancy Value Model* proposes that parents' beliefs affect children's achievement motivation and performance (Fredricks and Eccles 2002; Frome and Eccles 1998). Although not a social cognitive model, Walberg's theory of educational productivity (e.g., Reynolds and Walberg 1992) supports the idea that parental, teacher, and friend support for math and science are related strongly to the careers that students pursue. Social support and its relationships with self-efficacy and attitudes toward math and science are under-researched components of social cognitive models, and consequently, the focus of this study.

Self-efficacy and Attitudes Toward Academic Achievement During Adolescence

Generally, students' attitudes, interest, and efficacy in math declines over the adolescent school years, but there are somewhat different patterns for males and females. Seminal works by Eccles, Midgley, and colleagues (Eccles et al. 1984; Midgley et al. 1989) describe cognitive and achievement changes during the transition to junior high (at approximately 12 years). In their research, attitudes toward math significantly declined for both boys and girls over the transition to junior high (in contrast to English) and continued to decline over the first year of junior high. Both before and after the transition, boys had better math self-concepts than girls. Similar patterns are apparent in transition to high school research by Marsh and Yeung (1997) who found that girls who had better grades than boys still had poorer self-concepts. Throughout adolescence, girls often express less confidence in their math ability than boys and hold less positive attitudes toward math and science (Correll 2001; National Council for Research on Women 2001). However, the gender gap in math self-concept decreases over school years (Barth et al. 2011; Fredricks and Eccles 2002). Relatedly, our own cross-sectional research found that math and science interest and self-efficacy showed unique patterns that differed for adolescent boys and girls from elementary school through college (Barth et al. 2011): Boys' math and science self-efficacy increased from 8^{th} grade through the end of high school, but girls' math efficacy was relatively stable over different school settings, yet science efficacy declined. To summarize, research on self-efficacy and attitudes toward academic achievement shows mixed results. Generally, girls' self-efficacy and attitudes decrease or stay stable in adolescence while boys have been shown to have decreasing attitudes and self-efficacy during adolescence in some research but increasing in other research.

Positive parental, teacher, classmate, and school relationships are hypothesized to counteract these trends and improve academic outcomes generally (e.g., Barile et al. 2012; Corbett and Wilson 2002; Hughes 2011) and specifically affect children's perceptions of their math and science abilities and attitudes (Bowen et al. 2012; Crosnoe et al. 2010; Wang and Staver 2001). For example, in a series of studies of third through 12th grade students Demaray and Malecki (2002, 2003; Demaray et al. 2009), found that the perceived frequencies of parental, teacher, and peer support were related positively to higher academic self-concept, yet during that same time period, students' feelings about the importance and frequency of social support from teachers, schools, parents, and peers declined. Thus, the current study investigates how three distinct sources of support (parents, teachers, and friends) affect math and science attitudes and self-efficacy in order to advance the growing literature on social support in math and science.

Teacher and School Support During Adolescence

Eccles' *Stage-Environment Fit* theory (Eccles et al. 1993; Gutman and Eccles 2007) proposes that academic outcomes often decline after elementary school because later school settings do not support children's developmental needs (Pellegrini 2001, 2002). For example, in contrast to elementary school, middle school is characterized as having less supportive teachers, more ability grouped classes, and more peer aggression. Junior high and middle school teachers have more negative attitudes toward students and are more likely to believe that academic abilities are not modifiable through instruction. High school settings are even less personal, more competitive, and more grade-oriented. Ability differences are emphasized even more as the differences between college-bound students and other students become more salient (Gutman 2006). Thus, as children progress academically, the school environment is associated with decreasing teacher support and more peer competition, and this may account for some of the decline in students' self-perceptions of their abilities and attitudes toward science and math.

At the same time, perceptions of teacher and school social support decrease, critical decisions about math and science courses must be made that affect students' preparedness to pursue STEM careers. Teachers have considerable influence on children because of their authority in the classroom. Students' perception of positive instructional approaches (i.e., teacher support and engaging instruction) is associated with better attitudes and higher self-efficacy for math and science during the transition to middle school or high school (Ahmed et al. 2010; Barth et al. 2011). In summary, although adolescent school settings generally are characterized as less nurturing environments, teacher support in these settings is related to better self-efficacy and attitudes for math and science.

Parental Support During Adolescence

Children's academic self-perceptions and career choices are affected by their parents' perceptions of their academic ability, achievement expectations, and support (e.g., Ahmed et al. 2010; Bowen et al. 2012; Ferry et al. 2000; Frome and Eccles 1998). Two studies using the Longitudinal Study of American Youth (LSAY) database further support the importance of parents (Wang and Staver 2001; Wilkins and Ma 2003) for math and science outcomes. For example, Wilkins and Ma (2003) found a steady decline in students' math attitudes in high school, but higher parental support was associated with a less steep decline. Even as students move into college, there is evidence that parental support is predictive of students' grades (Ferry et al. 2000). Despite having very different roles in the lives of adolescent children, parent, and teacher support promote math and science outcomes in similar ways.

Peer Support During Adolescence

Previous research primarily has focused on parents and teachers, but some limited research suggests that classmates also have an impact on students' attitudes toward academic subjects (Ahmed et al. 2010; Wilkins and Ma 2003), academic self-concept (Ahmed et al. 2010; Demaray et al. 2009; Rueger et al. 2010), and career aspirations (Wang and Staver 2001). Support from the general peer group is associated more strongly with positive outcomes than close friend support (Rueger et al. 2010) and some longitudinal studies find that the effects of peer support on achievement weaken over time (Rueger et al. 2010). Friends also provide an academic comparison group, so it is important to consider the value that friends place on math and science. Bissell-Havran and Loken (2009) found that 8th graders' intrinsic value of math was related to their perceptions of their friends' values. Thus, academic self-concept and attitudes are related to peer support in much the same way that they are related to parental and teacher support. An important question is, how do the three sources of support work together to predict math and science outcomes?

Multiple Social Support Agents

Although several studies have included multiple social support agents simultaneously, most of these focus on general academic achievement (e.g., Demaray et al. 2009; Demaray and Malecki 2002, 2003; Rueger et al. 2010). In one of the few studies to include all three social support agents for math and science, Wilkins and Ma (2003) found that teacher, parent, and friend support for math and science were associated with more positive attitudes. They concluded that changes in attitude were related more consistently to the social context provided by teachers, parents, and friends than prior achievement, instruction, and curriculum. Furthermore, Ahmed et al. (2010) found that the relationships between parental, teacher, and peer support and math achievement were mediated by attitudinal and motivational factors. Other research, however, has found that the strength of the relationships between the different support agents and STEM outcomes vary. In a test of the Social-Cognitive Career Theory with Mexican–American middle school students, Navarro et al. (2007) found that when the three social support agents were considered together, only parental support was associated with math/science self-efficacy. In contrast, Bowen et al. (2012) reported that friend support, but not parent and teacher support, was predictive of sixth graders math achievement. Chen (2005) found that teacher and parental support for Chinese students were directly related to academic achievement, but peers had a negative impact. Together, these findings indicate that there are inconsistencies across studies in the relationships between teacher, parental and friend support and students' math and science self-perceptions, attitudes, and achievement. Contributing to the lack of clarity is that each study examined a different age group, making it difficult to determine if differences in findings are due to developmental shifts in the importance of different social agents. This study will address this issue by examining self-efficacy and attitudes for math and science at four distinct academic time points: elementary school, middle school, high school, and the first year of college.

Sex differences in math and science self-efficacy and interest are robust for these age groups, so we examined if social support might account for these differences. Generally, boys and girls report similar levels of parent and teacher support (Demaray and Malecki 2002, 2003), but girls perceive higher levels of peer support than boys (Rueger et al. 2010). Recent research found that peer support was a stronger predictor of school attitude for boys than girls, but parent and teacher support had similar relationships for boys and girls (Rueger et al. 2010). The current study will both clarify and advance research by examining sex differences in the level of support and how support is related to math and science interest and efficacy.

The Current Study: Advancing Research on Social Support Effects on Math and Science

Existing research on how social support affects adolescents' math and science attitudes and self-concepts has some notable gaps. First, only a handful of studies have included science, yet science is needed for nearly all STEM careers, except for math. Generally, research has included math *or* science (Wilkins and Ma 2003; Ma and Wilkins 2002), or combined the two together (e.g., Ferry et al. 2000; Fouad and Smith 1996). However, new evidence (Barth et al. 2011) suggests that self-efficacy and attitudes toward the two subjects show different trajectories over adolescence. Thus, math and science should be studied separately.

Second, there are only a few studies that have examined the influence of multiple social support agents on self-perceived abilities and attitudes toward math and science (e.g., Bowen et al. 2012; Chen 2005; Navarro et al. 2007; Wilkins and Ma 2003), and these studies report different findings with respect to the relative importance of different social agents. Furthermore, because there are sex differences in math and science self-efficacy, attitudes, and academic outcomes, it is important to examine sex differences in social support. A contribution of this research is that it assesses support from multiple agents, how that support is linked to math and science self-concept and attitudes, and if there are sex differences in the levels of perceived support and their relationships with math and science self-concept and attitudes.

The current study extends our earlier research on the effects of classroom environment and teacher support on students' self-efficacy and attitude in math and science (Barth et al. 2011). We now examine support from teachers, parents, and friends in four different grade levels (fifth, eighth, high school, and first year of college) that correspond to distinct school environments (elementary school, middle school, high school, and college). These periods were chosen because they represent critical junctures in school and are time periods in which social support could have a significant impact. We expect that social support will have a significant relationship to attitudes and self-efficacy in math and science. As for how grade level and sex might affect the relationship, previous research has been inconsistent in definitive results for these variables and, therefore, we are conducting several analyses in order to better understand and clarify the roles these variables may play.

Method

Participants

Sampling Procedure

Students were recruited from public schools in a suburban Southeastern city in the United States. Fifth, eighth, eleventh, and early college students were targeted in order to capture the distinct educational settings where social support could potentially have a different impact on student interests in certain subject areas. College-level participants were recruited from a broad range of entry level STEM courses for majors (e.g., calculus, physics, chemistry, and engineering). Approximately 1,640 college students (based on course enrollment) in entry level STEM courses were approached on the first day of class in the Fall term. A member of the research team went to each class and explained the purpose of the study and read a consent statement. Students wishing to participate stayed after class to complete a questionnaire. Nine hundred eighty-eight students (60 %) provided complete questionnaires. Since we were focused on students early in their college careers, we only included the 870 students who indicated that they had 4 or less semesters of college. Female students comprised 29 % of the sample ($n = 255$), however, three students failed to answer the question asking their sex. Since STEM courses were the primary target, there was a lower enrollment of female to male students in each class and, therefore, a lower amount of female participants in this age group.

The younger participants were recruited from local public elementary (grade 5), middle (grade 8), and high schools (primarily grade 11). A letter was sent home to parents asking for consent for their child to participate in a survey. Parents were also informed that compensation for their children's time would be in the form of a $5 donation to the school. The initial response rate was 46.6 % of the 1,511 potential students. Since parental consent was required for these students to participate, response rates were lower than those of the college students. Students who indicated that they were high school seniors ($n = 22$) were not included in the analysis since high school juniors were the age group of interest to the current study.

Final Sample

The final sample included 1,552 students (634 females or 41 %): 290 fifth graders (147 female, 82 % White, mean age = 10.8 years), 207 eighth graders (114 females, 63 % White, Mean age = 14.0 years), 185 high school students (118 female, 71 % White, Mean age = 16.7 years), 870 college students (255 female, 85 % White, mean age = 18.5 years). The racial make-up of the sample was: 79.9 % White non-Hispanic, 15.1 % Black, 1.5 % Hispanic, 1.7 % Asian, and 1.2 % indicated "other" or did not specify a race. SES information was not available for most participants, but school district information from the non-college sample suggests that the sample was largely drawn from lower to middle income neighborhoods.

Procedure

A member of the research team came to the students' classrooms and briefly explained the purpose of the study. Students were given an assent statement to read, and the researchers went over the key elements of assent with them (e.g., participation is voluntary, ability to withdraw without penalty). Students then completed the Math, Science, and Technology Questionnaire at their own pace. This questionnaire included 338 items designed to assess several factors related to STEM classes and careers. The sample sizes varied somewhat among the analyses because a few students failed to answer all of the questions in the questionnaire.

Measures

Support

Support was measured through six sets of questions that related to teacher, parental, and friend support for math and science. Questions were adapted from the Longitudinal Study of American Youth (Miller et al. 2000; Wilkins and Ma 2003), and the number of items varied in the amount of questions available for math and science as well as the amount of questions available for each support agent in the existing measure. All questions were answered on a 5-point scale, 1 = strongly disagree to 5 = strongly agree. Scale scores were calculated as averages over the items in each scale, and thus had a possible range of one to five.

Parental Support was assessed using 16 items. Seven items focused on math ($\alpha = .79$) and nine items focused on science ($\alpha = .85$). Example items include: "My parents have always encouraged me to work hard on math" and "My parents care if I like science." Teacher Support was assessed similarly with six items devoted to math ($\alpha = .85$) and seven items devoted to science ($\alpha = .87$). Sample items are: "My science teacher cares how we feel" and "My math teacher expects me to do well in math." Finally, Friend Support consisted of five items examining math ($\alpha = .75$) and six items examining science ($\alpha = .80$). Sample items are: "My friends encourage me to take all the math I can get in school" and "Most of my friends are good at science."

Self-efficacy

Students responded to two items for each subject area on a 5-point scale, 1 = strongly disagree to 5 = strongly agree: "I could learn to do any type of math [science] problem if I wanted to" and "When taking a math [science] test I've studied for, I do very well." Questions were drawn from the Michigan Study of Adolescent and Adult Life Transitions (2006). Self-efficacy scores were calculated by averaging the items separately for each subject ($\alpha = .58$ for math; $\alpha = .62$ for science).

Attitude

Students' attitudes toward math and science were also assessed in the Math, Science, and Technology Questionnaire. Sample items for interest include: "I like math [science];" and "Doing math [science] makes me nervous." Questions were drawn from the Michigan Study of Adolescent and Adult Life Transitions (2006). All questions were answered on a 5-point scale, 1 = strongly disagree to 5 = strongly agree. Attitude scores were calculated by averaging the items for each subject to form two separate measures ($\alpha = .54$ for math; $\alpha = .45$ for science).

Results

Data Analysis Strategy

Our data analyses investigated whether the amount of support received from parents, teachers, and friends was associated with participants' Self-efficacy and Attitude towards math or science. Because previous research suggests that there may be sex and grade level differences in the relationships among support, self-efficacy, and attitudes, we also aimed to describe how these factors might modify these relationships. First, a multivariate analysis of variance (MANOVA) was conducted to examine sex and grade level differences in support. The next set of analyses described the influence of support on math or science self-efficacy and attitudes. First, correlations were calculated between the measures of support and the dependent measures. Then, to examine the effects of the combined social support agents on self-efficacy and attitude toward math or science, a structural equation model was constructed combining the three social support agents into one latent construct. This analysis enabled us to understand how these support agents can work together to affect self-efficacy and attitude toward math and science.

Sex and Grade Level Differences in Support

A 3 (Source: parents, teachers, or friends) × 2 (Topic: math or science) × 2 (Sex) × 4 (Grade: 5th, 8th, 11th or college) MANOVA was conducted. Source and Topic were within subject variables while the other variables were between subjects. The dependent variable for this analysis was perceived level of support. Significant results are presented in Table 1. The significant main effects (Source, Topic, and Grade) were qualified by the three significant two-way interactions (Topic × Grade, Topic × Source, and Source × Grade) and one significant three-way interaction (Topic × Source × Sex). We first examine the grade level effects. Figure 1 illustrates the effects for Grade and the Source × Grade interaction. Post hoc analyses using Fischer's LSD tests indicated that fifth graders reported higher levels of Friend Support, than all other grade levels and college students had higher levels of support than 8th graders (all p's $< .01$ or better). Post hoc analyses for Teacher Support indicated a similar pattern with fifth graders indicating higher levels of Teacher

Table 1 Significant effects for the Source × Topic × Sex × Grade MANOVA

Factor	F	df	$p \leq$	Partial η^2
Topic	32.98	1, 1501	.001	.022
Source	758.74	2, 3002	.001	.336
Grade	11.26	3, 1501	.000	.022
Topic × Grade	9.91	3, 1501	.001	.019
Source × Grade	5.78	6, 3002	.001	.011
Topic × Source	55.33	2, 3002	.001	.036
Topic × Source × Sex	6.381	2, 3002	.002	.004

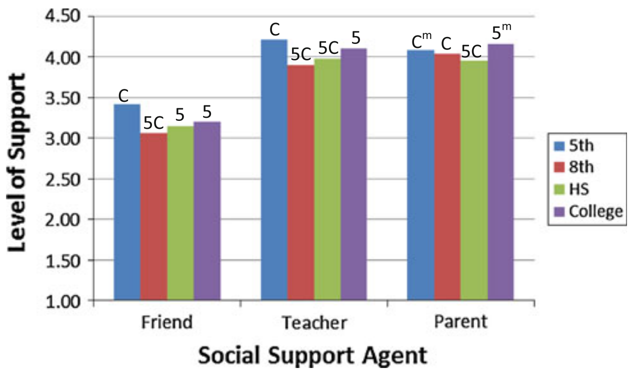

Fig. 1 Source × Grade interaction. *Bars* denoted with a "*C*" are significantly different from college students within a source; *Bars* denoted with a "*5*" are significantly difference from the fifth grade students within a source. A superscript of "*m*" indicates that the difference was marginally significant. Level of support scores ranged from 1 to 5

Support than all other age groups and college students having higher levels of Teacher Support than eight graders and high school students (all p's $< .05$ or better). Finally for Parental Support, college students reported greater levels of support compared to eighth graders and high school students ($p < .02$, .001, respectively) and marginally significant higher levels than 5th graders ($p < .09$). Fifth graders had higher levels of Parental Support than high school students ($p < .05$). The Topic × Grade interaction was accounted for by math support being significantly higher than science support for fifth and eighth graders ($p < .001$), but there were no differences between math and science for high school and college students. Taken together, these findings suggest that levels of social support show somewhat of a "U" shape with 5th graders and college students generally reporting higher levels of support than eighth graders or high school students. Furthermore, the two younger age groups reported greater levels of support for math than science.

Table 2 presents the means for the Source main effect, the Topic × Source two-way interaction and the Topic × Source × Sex three-way interaction. Friends were generally rated as less supportive than either parents or teachers by both sexes. Support for math was slightly higher than support for science from teachers and parents, but the reverse pattern was seen for friends. Differences between math and science support were greatest for Parental Support. The 3-way interaction was decomposed by examining three Topic × Sex ANOVA's, one for each level of Source (Parents, Teachers, and Friends). Results indicated that the Topic × Sex interaction was only significant for Parental Support, F (1, 1,516) $= 9.49$, $p < .002$. Although both sexes reported less Parental Support for science compared to math, this difference was greater for girls than it was for boys.

Table 2 Means and SD for Topic × Source × Sex

Support source	Sex	Topic	
		Math	Science
Friend	Female	3.24 (.85)	3.28 (.84)
	Male	3.14 (.78)	3.25 (.80)
Teacher	Female	4.14 (.86)	4.11 (.86)
	Male	4.11 (.81)	4.01 (.87)
Parent	Female	4.21 (.74)	3.99 (.86)
	Male	4.19 (.65)	4.04 (.74)

Correlations Among Support, Self-efficacy, and Attitude

As a preliminary analysis to the structural equation model described below, correlations were calculated between the support measures for math and science (Parents, Teachers and Friends) and math and science self-efficacy and attitude. All correlations were positive and significant (Table 3) indicating that greater support from each of the three agents was associated with student reports of higher Self-efficacy and more favorable Attitudes toward math and science. Correlations between Self-efficacy and Attitude were also highly significant, $r\,(1{,}512) = .46$, $p < .001$ and $r\,(1{,}518) = .46$, $p < .001$, for math and science, respectively. Separate analyses for each of the four grade levels revealed the same pattern of correlations for each grade.

Modeling the Effects of Support on Interest and Self-efficacy

The previous analyses showed that Friend, Parent and Teacher Support were associated with Self-efficacy and Attitude towards math and science. From here we had the

Table 3 Correlations between support and math and science self-efficacy and attitude

	Support		
	Friend	Teacher	Parent
Math			
Self-efficacy ($N = 1{,}521$)	.27	.29	.23
Attitude ($N = 1{,}506$)	.27	.34	.21
Science			
Self-efficacy ($N = 1{,}510$)	.27	.26	.30
Attitude ($N = 1{,}520$)	.31	.26	.22

All correlations are significant at $p < .001$

ability to model the more complex effects of all the support sources taking into account the relationships between math and science self-efficacy and attitude. It is important to note that although academic self-efficacy is generally modeled as predicting interest or attitudes, it is likely that the two are mutually influencing within an age group and over time. Furthermore, social support agents might impact both of these factors. For example, parents, teachers and peers can affect self-efficacy by praising a student's science performance in school, and at the same time promote favorable attitudes by exposing a student to interesting scientific findings and experiments. Thus, the primary goal of this analysis is to demonstrate how social support is related to math and science self-efficacy and attitudes. We believe that the relationship between self-efficacy and attitudes is less critical to understanding the social support influences and therefore, we do not constrain the relationship between attitudes and self-efficacy in our models.

To simplify the models, and because additional analyses (i.e., regression analysis) did not find grade level differences in the relationships between support and Self-efficacy and Attitude, grade level was not included in the models reported. Furthermore, SEM analyses not reported here indicated few differences in the relationships between support and Self-Efficacy and Attitudes among the three social support agents (i.e., significant pathways were very similar). As a result, we modeled the combined effects of Parental, Teacher, and Friend Support on Self-efficacy and Attitude toward math or science. These models also achieve a better fit than examining each support agent or grade level separately. Two separate SEMs were constructed, one for math and one for science, and the overall effect of support was examined, as well as possible sex differences within the model. Although our previous analyses revealed few sex differences in the mean levels of perceived support, due to the theoretical importance of sex in the literature we included it in these analyses.

Math (Fig. 2)

First, a general model was constructed to ensure overall good model fit before any comparison was made between males and females. This model showed good model fit, $\chi^2(4) = 14.27$, $p < .01$; CFI = .99, RMSEA = .04, lending support to the idea that Support predicts Self-efficacy and Attitude toward math. Next, different constraints were placed on the measurement weights and intercepts between males and females in order to test for sex differences. The unconstrained model also showed slightly better model fit than the constrained model, $\chi^2(8) = 23.69$, $p < .001$; CFI = .99, RMSEA = .036 versus $\chi^2(18) = 71.86$, $p < .001$; CFI = .95, RMSEA = .044, and the χ^2 test between the models was significant, $\chi^2(9) = 48.17$, $p < .001$, indicating a difference between males and females for the general model. The model shows that Support had direct effects on both Self-efficacy and Attitudes and a mediated effect on Self-efficacy through Attitudes. Interestingly, one pathway from support leading to Math Attitude showed a significant sex difference ($z = 2.27$, $p = .01$), indicating that support may be more important in establishing attitudes toward math particularly in females.

Science (Fig. 3)

A general model was constructed to ensure good fit before any comparison analyses were conducted, $\chi^2(4) = 16.90$, $p < .01$; CFI = .98, RMSEA = .05. Similar to the general model for math, the model for science suggested that Support was important for Self-efficacy and Attitude toward science. Next, the different constraints were placed on the model to differentiate between the male and female groups in order to examine sex differences in the measurement weights and intercepts. The unconstrained model showed the clear best model fit for science, $\chi^2(8) = 20.42$,

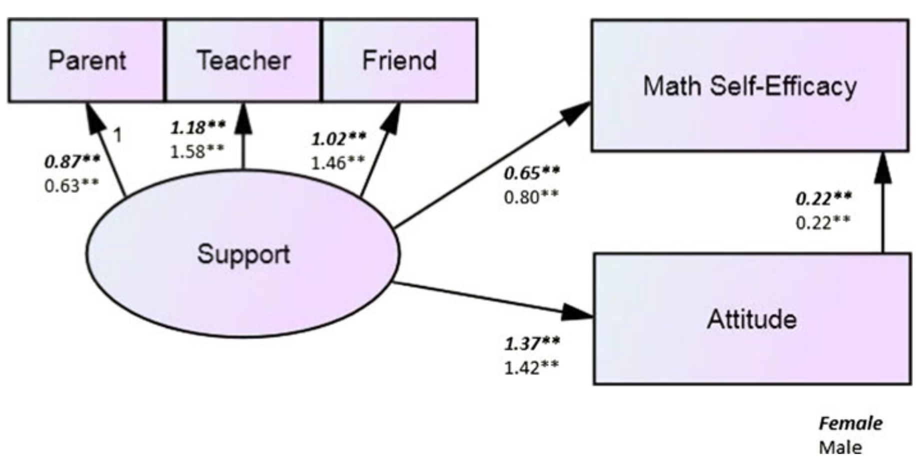

Fig. 2 Standardized estimates for females versus males in math subjects. Coefficients in *bold italics* are for females. Only the path from support leading to math attitude showed a significant sex difference, $^{**}p < .001$

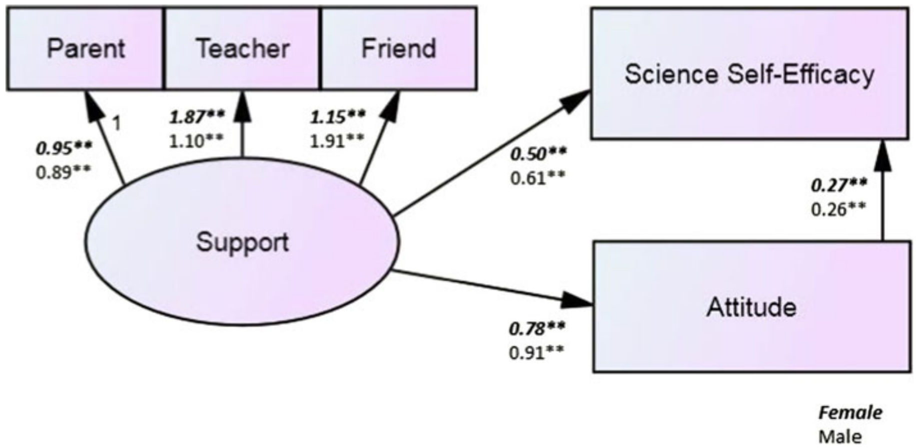

Fig. 3 Standardized estimates for females versus males in science. Coefficients in *bold italics* are for females. There were no significant sex differences. $^{**}p < .001$

$p = .01$; CFI = .99, RMSEA = .03, which does not lend support for sex differences in the model for the subject science (Fig. 3). The science model showed a similar pattern of direct and indirect relationships between Support, Attitudes and Self-efficacy as the model for math.

Discussion

Taking a social-cognitive perspective, this study examined the relationships between social support and two motivational factors (student attitudes and self-efficacy) hypothesized to affect students' willingness to pursue math and science coursework for four adolescent age groups. The study helps fill gaps in previous research by examining support for both math and science, investigating multiple support agents, studying age groups that span adolescence, and assessing sex differences in not only levels of support from multiple agents, but also in how support is linked to math and science self-concept and attitudes. Although it was found that the relationships between support and math and science self-efficacy and attitudes were very similar across the four different age groups, students' *perceived level of support* from different social agents varied at different ages for math and science. Furthermore, despite sex differences in the levels of math and science attitudes, perceived support and its relationship to these measures showed more similarities than differences. Below we discuss the major findings and their implications for future research

Grade Level Differences in Perceived Support

Fifth graders reported higher levels of support from teachers and friends than students at other grade levels, and the steepest decline in support from teachers and friends occurred between the elementary and middle school age groups, consistent with Eccles' *Stage Environment Fit* model (Eccles et al. 1993). However, we did not find a great decline in perceived support between the middle and high school age groups. One explanation for the lack of differences might be that the middle schools involved in this study were structured similarly to the high schools in that students changed classes for every course and thus teachers and classmates changed several times throughout the day. Thus, it makes sense that teacher and friend support were also very similar between these two age groups. With respect to parental support, elementary school children reported higher levels than high school students, but surprisingly, college students reported the highest levels of parental support. Across the four age groups, perceived support from friends, teachers, and parents seemed to have a broad "U" shape with 5^{th} graders and college students generally reporting higher levels of support than eighth graders or high school students. To our knowledge, no one has compared support for math and science from fifth grade through the first year in college, but our findings are somewhat similar to Demaray and Malecki (2002), who found that elementary school children generally reported higher levels of support from teachers and classmates than middle school and high school students.

What might account for higher scores for college students? It is important to note that college students in this study were an academically successful group because they were all admitted to a prestigious university. Since high levels of social support generally are associated with academic success, it is possible that same-aged youth who did not make it into college had lower levels of support, and thus the range of social support was attenuated, leaving off the lower levels. It is important to note that, in general, grade level differences in support may represent real developmental changes, or may be an artifact of differences in characteristics among the four groups that are not age related. Despite this possibility, the relationships between social support and the two motivational factors were similar for this age group compared to the other age groups. Clearly, more developmental research is needed to understand shifts in perceived support over adolescence.

Support for Math and Science for Males and Females

Throughout our analyses, we found little evidence that perceptions of math and science support were higher for one sex over the other, which is similar to some previous research (Demaray and Malecki 2002, 2003). Although both sexes reported higher levels of parental support for math than science, the difference was greater for females than males. Math is required for a wider range of careers compared to science (e.g., business), and parents might see it as being more critical for their children's future careers. A parent placing less emphasis on science for daughters is consistent with gender role expectations, since most science related careers are stereotyped masculine (e.g., engineering, physics, and geology).

Sex differences in students' classroom experiences have been documented for decades (e.g., Wilkinson and Marrett 1985), so it was somewhat surprising that we did not find differences in support from teachers and friends. Our support measure emphasized encouragement, expectations, and values, but a different measure, such as direct observation, might be better suited to capture sex differences in social support for math and science in a classroom setting. Such a measure could potentially be more sensitive to differences in math or science support by including a broader range of specific opportunities and behaviors, such as access to individualized tutoring or participation in study groups with friends. Nevertheless, the current measures of social support showed consistent relationships to math and science efficacy and attitudes for both sexes.

Relationships Between Support and Math and Science Efficacy and Attitudes

The findings from this study suggest that students who perceive greater social support for math and science from parents, teachers, and friends have better attitudes toward math and science and a greater sense of their own competence in these subjects. These results are consistent with previous theorizing about factors that affect students' academic and career choices (Eccles et al. 1983; Lent et al. 2000). A somewhat surprising finding was that parental, teacher, and friend support showed similar relationships to math and science self-efficacy and attitudes across the different age groups. Although previous research (Bowen et al. 2012; Navarro et al. 2007) suggests that importance of friend support for predicting attitudes and self-efficacy might be greater as students advance through schooling, this was not the case in our sample. Consistent with our results, other research has failed to identify grade level differences in how support from parents, teachers, and peers is related to academic self-concept (Demaray and Malecki 2002, 2003; Demaray et al. 2009; Wilkins and Ma 2003). It is possible that other outcome variables such as risk behaviors and social-emotional functioning would show different relationships with different social support agents. However, there is a growing body of research that suggests that for academic outcomes support from a wide range of social support agents can be beneficial. Our findings suggest that social support is an important factor in establishing positive self-efficacy and attitudes toward math and science throughout a student's education.

Considering that all three sources of support showed very similar importance in establishing positive attitudes and self-efficacy in math and science, we tested a model to examine these three sources of support combined and their relationship to attitudes and self-efficacy in math and science. This was similar to the approach taken by Lent and colleagues (Lent et al. 2003, 2005). Our model showed that support had both a direct and mediated effect on self-efficacy and a direct effect on attitude. The mediated pathway through attitude to self-efficacy suggests that children develop attitudes toward math and science (in part) based on the support they receive from teachers, parents and friends, which in turn affects their self-efficacy for math and science. This model is somewhat different from those in previously published work in that the best fitting model showed attitudes predicting self-efficacy, while other research shows these pathways in the opposite direction. Despite the slight difference in models, attitudes and self-efficacy are usually strongly correlated, and it is likely that they are mutually influencing over time. Our cross sectional data are not well suited to assessing causation across different age groups. Regardless of the model, our research corroborates previous research indicating that attitudes and self-efficacy are related, and social support shows a relationship with these two motivational constructs.

Some interesting questions arise from these results. Many broad descriptions of adolescence describe it as a period in which the peer groups become increasingly important, and the *Stage-Environment-Fit* model suggests that perceptions of teacher support should decline throughout schooling. Our findings indicated no differences in how social support from friends and teachers was related to math and science outcomes and in fact show that friend support for math and science is lower than teacher support. When considered together, one interpretation of these results is that children might form general beliefs toward their school with respect to it being a supportive environment (e.g., Rueger et al. 2010). Thus, teachers and friends might form a school-based support system that impacts students' math and science self-efficacy and attitudes. It is then possible that teachers and friends may be more influential than parents in affecting these school-based outcomes. If this were the case, it seems possible that strong school-based support systems can compensate for lower levels of parental support and vice versa. To test this model, it would be necessary to find students who fit different support profiles (e.g., high on school support and low on parental support and vice versa). These analyses are beyond the scope of this article. However, examining overall school support could be an interesting addition to the literature on STEM academic and career outcomes and should be pursued in the future.

Implications, Limitations, and Conclusions

It is important to explore the practical applications that can be derived from this research in order to possibly increase the number of students pursuing STEM careers. Previous research has found that positive self-perceptions of ability in a particular subject are related to future involvement with that subject (Bandura et al. 2001; Ferry et al. 2000; Frome and Eccles 1998; O'Brien et al. 1999). The current research revealed that social support promotes positive self-efficacy and attitudes toward both math and science, which are important for establishing a future interest in pursuing these types of careers. Practical applications from this research could include the development of outside activities involving parents, teachers, and friends to encourage interest in math and science careers. This might include math and science related clubs and fairs, field trips to museums, workshops with STEM college students and introducing fun parent–child competitions in math and science. Friend support may be especially useful in dispelling the stereotype that math and science are "nerdy" or masculine subjects. Overall, making STEM subjects more attractive and fun to students and their social support agents could aid in retaining interest in these subjects long-term.

In addition to positive practical applications, the current research also sparks several ideas for further research examining the roles of social support. Typically, STEM academic subjects and careers are stereotyped as masculine and because of this considerable effort has been made toward exploring ways to encourage female students to pursue the necessary academic courses that are preparatory toward STEM degrees and careers. Similar to others (e.g., National Council for Research on Women 2001), we have found in previous research using the same sample (Barth et al. 2011) that, compared to female students, males were more interested in math and science and had higher self-perceptions of their abilities. However, the limited sex differences that we found do not give strong support for the idea that boys and girls differ greatly in their perceptions of social support

A limitation of our research is that we measured students' perceptions of support rather than actual support that each student received, so it may be interesting to explore perceived social support in comparison with actual social support for males and females. It may be beneficial to undertake an "intervention" that actually adds social support activities to assess their benefit to enhancing self-efficacy and attitudes in STEM academic subjects and careers. Much of the research on social support has been focused at the individual level, and it is possible that social support could be nested in groups such as school or classroom. For example, it is possible that different teachers or environments could either promote or hinder whole groups of students' ideas about math and science subjects. In the event this were the case, corrective measures could be taken at the school or classroom level that would result in improved perceptions of social support by students, which would potentially bolster their own self-efficacy and attitude toward math and science. In such a study, it would be important to examine social support from the parent or teacher perspective as well as continuing to examine the students' perspective.

In conclusion, the results of the current study lend support to both Lent's *Social Cognitive Career Theory* and Eccles' *Expectancy Value Model.* Expanding on these models, we examined social support for math and science efficacy and interest from three different social agents across adolescence. The current study found that parents, teachers, and friends were all important social support agents for establishing positive self-efficacy and attitudes in math and science across distinct adolescent school settings. Although previous research has shown robust sex differences in efficacy in and attitudes toward STEM, we find minimal sex differences that are more of degree than kind. Our research suggests that middle school and high school students perceive less social support than either elementary school children or college students for math and science, a unique finding that needs further investigation The factors leading to students' interest in STEM subjects are complex, and more research is necessary for a complete understanding of how to increase the number of students who pursue STEM careers.

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References

Ahmed, W., Minnaert, A., Van der Werf, G., & Kuyper, H. (2010). Perceived social support and early adolescents' achievement: The mediational roles of motivational beliefs and emotions. *Journal of Youth and Adolescence, 39*, 36–46.

Bandura, A., Barbaranelli, C., Caprara, G. V., & Pastorelli, C. (2001). Self-efficacy beliefs as shapers of children's aspirations and career trajectories. *Child Development, 72*(1), 187–206.

Barile, J. P., Donobue, D. K., Anthony, E. R., Baker, A. M., Weaver, S. R., & Henrich, C. C. (2012). Teacher-student relationship climate and school outcomes: Implications for educational policy incentives. *Journal of Youth and Adolescence, 41*(3), 256–267.

Barth, J. M., Todd, B., McCallum, D. M., Goldston, M., Guadagno, R. E., Roskos, B., & Burkhalter, C. (2011). Effects of engaging classroom strategies and teacher support on student outcomes over school transitions. *Proceedings of the American Society for Engineering Education, 2011*. http://www.asee.org/public/conferences/1/papers/2446/view.

Bissell-Havran, J. M., & Loken, E. (2009). The role of friends in early adolescents' academic self competence and intrinsic value for math and English. *Journal of Youth and Adolescence, 38*, 41–50.

Bowen, G. L., Hopson, L. M., Rose, R. A., & Glennie, E. J. (2012). Students' perceived parental school behavior expectations and their academic performance: A longitudinal analysis. *Family Relations: An Interdisciplinary Journal of Applied Family Studies, 61*(2), 175–191.

Ceci, S. J., Williams, W. M., & Burnett, S. M. (2009). Women's underrepresentation in science: Sociocultural and biological considerations. *Psychological Bulletin, 135*, 218–261.

Chen, J. J. (2005). Relations of Academic support from parents, teacher, and peers to Hong Kong adolescents' academic achievement: The mediating role of academic engagement. *Genetic, Social, and General Psychology Monographs, 13*, 77–127.

Corbett, D., & Wilson, B. (2002). What urban students say about good teaching. *Educational Leadership*, *60*, 18–22.

Correll, S. J. (2001). Gender and career choice process: The role of biased self-assessments. *American Journal of Sociology, 106*(6), 1691–1730.

Crosnoe, R., Morrison, F., Burchinal, M., Pianta, R., Keating, D., Friedman, S. L., et al. (2010). Instruction, teacher-student relations, and math achievement trajectories in elementary school. *Journal of Educational Psychology, 102*(2), 407–417.

Demaray, M. K., & Malecki, C. K. (2002). Critical levels of social support associated with student adjustment. *School Psychology Quarterly, 17*, 213–241.

Demaray, M. K., & Malecki, C. K. (2003). Importance ratings of socially supportive behaviors by children and adolescents. *School Psychology Review, 32*, 108–131.

Demaray, M. K., Malecki, C. K., Rueger, S. Y., Brown, S. E., & Summers, K. H. (2009). The role of youth's ratings of importance of socially supportive behaviors in the relationship between social support and self-concept. *Journal of Youth and Adolescence, 38*, 13–28.

Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C. M., Meece, J. L., et al. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motivation* (pp. 75–146). San Francisco: W. H. Freeman.

Eccles, J. S., Midgley, C., & Adler, T. (1984). Grade-related changes in the school environment: Effects on achievement motivation. In J. G. Nicholls (Ed.), *The development of achievement motivation* (pp. 283–331). Greenwich, CT: JAI.

Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., et al. (1993). Development during adolescence: The impact of stage-environment fit on young adolescents' experiences in schools and in families. *American Psychologist, 48*, 90–101.

Ferry, T. R., Fouad, N., & Smith, P. L. (2000). The roles of family contest in a social cognitive model for career-related choice behavior: A math and science perspective. *Journal of Vocational Behavior, 57*, 348–364.

Fouad, N., & Smith, P. L. (1996). A test of a social cognitive model for middle school students: Math and science. *Journal of Counseling Psychology, 43*, 338–366.

Fredricks, J. A., & Eccles, J. S. (2002). Children's competence and value beliefs from childhood through adolescence: Growth trajectories in two male-sex-typed domains. *Developmental Psychology, 38*(4), 519–533.

Frome, P. M., & Eccles, J. S. (1998). Parents' influence on children's achievement-related perceptions. *Journal of Personality and Social Psychology, 74*, 435–452.

Gutman, L. M. (2006). How student and parent goal orientations and classroom goal structures influence the math achievement of African Americans during the high school transition. *Contemporary Educational Psychology, 31*, 44–63.

Gutman, L. M., & Eccles, J. S. (2007). Stage—Environment fit during adolescence: Trajectories of family relations and adolescent outcomes. *Developmental Psychology, 43*, 522–537.

Hughes, J. N. (2011). Longitudinal effects of teacher and student perceptions of teacher-student relationship qualities on academic adjustment. *The Elementary School Journal, 112*, 38–60.

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice and performance. *Journal of Vocational Behavior, 45*(1), 79–122.

Lent, R. W., Brown, S. D., & Hackett, G. (2000). Contextual support and barriers to career choice: A social cognitive analysis. *Journal of Counseling Psychology, 47*, 36–49.

Lent, R. W., Brown, S. D., Schmidt, J., Brenner, B., Lyons, H., & Treistman, D. (2003). Relation of contextual supports and barriers to choice behavior in engineering majors: Test of alternative social cognitive models. *Journal of Counseling Psychology, 50*, 458–465.

Lent, R. W., Brown, S. D., Sheu, H., Schmidt, J., Brenner, B. R., Gloster, C. S., et al. (2005). Social cognitive predictors of academic interests and goals in engineering: Utility for women and students at historically Black universities. *Journal of Counseling Psychology, 52*, 84–92.

Lent, R. W., Sheu, H. B., Singley, D., Schmidt, J. A., Schmidt, L. C., & Gloster, C. S. (2008). Longitudinal relations of self-efficacy to outcome expectations, interests, and major choice goals in engineering students. *Journal of Vocational Behavior, 73*(2), 328–335.

Ma, X., & Wilkins, J. L. (2002). The Development of Science Achievement in Middle and High School Students. *Evaluation Review, 26*, 395–417.

Marsh, H. W., & Yeung, A. S. (1997). Coursework selection: Relations to academic self-concept and achievement. *American Educational Research Journal, 34*, 691–720.

Michigan Study of Adolescent and Adult Life Transitions (2006). University of Michigan Gender and Achievement Research Program. http://www.rcgd.isr.umich.edu/msalt.

Midgley, C., Feldlaufer, H., & Eccles, J. S. (1989). Student/teacher relations and attitudes toward mathematics before and after the transition to junior high school. *Child Development, 60*, 902–981.

Miller, J., Kimmel, L., Hoffer, T., & Nelson, C. (2000). *Longitudinal study of American youth: User's manual*. Chicago, IL: International Center for the Advancement of Scientific Literacy, Academy of Sciences.

National Council for Research on Women. (2001). *Balancing the equation: Where are women and girls in science, engineering and technology?*. New York: National Council for Research on Women.

Navarro, R. L., Flores, L. Y., & Worthington, R. L. (2007). Mexican American middle school students' goal intentions in mathematics and science: A test of social cognitive career theory. *Journal of Counseling Psychology, 54*(3), 320–335.

O'Brien, V., Martinez-Pons, M., & Kopala, M. (1999). Mathematics self-efficacy, ethnic identity, gender, and career interests related to mathematics and science. *Journal of Educational Research, 92*, 231–235.

Pellegrini, A. D. (2001). A longitudinal study of heterosexual relationships, aggression and sexual harassment during the transition from primary school through middle school. *Journal of Applied Developmental Psychology, 22*, 1–15.

Pellegrini, A. D. (2002). Bullying, victimization, and sexual harassment during the transition to middle school. *Educational Psychologist, 37*, 151–163.

Reynolds, A. J., & Walberg, H. J. (1992). A structural model of science achievement and attitude: An extension to high school. *Journal of Educational Psychology, 84*(3), 371–382.

Rueger, S. Y., Malecki, C. K., & Demaray, M. K. (2010). Relationship between multiple sources of perceived social support and psychological and academic adjustment in early adolescence: Comparisons across gender. *Journal of Youth and Adolescence, 39*, 47–61.

Wang, J., & Staver, J. R. (2001). Examining relationships between factors of science education and student career aspiration. *The Journal of Educational Research, 94*(5), 312–319.

Wilkins, J. L. M., & Ma, X. (2003). Modeling change in student attitude toward and beliefs about mathematics. *Journal of Educational Research, 97*, 52–63.

Wilkinson, L. C., & Marrett, C. B. (1985). *Gender Influences in classroom interaction*. Orlando, FL: Academic Press.

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