Changes in Math and Science Interest over School Transitions: Relations to Classroom Quality, Gender Stereotypes, and Efficacy

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ABSTRACT

Significant declines in STEM ability beliefs and interest are often found during the transitions to middle school and high school. Girls generally report lower self-concept and interest in STEM compared to boys. Some children remain interested in math and science over these transitions, but we know little about the school and social factors that contribute to their continued interest and if these factors differ by gender. This study examines changes in math and science self-efficacy and interest over two school transitions and the final two years in high school. It further examines if changes and gender discrepancies in math and science interest, can be accounted for by self-efficacy, classroom qualities and the gender stereotypical beliefs about the usefulness of math and science. Student in grades 5, 8, and 11 (N= 595) completed surveys on their math and science interest, self-efficacy, stereotypes, and classroom quality prior to transitioning to the next grade, and then one year post-transition. Although there were declines in interest and efficacy over school transitions they were not as substantial or pervasive compared to previous research. Gender differences were more apparent in high school than in earlier grades. Regression analyses indicated that changes in interest over time were explained by self-efficacy, classroom quality, and gender stereotype beliefs, although gender stereotypes were only predictive of science interest

KEYWORDS

STEM interest; STEM Efficacy, STEM Instruction; Gender Stereotypes; School Transitions

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INTRODUCTION

Research on women's underrepresentation in STEM (science, technology, engineering, and mathematics) indicates that girls in high school achieve at about the same level as their male counterparts in math and science (National Science Board, 2018), but fail to continue on to college majors in these fields. Recruitment of students into STEM undergraduate programs depends to a large degree on maintaining interest in math and science over the school years prior to college. Previous work indicates that college students in a range of STEM majors became interested in STEM prior to sixth grade (Maltese, Melki, & Wiebke, 2014). Students' interest in science is related to their career aspirations (for a review, see Regan & DeWitt, 2015), suggesting that early school experiences may be important for recruiting STEM majors.

Theoretical models such as expectancy value (Eccles, 1994, 2011) and social cognitive theory (Bandura, Barbaranelli, Caprara, & Pastorelli, 2001) point to self-perceptions of math and science abilities (e.g., self-concept and self-efficacy) as being critical to continuing academic engagement in these fields. Although expectancy value theory and social cognitive theory use different terminology, both theories address the importance of competence-related beliefs on academic motivation and outcomes (Hyde & Durik, 2005). In expectancy-value theory, expectancy belief (e.g., ability self-concept; expectation for success) refers to individuals' evaluations of their competence in different tasks and how well they will do on upcoming tasks. Self-efficacy beliefs refer to persons' judgments of their confidence to learn, perform or succeed in academic domains and are also strong predictors of adaptation and change, as well as academic aspirations, level of motivation, and resilience (Bandura et al., 2001). Because these constructs are highly correlated (Wigfield & Eccles, 2000), we will use the term preferred by the author in discussing a particular study and refer to both terms generically as perceived abilities throughout the introduction. The measure used in the current research more closely aligns with self-efficacy.

Unfortunately, females often rate themselves lower than males on self-report measures of competence and interest in math and science (Baird & Keane, 2019; Cunningham, Hoyer, & Sparks, 2015; Watt, 2004; Watt, Eccles, & Durik, 2006). Declines in these and related motivational and social support factors over the course of schooling are well documented, especially during the transitions to middle school and high school (Eccles, Midgely, & Adler, 1984; Gutman, 2006; Isakson & Jarvis, 1999; Ma & Wilms, 1999; Pintrich, 2000; Watt, 2004; Wilkins & Ma, 2003). However, some research has found that global self-esteem increases for boys and girls when the school configuration has only one transition (8^{th} to 9^{th} grade; Blyth, Simmons, & Carlton-Ford, 1983). Using stage-environment fit theory (Eccles et al., 1993), social cognitive theory (Bandura et al., 2001), and expectancy value theory (Eccles, 2011) for theoretical grounding, this study examines changes in math and science self-efficacy and interest over two school transitions and the final two years of high school. The research design is cross-sectional between grade levels (5th, 8th, and 11th grades), but longitudinal over the transitions. It further examines factors derived from these theories that might account for changes and gender discrepancies in interest, including math and science self-efficacy, classroom qualities, and gender stereotypical beliefs about the usefulness of math and science. Most of the research cited on school transitions is based on data collected over two decades ago when there were larger, more substantial gender discrepancies in high school math and science course taking (Cunningham et al., 2015), as well as in some STEM college majors (e.g., Biology; National Science Foundation [NSF], 2017). Thus, this study serves to update the trends observed in earlier studies.

BACKGROUND

School Transitions

The Eccles et al. (1993) stage-environment fit model proposes that school transitions negatively affect academic outcomes because there is an inconsistency between children's developmental needs and post-elementary school environments (Eccles et al., 1993; Gutman & Eccles, 2007). Each school transition marks a significant decline in teacher support, a change to a more peer-competitive school setting, and a change in the academic context of math and science course-taking (e.g., required vs. elective courses; regular vs. advanced classes). Together these factors may account for some of the declines in student self-concept and attitudes. Specifically, in contrast to elementary schools, middle schools are characterized as having less supportive teachers, more ability-grouped classes, and more competition (Eccles et al., 1993). Prior to the transition to middle school, students have generally all received the same instruction in math and science. Both middle and high school students have more specialized experiences in science and math based on abilities and interests. Compared to middle school, the high school setting is even less personal, more competitive, and more grade oriented. The last two years of high school mark a significant period of preparation for post-secondary education and careers as students select courses based on post-high school plans. At this level, students are more likely to be taking advanced level math or science classes beyond the required courses for the high school diploma (e.g., physics, pre-calculus, and calculus). Thus, ability differences are even more emphasized as the differences between college bound and other students are more salient (Gutman, 2006).

Several studies have identified self-concept, academic self-efficacy, and attitudes as factors that might explain why some students' interest and academic performance are higher than others' during school transitions (Bandura et al., 2001; Wigfield, Eccles, MacIver, Reuman, & Midgley, 1991; Wilkins & Ma, 2003). For example, Ma and Wilms (1999) found that adolescents drop from advanced math courses during two transitions: from eighth grade to high school and from eleventh to twelfth grade. During the transition from eighth to ninth grade, dropping out was attributed primarily to prior achievement, while dropping out over the transition from eleventh to twelfth grade was attributed to negative attitudes toward math. Gender differences in changes in these factors are evident across school transitions, as girls manifest a steeper decline in math interest over the course of adolescence compared to boys (Fredricks & Eccles, 2002).

Prior work indicates that perceived competence better predicts academic pursuits and occupational interest than previous achievement (Bandura et al., 2001; Brown et al., 2008; Ferry, Fouad, & Smith, 2000; Frome & Eccles, 1998). Empirical work also reveals that boys have higher general self-esteem, compared to girls, both before and after school transitions (Blyth et al., 1983; Booth & Gerard, 2014). However, the timing of children's first school transition (6^{th} to 7^{th} grade vs. 8^{th} to 9^{th} grade) and the number of transitions over the middle and high school years may make a difference in whether girls' self-esteem declines (earlier grade transition) or increases (later grade transition; Blyth et al., 1983). Gender differences in math self-efficacy have been found to mediate gender differences in the decisions to enter some STEM fields (Correll, 2001; Parker, Nagy, Trautwein, & Ludtke, 2014).

Based on prior research, it is expected that academic self-efficacy and interest will decline at each transition. In addition, it is predicted that there will be gender differences in interest and efficacy favoring males. However, expectancy value theory, suggests that these outcomes are affected by other factors besides gender, including classroom quality and socialized gendered beliefs about math and science (Eccles, 2011).

Classroom Quality

Stage-environment fit theory (Eccles et al., 1993) proposes that the new classroom environment after a school transition accounts for general declines in students' motivation, and more specifically, that such experiences influence students' perceived abilities and interests. The classroom environment involves the personal relationships between students and teachers as noted above (less personal and less positive interactions and greater emphasis on control) and teachers' instructional style. Positive student-teacher relationships have immediate (Marchant, Paulson, & Rothlisberg, 2001; Wang & Eccles, 2013) and long-term impacts on academic self-concept (Murdock, Anderman, & Hodge, 2000). Teachers who support and encourage students to achieve in math and science positively affect children's attitudes and interest toward math and science coursework (George, 2003), promote higher levels of expectation for academic success (Goodenow, 1993; Midgley, Feldlaufer, & Eccles, 1989), and more positive academic self-efficacy (Ryan & Patrick, 2001).

Positive instructional methods include opportunities to engage in achievement-related activities, which in turn provide students with information about their competence and interest in academic subjects that eventually lead to the development of ability self-concepts (Wang & Eccles, 2013). Teaching for relevance, or meaningful instruction, refers to the extent to which class instruction is related to students' personal interests and goals (Wang & Eccles, 2013). For example, Wang (2012) found that teaching for meaning and promoting cooperative learning significantly predicted students' subjective task values for math (e.g., interest, usefulness), which in turn predicted the number of mathematics classes taken and mathematics-related career plans. Indeed, there is evidence to suggest that meaningful instruction can increase academic interests (National Research Council,

2004) and lead to stronger beliefs in one's academic abilities (Stipek, 2001). For example, students report greater motivation, interest, and future orientation towards science when exposed to interactive, hands-on activities, and science applications in classrooms (Hampden-Thomson & Bennett, 2013). This is consistent with recommendations from the National Research Council's framework for K-12 Science ducation and science instruction (2012; also see 2004), which include an emphasis on students practicing science (e.g., participating in experiments and demonstrations). The National Research Council also notes the importance of students developing an awareness of science careers and the stories of individual scientists to promote science identity.

Together, a number of studies suggest that the optimal classroom environment creates a comfort zone with classmates and teachers, but also provides a degree of challenge. Based on this research, we propose that classroom quality (teacher support and meaningful instruction) may partially explain changes in students' interest in science and math after a school transition. Consistent with expectancy value theory, we further propose that gender stereotypical beliefs of the importance of math and science also may account for declines in interest, especially for girls.

Gender Stereotypes

The expectancy value model of academic achievement formally proposes that children's perceptions of gender stereotypes should impact children's ability beliefs (expectations for success) and subjective task values (interest, utility value, attainment value, and relative costs), which in turn impact academic choices and behaviors (Eccles, 1994; 2011; Lane, Goh, & Driver-Linn, 2012). More traditional gender stereotypical beliefs in childhood are associated with more gender stereotypical vocations in early adulthood (Lawson, Lee, Crouter, & McHale, 2018).

Gender stereotype knowledge related to academic subjects and occupations increases over schooling and may adversely affect both girls' and boys' interest in math and science (Barth, Kim, Eno, & Guadgno, 2018; Chatard, Guimond, & Selimbegovic, 2007; Evans, Copping, Rowly, & Kurtz-Costes, 2010; Katz & Ksansnak, 1994; Kurtz-Costes, Rowley, Harris-Britt, & Woods, 2008; Wigfield & Eccles, 2002). Blažev, Karabegović, Burušić, & Selimbegović (2017) found that primary school students with stereotype-consistent interests are more prone to hold stereotypical beliefs than those who have less gender-stereotypical interests in school subjects. Similarly, female college students who endorse math gender stereotypes have more negative self-perceptions related to their math abilities than women who reject these stereotypes (Schmader, Johns, & Barquissau, 2004). Additionally, there may be gender differences in the effect of stereotypes on STEM attitudes. For instance, Nosek, Banaji, and Greenwald (2002) observed that strong gender stereotypes were correlated with negative math attitudes for women, while the opposite was true for men. Further, stereotypes that boys are more suited for math or science than girls may influence girls' motivation and interest in math and science (Cvencek, Meltzoff, & Greenwald, 2011; Master, Cheryan, & Meltzoff, 2016; Steffens, Jelenec, & Noack, 2010). However, Barth et al. (2018) found that holding traditional STEM occupation gender stereotypes was related to lower STEM career interests for both boys and girls.

There are conflicting views as to whether gender stereotypes have a stronger influence on older or younger children (e.g., Gottfredson, 1981; Gottfredson & Lapan, 1997 vs. Garrett, Ein, & Tremaine, 1977; Katz & Ksansnak, 1994). Cross-sectional research comparing gender stereotypes in younger and older children suggests that younger children do not endorse traditional gender stereotypes because they tend to hold an "own gender" bias when comparing boys and girls (Kurtz-Costes et al., 2008). However, other evidence suggests that children as young as seven years of age endorse traditional gender stereotypes (Cvencek et al., 2011).

In a recent study, Barth et al. (2018) found that across a wide range of ages from elementary school to college, ability beliefs, whether for oneself or others, were strong predictors of career interests, and that stereotypical beliefs about occupations played a secondary role, but still a significant one. Girls and boys appeared to become less stereotypical in their own STEM career interests and efficacy over schooling, but the expectation that others would hold gender stereotypical career interests did not change accordingly over the same time period. To extend upon this work, we focus on the gender stereotyped belief that math and science are more useful for males than females. This is consistent with the Eccles et al. (2011) hypothesis that gender stereotypes are related to subjective task values, such as the utility value.

Current Study

This study examines factors that affect change in children's interest in math and science over three transition periods: from fifth grade to middle school, from eighth grade to high school, and from eleventh to twelfth grade in high school. The research design is cross-sectional between grade levels (5^{th}, 8^{th}, and 11^{th} grades), but longitudinal over the transitions. An important contribution of this study is the consideration of both math and science, as most previous research has primarily included only math. There are two primary objectives. First, changes in interest and self-efficacy for math and science over the three transition periods are examined, partially replicating previous work (Ma & Wilms, 1999). Although the transition to middle school and junior high has been extensively studied, there is less research on the transition to high school and the last two years of high school that focuses on math and science. Consequently, this objective seeks to validate and extend previously reported declines in interest and efficacy over different transition periods, as well as previously reported gender differences before and after the transitions. It is expected that interest and efficacy will decline over each transition and be greater for younger students compared to older students (i.e., fifth graders > middle school students > high school students). Additionally, based on past research, we expect that girls' interest will drop more than boys' over transitions.

The second objective examines if self-efficacy, perceived classroom quality, and math/science usefulness stereotypes can account for changes in interest over transitions, especially for gender differences in change in interest. Theorizing and research based on expectancy value and social cognitive theory (Bandura et al., 2001; Eccles, 2011) led to the prediction that self-efficacy will be the strongest predictor of interest in math and science, and this study will assess if classroom quality and gender stereotypes add explanatory power. Thus, we examine if changes in interest over school transitions are accounted for by self-efficacy, classroom quality, and gender stereotypes about the usefulness of math and science after the school transition. Although grade level changes are examined in the analyses, it is expected that these factors are similarly important across schooling.

METHOD

Participants

Participants were recruited from fifth, eighth, and eleventh grade classrooms in nine U.S. public schools (three each for elementary, middle, and high school), all of which were part of the same county school system that included both urban and non-urban schools. The nine schools from which the students were recruited were predominantly non-Hispanic White (school average of 72%, range 42% to 94%), but had a significant percentage of Black students (school average 24%, range 4% to 51%). The average free/reduced lunch rate was 45% (range 27% to 73%). The elementary, middle, and high schools were vertically aligned (i.e., in the same school zone within the school system), such that the elementary school children were expected to transition into one of the participating middle schools, and the middle school students were expected to transition into one of the participating high schools. The vertical alignment made it unlikely that differences between grade levels were due to factors related to school demographic characteristics (e.g., SES) since students were drawn from the same school zones. In middle and elementary schools, we were able to recruit from all students at a particular grade level. At the high school level, we recruited from math and science courses for 11th graders.

In the last half of the spring semester, parents received a letter that explained the purpose of the project and asked them to return a consent form to school if they were interested in allowing their child to participate. Parents were told that a $5 donation would be made to their school for each returned consent form and that there was an opportunity for children to participate in a second career survey (not included in this research report) and earn $15 (fifth graders) or $20 (eighth graders and high school students). The initial response rate was 47% of the 1511 potential students with 704 students completing the survey. This included 290 fifth graders, 207 eighth graders, and 207 high school students. Fifty-six percent of the students were female, 74% were Caucasian (0.8% Hispanic), 22% Black, and the remaining 4% were Asian, mixed race, other, or did not specify a race.

Approximately one year later, schools and students were re-contacted and surveys were re-administered for the post-transition time point. The retention rate was 84% at the second time point (N = 595 students). The primary factor affecting retention was that students had moved out of the school district or were absent on the days that the survey was administered. This group of students was 55% female and had a racial make-up similar to the original sample: 75% Caucasian (1% Hispanic), 22% Black, and the remaining 3% were all other races or unspecified. Comparisons between students who participated at both time points to those who only participated at the pre-transition time point on the pre-transition measures described below revealed three significant differences. Compared to those who dropped out after the first time point, those who were retained rated themselves higher in math Efficacy (M_{droped} = 3.66, $SD_{dropped}$ = 0.87; $M_{retained}$ = 3.99, $SD_{retained}$ = 0.72, p < .001), science Efficacy ($M_{dropped}$ = 3.83, $SD_{dropped}$ = 0.68; $M_{retained}$ = 3.99, $SD_{retained}$ = 0.68, p = .027), and math Interest ($M_{dropped}$ = 3.66, $SD_{dropped}$ = 0.81; $M_{retained}$ = 4.03, $SD_{retained}$ = 0.73, p < .001). Despite this difference, the pattern of relations among the measures between the two time points was very similar. (See correlations in Table 2.)

Procedure and Measures

At each time point, students completed the 172 item *Math, Science, and Technology* (MST*)* questionnaire in a group setting at their schools during regular school hours. Assent information and directions were read aloud by the research staff, and then students were allowed to proceed at their own pace. Research staff was available to answer questions and provide assistance if necessary. Younger children averaged 20 to 30 minutes to complete the questionnaire, and older students were able to finish in 15 to 30 minutes.

The MST assessed students' efficacy, interest, classroom experiences, attitudes, goals, and gender stereotypes in the areas of math, science, and technology. We report on four sets of measures from this battery that focus on math and science. Items on the scales were primarily taken from previously published measures. Some items were edited slightly to increase clarity for the younger children in the study and/or make the response format consistent with a 5-point scale. It should be noted that sample sizes vary slightly for different measures due to some participants not fully completing the questionnaire. Unless otherwise specified, the rating scales for Self-Efficacy, Interest, Classroom Quality and Usefulness Stereotype were strongly disagree = 1 to strongly agree = 5. All scale scores were calculated as averages over responses to items so that the range of scores for all measures was 1 to 5. Participants had to have answered 75% of the items on a scale to receive a score for that scale. Table 1 presents descriptive statistics for each measure pre- and post-transition by gender and grade.

Measures for Self-Efficacy, Interest, and Usefulness Stereotypes were based on measures used in the Michigan Study of Adolescent and Adult Life Transitions (MSALT; http://garp.education.uci.edu/msalt.html).

Math and Science Self-Efficacy. Questions were adapted from MSALT and included items related to performance in school (e.g., self-ranking of ability from 1 = near the bottom to 5 = near the top, performance in math and science in comparison to other subjects from 1 = much worse to 5 = much better), and items related to the ability to learn math or science ("When taking a math/science test I've studied for, I do very well;" "I could learn to do any type of math/science problem if I wanted to"). Higher scores indicated better self-efficacy. Internal consistency for these four Efficacy scales (Math pre- and post-transition; science pre- and post-transition) was acceptable at each time point (*Cronbach's alpha* range = .68 – .74, *Median* = .72).

Table 1
Descriptive Statistics for Measures

Field			5th Grade				8th Grade				11th Grade			
			Male		Female		Male		Female		Male		Female	
			M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Math	Useful Stereo.	Pre	2.49	1.26	1.97	1.23	2.14	1.17	1.76	0.97	2.21	1.27	1.81	1.17
		Post	2.47	1.22	1.96	1.25	2.42	1.02	1.85	1.04	2.16	1.11	1.56	0.99
	Class Quality	Pre	3.70	0.62	3.79	0.59	3.63	0.85	3.56	0.82	3.42	0.81	3.29	0.88
		Post	3.37	0.94	3.70	0.81	3.42	0.70	3.49	0.90	3.61	0.77	3.61	0.65
	Efficacy	Pre	3.96	0.70	3.94	0.65	3.97	0.77	3.88	0.71	4.08	0.87	3.88	0.89
		Post	3.89	0.78	3.99	0.65	4.03	0.89	3.95	0.79	4.18	0.61	4.01	0.73
	Interest	Pre	4.06	0.61	4.08	0.69	4.02	0.70	3.86	0.74	3.99	0.85	3.80	0.93
		Post	3.79	0.78	3.96	0.74	3.96	0.75	3.86	0.74	4.11	0.67	3.88	0.85
Science	Useful Stereo.	Pre	2.42	1.24	2.03	1.26	2.27	1.18	1.71	1.03	2.40	1.33	1.79	1.14
		Post	2.48	1.33	2.04	1.28	2.33	1.12	1.92	1.18	2.12	1.09	1.62	1.06
	Class Quality	Pre	3.88	0.62	3.96	0.57	3.63	0.85	3.66	0.81	3.77	0.78	3.80	0.75
		Post	3.55	1.02	3.87	0.76	3.71	0.69	3.55	0.86	3.98	0.69	4.02	0.63
	Efficacy	Pre	3.97	0.69	3.96	0.68	3.98	0.72	3.91	0.72	4.14	0.60	3.90	0.65
		Post	3.89	0.89	3.84	0.72	4.04	0.67	3.76	0.76	4.21	0.57	3.90	0.71
	Interest	Pre	4.03	0.76	3.88	0.78	3.88	0.74	3.71	0.79	3.95	0.81	3.89	0.81
		Post	3.75	0.85	3.76	0.83	3.84	0.79	3.75	0.82	4.15	0.68	3.84	0.82
N range			118-142		132-147		79-93		87-114		58-67		101-118	

Math and Science Interest. Two separate scales were created for math and science, one for each time point (four measures altogether). Items were adapted from the MSALT. The scales combined five items related to attitudes (liking, interest in taking more math or science) and the perceived importance and benefit of math or science for the future. Higher scores indicated greater interest. The scales had acceptable internal consistency (*Cronbach's alpha range* = .70 – .77, *Median* = .72).

Student Perceptions of Classroom Quality. Two separate scales were created for each time point, one for science and one for math (four scales altogether). Items on the scales included assessments of teacher support or "push" (e.g., teacher expectations for students to work hard, teacher encouragement in math and science), and teacher-student relations (e.g., the teacher cares how students feel) adapted from Midgley et al. (1989) and Wilkins and Ma (2003). Student experience with different classroom activities associated with greater learning and interest in science and math were also assessed by investigator–developed questions related to teaching for relevance (e.g., use of hands-on activities, use of real world examples, including information on careers) that were derived from recommendations from various educational guides, such as the National Research Council, 2004, 2012). These items were averaged to form Classroom Quality scales for math (12 items) and science (17 items) such that 1 = low Classroom Quality and 5 = high Classroom Quality. Internal consistency for these scales was high (*Cronbach's alpha range* = .85 – .91, Median = .87).

Math and Science Usefulness Stereotype. These questions were adapted from the MSALT question "Who finds math more useful" (1 = women much more useful to 5 = men much more useful) to fit with the agreement response scale used for the other items: "Math [science] is more useful for boys than girls" (1 = strongly disagree to 5 = strongly agree). Higher scores on Usefulness Stereotype indicated more stereotypical beliefs about math and science, specifically, that they are more useful for boys than girls. These measures were assessed pre- and post-transition.

RESULTS

First, grade related changes in Efficacy and Interest in math and science were examined to see how this sample compared with previously reported changes in these constructs over school transitions and gender differences. Next, we examined if Efficacy, Classroom Quality, and Usefulness Stereotypes could account for Interest in math and science prior to the transition (including gender differences therein) and then examined if these factors could account for change in Interest over the transition. Table 1 presents descriptive statistics for all measures. It should be noted that although participants are nested within schools, the small number of schools (N = 9) does not meet the threshold recommended for hierarchical or multi-level modeling (Maas & Hox, 2005; O'Dwyer & Parker, 2014; Scherbaum & Ferreter, 2009).

Transition-Related Changes in Efficacy and Interest

Two repeated measures MANOVAs were conducted, one each for Interest and Efficacy. The statistical design was a multi-level factorial design: 2(Gender) x

3(Starting Grade: 5th, 8th, or 11th) x 2(Transition: before or after) x 2(Field: math or science). A Bonferroni correction was used for all follow-up comparisons.

Analyses examining change in Interest over time revealed three significant main effects and two interactions. The main effect for Gender, $F(1, 568) = 5.36$, $p = .005$, $\eta p^2 = .01$, revealed that males reported greater Interest (for math and science combined) than females, $M_{boys} = 3.99$, $SE_{boys} = .035$; $M_{girls} = 3.88$, $SE_{girls} = .03$. The significant interaction between Gender and Grade, $F(2, 568) = 2.97$, $p < .05$, $\eta p^2 = .01$ sheds further light on this effect. As Figure 1 illustrates, follow-up comparisons indicated that the gender difference was only significant for the oldest students.

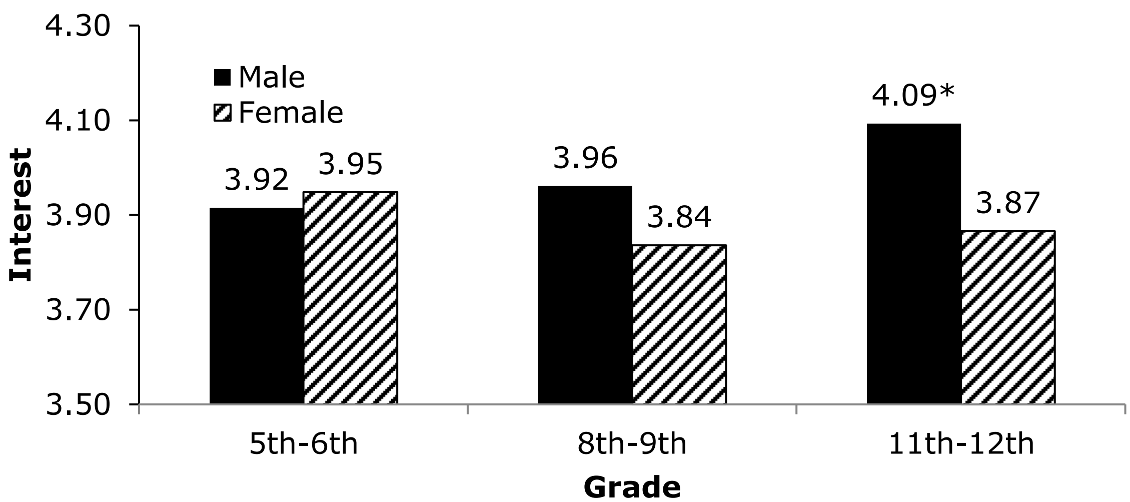

Figure 1. Interest: Gender x Grade Interaction. Interest scores are for math and science combined. Scores are also averaged between the pre- and post-transition scores for each of the three grade levels. $^*p = .01$

There was a significant effect for Transition, $F(1, 568) = 7.97$, $p = .005$, $\eta p^2 = .01$, indicating that Interest scores (for math and science combined) declined from pre- to post-transition, $M_{pre} = 3.98$, $SE_{pre} = .03$; $M_{post} = 3.90$, $SE_{post} = .03$. This effect should be interpreted in the context of the significant Transition x Grade interaction, $F(1, 568) = 6.72$, $p = .001$, $\eta p^2 = .023$. For the transition to middle school (5th to 6th grade) there was a significant decline in Interest, $M_{pre} = 4.03$, $SE_{pre} = .04$; $M_{post} = 3.83$, $SE_{post} = .04$, $p < .001$; however for the other two grade levels, the change from pre- to post-transition did not reach significance, for 8th to 9th grade, $M_{pre} = 3.94$, $SE_{pre} = .05$; $M_{post} = 3.86$, $SE_{post} = .05$, $p = .150$; for 11th to 12th grade, $M_{pre} = 3.96$, $SE_{pre} = .05$; $M_{post} = 4.00$, $SE_{post} = .05$, $p = .47$.

Finally, the main effect for Field was also significant, $F(1, 568) = 8.86$, $p = .003$, $\eta p^2 = .02$, indicating that interest was higher for math than science, $M_{math} = 3.99$, $SE_{math} = .03$; $M_{science} = 3.89$, $SE_{science} = .03$.

The results for Efficacy indicated a significant effect for Gender, $F(1, 556) = 9.90$, $p < .002$, $\eta p^2 = .02$, revealing that boys reported higher levels of Efficacy than girls, $M_{boys} = 4.07$, $SE_{boys} = .03$; $M_{girls} = 3.93$, $SE_{girls} = .03$. Although only marginally significant, $F(1, 556) = 2.86$, $p = .058$, $\eta p^2 = .01$, the Gender x Grade interaction effect is illustrated in Figure 2 because this interaction effect was significant for Interest and the pattern over grade levels was similar. As indicated in Figure 2, gender differences were not significant for the younger students, but were significant in older grade levels. Additionally, the three-way interaction between Transition, Field, and Gender was significant, $F(1, 556) = 5.14$, $p = .024$, $\eta p^2 = .01$. Follow-up comparisons indicated that at pre-transition gender differences were evident for both fields, although only marginally significant for science (for science $p = .067$, $M_{boys} = 4.07$, $SE_{boys} = .05$; $M_{girls} = 3.96$, $SE_{girls} = .04$ vs. for math $p = .015$, $M_{boys} = 4.10$, $SE_{boys} = .05$; $M_{girls} = 3.95$, $SE_{girls} = .04$). However, post-transition, gender differences were only evident for science, $p = .001$, $M_{boys} = 4.05$, $SE_{boys} = .05$; $M_{girls} = 3.83$, $SE_{girls} = .04$. Additional comparisons indicated that only girls had a significant drop in science efficacy over the transition, $p = .005$, $M_{pre} = 3.96$, $SE_{pre} = .04$; $M_{post} = 3.83$, $SE_{post} = .04$.

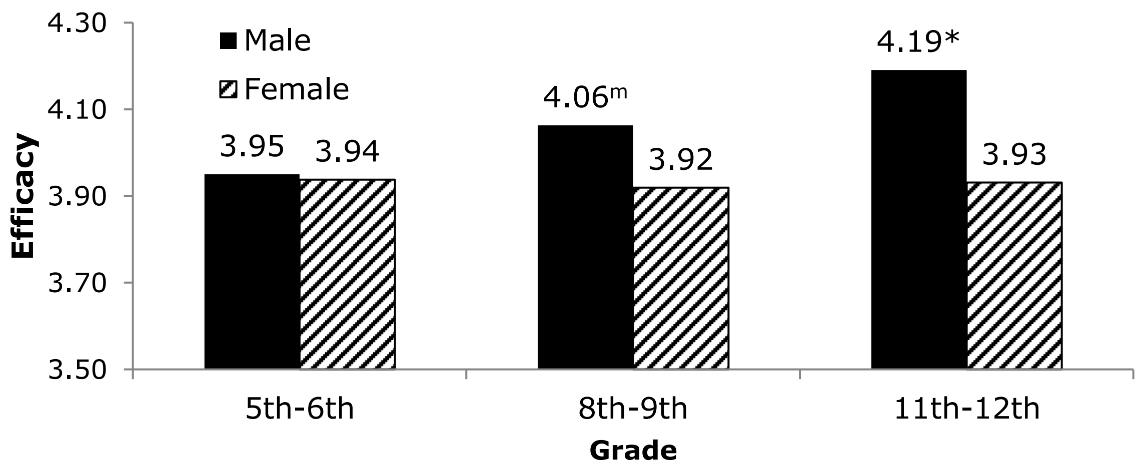

Figure 2. Efficacy: Gender x Grade Interaction. Efficacy scores are for math and science combined. Scores are also averaged between the pre- and post-transition scores for each of the three grade levels.
$^{m}p = .070$; $^{*}p = .002$

To summarize, Interest in math and science decreased in the transition from 5th to 6th grade, but not in other grades. Overall, boys reported higher Interest in math and science than girls, but this difference was only significant for high school students. Both boys and girls had greater Interest in math than science. For Efficacy, gender differences favoring boys were more prominent in upper grades. Boys reported higher math and science Efficacy than girls prior to the transition, but after the transition the gender difference was only evident for science. Girls' science Efficacy declined over the transition, but this pattern was not evident for boys.

Predicting Interest from Efficacy, Classroom Quality, and Usefulness Stereotype

As a preliminary step, math and science Interest scores were correlated with comparable subject-specific Efficacy, Classroom Quality, and Usefulness Stereotype scores (Table 2). All correlations were significant or marginally significant and in the expected direction. It should be noted that negative correlations with Usefulness Stereotype indicate that more stereotypical beliefs are associated with less Interest. Correlations calculated separately for each gender generally showed the same pattern of correlations. Specifically, pre- and post-transition Efficacy and Classroom Quality were positively correlated with Math and Science Interest. Usefulness Stereotype was negatively correlated with Math and Science Interest for both boys and girls and similar to the results presented in Table 2, were weaker and at times not significant for the correlation between Math Interest and Usefulness Stereotype.

Table 2
Correlations between Interest and Efficacy, Classroom Quality, and Stereotypes

	Math Interest		Science Interest	
Transition/	Pre	Post	Pre	Post
Measure	*N* = 671-677	*N* = 571-580	*N* = 674-678	*N* = 565-575
Pre				
Efficacy	$.69^{***}$	$.47^{***}$	$.62^{***}$	$.36^{***}$
Classroom Quality	$.45^{***}$	$.27^{***}$	$.34^{***}$	$.25^{***}$
Usefulness Stereotype	$-.09^{*}$	$-.07^{m}$	$-.17^{***}$	-.09*
Post				
Efficacy		$.68^{***}$		$.66^{***}$
Classroom Quality		$.40^{***}$		$.48^{***}$
Usefulness Stereotype		$-.07^{m}$		$-.17^{***}$

Note. Higher scores on Efficacy and Classroom Quality are associated with better ratings on these constructs. Higher scores on Usefulness Stereotype indicate more traditional stereotypical beliefs.
^{m} $p < .10$; * $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Next, regressions were calculated to examine the additive predictive effects of Efficacy, Classroom Quality, and Usefulness Stereotype for math and science Interest pre-transition. These analyses lay the foundation for the second set of regressions which examined how these factors predicted change in Interest. It should be noted that the second objective included an accounting of gender differences in change in Interest over the school transitions. However, the ANOVA results for Interest did not reveal a significant Gender X Transition interaction, suggesting that males and females showed similar changes over time. As a result, this part of the second objective was not considered in the analyses.

Predicting pre-transition Interest. A step-wise approach was used to assess the impact of three sets of variables: 1) demographics, consisting of Gender (0 =

female, 1 = male), Grade, and the Gender x Grade interaction; 2) Efficacy; and 3) Classroom Quality and Usefulness Stereotypes. If the third step of the regression were significant, then that would suggest that Classroom Quality and Stereotypes make unique contributions to explaining Interest above that of Efficacy. Table 3 presents the results of these regressions. In the second step of the model, Efficacy significantly increased the amount of variance explained above Gender and Grade for both math and science Interest. Classroom Quality and Usefulness Stereotypes were added in the third step of the model and resulted in a significant increase in variance explained for both math and science Interest. (The negative coefficient for Usefulness Stereotype indicates that more traditional beliefs are associated with less interest.) In the final models for both math and science Interest, Efficacy was the strongest predictor, followed by Classroom Quality and Usefulness Stereotype. For Science, in the final model, Gender was also a significant predictor, indicating that boys had higher interest ratings than girls, as previously reported. (It should be noted that the removal of non-significant Gender x Grade interaction effect from the regression for Math Interest yields $F(5, 667) = 147.09$, $p < .001$, $R^2 = .53$.)

Table 3
Regressions Predicting Pre-transition Interest from Demographics, Efficacy, Classroom Quality, and Stereotypes

		Math		Science	
Step	Predictor	Beta	R^2 Change	Beta	R^2 Change
1	Gender	-.07	.02**	.14	.01
	Grade	-.15**		.002	
	Gender x Grade	.14		-.06	
2	Gender	-.03	.47***	.18*	.38***
	Grade	-.13***		.02	
	Gender x Grade	.05		-.15*	
	Pre-Tran. Efficacy	.69***		.62***	
3	Gender	.01	.04***	.20**	.04***
	Grade	-.08*		.03	
	Gender x Grade	.03		-.14[m]	
	Pre-Tran Efficacy	.61***		.55***	
	Pre-Tran. Classroom Quality	.20***		.18***	
	Pre-Tran Stereotype	-.06*		-.09**	
Full Model		$F(6, 666) = 122.45$***; $R^2 = .53$		$F(6, 666) = 82.68$***; $R^2 = .43$	

Note. Negative coefficients for Usefulness Stereotype indicate that more traditional stereotypical beliefs are associated with lower Interest.
[m] $p < .10$; * $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

To summarize, these findings are consistent with the hypothesis that Efficacy, Classroom Quality, and Usefulness Stereotype would each predict Interest and that

Efficacy would have a stronger relationship to Interest than either Classroom Quality or Usefulness Stereotype. Gender differences were still evident for science Interest, even after these variables were considered. Otherwise, there were no significant gender or grade level effects. It should be noted that including additional grade and gender interaction terms with Efficacy, Classroom Quality, and Usefulness Stereotype did not yield significant effects. For the sake of parsimony, these effects were not presented.

Predicting change in Interest. The second set of analyses examined if Gender, Grade, Efficacy, Classroom Quality, and Usefulness Stereotypes post-transition, explained changes in interest over time. In these regression analyses post-transition Efficacy, Classroom Quality, and Usefulness Stereotype measures were used as predictors of change in Interest since stage-environment theory proposes that declines in Interest are due to the new school environment. Before considering the issue of mediation, regressions were first calculated following the same step-wise procedure described previously, except that pre-transition Interest was entered on the first step, followed by a) Grade and Gender, b) Efficacy, and then c) Classroom Quality and Usefulness Stereotype to evaluate if each set of predictors contributed to the variance explained, regardless of a mediational role. Significant effects after the first step can be interpreted as accounting for change in interest.

The results in Table 4 indicate that each step of the model produced a significant change in R^2. Efficacy (step 3) produced the greatest increase in variance, explaining 25% for math and 27% for science. Classroom Quality and Usefulness Stereotype contributed smaller, although significant, explanatory power (2% for math and 5% for science); however, Usefulness Stereotype was only significant for science Interest. (The negative coefficient for Usefulness Stereotype indicates that more traditional beliefs are associated with less interest.) It is important to note that Gender and Grade effects were not significant in the final models. For this reason, Gender and Grade were not included in the mediation analysis. (It should be noted that removing the non-significant Gender x Grade interaction term yields $F(6, 554) = 107.94$, $p < .001$, $R^2 = .54$ for Math Interest and $F(6, 548) = 100.74$, $p < .001$, $R^2 = .52$ for science Interest.)

Table 4

Regressions Predicting Change in Interest from Pre-Transition Interest Demographics, Post-Transition Efficacy, Post-Transition Classroom Quality, and Post-Transition Stereotypes

		Math		Science	
Step	Predictor	Beta	R^2 Change	Beta	R^2 Change
1	Pre-Tran. Interest	.51	.25***	.43***	.18***
2	Pre-Tran. Interest	.51***	.01**	.42***	.02**
	Gender	-.21*		-.14	
	Grade	.02		.06	
	Gender x Grade	.19*		.18[m]	
3	Pre-Tran. Interest	.27***	.25***	.21***	.27***
	Gender	-.15*		-.11	
	Grade	-.02		.03	
	Gender x Grade	.13[m]		.10	
	Post-Tran. Efficacy	.55***		.57***	
4	Pre-Tran. Interest	.26***	.02***	.19***	.05***
	Gender	-.11		-.06	
	Grade	-.02		.01	
	Gender x Grade	.12		.08	
	Post-Tran. Efficacy	.50***		.46***	
	Post-Tran Classroom Quality	.16***		.24***	
	Post-Tran. Stereotype	-.04		-.09**	
Full Model		F(7, 553) = 92.44***; R^2 = .54		F(7, 547) = 86.55***; R^2 = .53	

Note. Negative coefficients for the Usefulness Stereotype indicate that more traditional stereotypical beliefs are associated with lower Interest.

[m]$p < .10$; *$p \leq .05$; **$p \leq .01$; ***$p \leq .001$

The next set of analyses examined whether post-transition Efficacy, Classroom Quality, and Usefulness Stereotype accounted for the change in math and science Interest over the transition. Using the Process Macro, a parallel mediation analysis was conducted (Hayes, 2018). A parallel mediation analysis estimates the total and specific effects of each mediator on the relation between pre-transition interest and post-transition interest. As illustrated in Figures 3 and 4, the indirect paths are indicated by the paths from pre-Interest to each of the proposed mediators and from each mediator to post-Interest. The direct effects of pre-Interest on post-Interest after accounting for Efficacy, Classroom Quality, and Usefulness Stereotype appear above the arrow connecting the two; whereas the total direct effect is presented below the arrow.

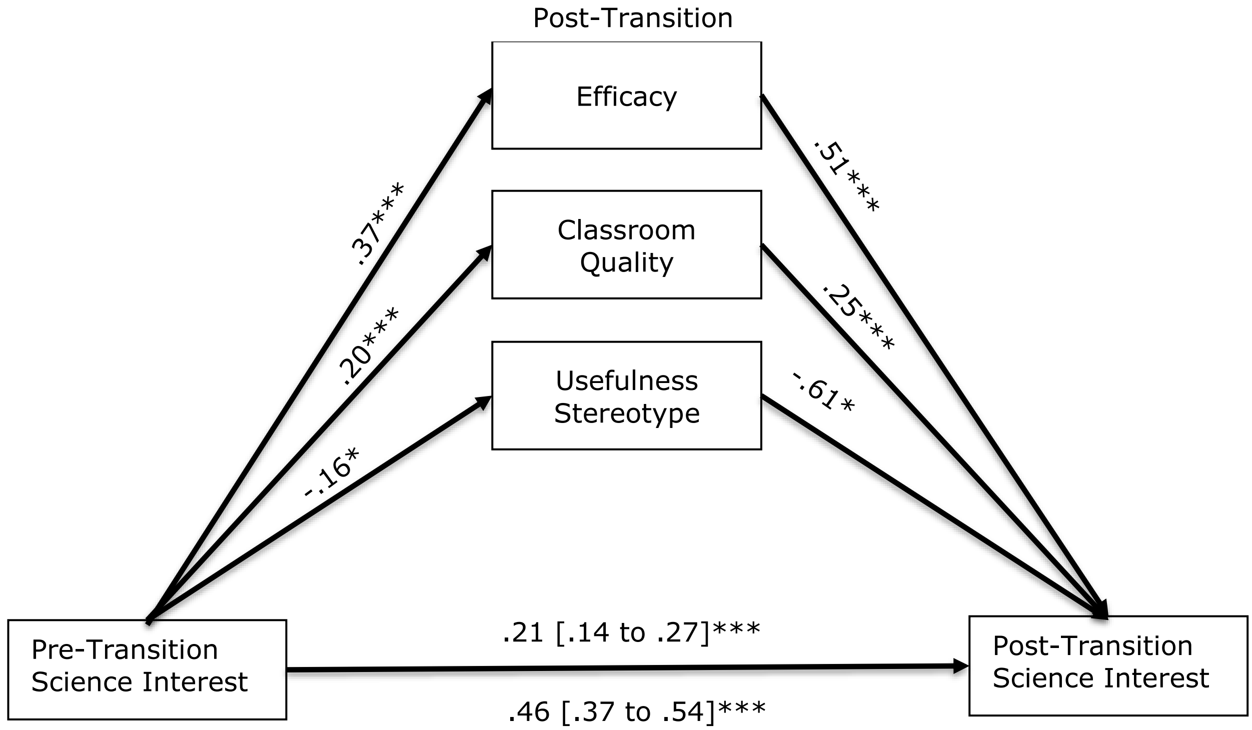

Figure 3. Accounting for change in science Interest with post-transition Efficacy, Classroom Quality, and Usefulness Stereotype. Results are for all grade levels and genders combined. For the path between pre- and post-transition Interest, the coefficient above the line is the remaining direct effect after taking into account the three other indirect paths. The coefficient below the line is the total effect of pre-transition Interest on post-transition Interest. 95% CIs are in brackets. Negative coefficients for Usefulness Stereotype indicate more traditional stereotypical beliefs are associated with lower Interest.
$^{*}p \leq .05$; $^{**}p \leq .01$; $^{***}p \leq .001$.

The total effect and direct effect of pre-transition Interest on post-transition Interest was significant for both math and science. Pre-transition Interest in science had a significant indirect effect on post-transition Interest in science through Efficacy (β = .18, *SE* = .02, 95% CI [.14 to .22]), Classroom Quality (β = .05, *SE* = .01, 95% CI [.02 to .07]), and Usefulness Stereotype (β = .01, *SE* = .01, 95% CI [.001 to .02]). While all were significant, planned contrasts revealed that Efficacy was a stronger mediator than Classroom Quality (β = .13, *SE* = .02, 95% CI [.08 to .18]) and Usefulness Stereotype (β = .17, *SE* = .02, 95% CI [.13 to .21]). Contrasts also revealed that Classroom Quality was a stronger mediator than Usefulness Stereotype (β = .04, *SE* = .01, 95% CI [01 to .06]). Pre-transition Interest in math had a significant indirect effect on post-transition Interest in math through Efficacy (β = .22, *SE* = .02, 95% CI [.17 to .26]) and Classroom Quality (β = .03, *SE* = .01, 95% CI [.02 to .06]), but not Usefulness Stereotype (β = .001, *SE* = .002, 95% CI [-.004 to .01]). Contrasts revealed that Efficacy was a stronger mediator than Classroom Quality (β = .18, *SE* = .03, 95% CI [.13 to .23]). For both mediation models, pre-transition Interest still had a significant direct effect on post-transition Interest after accounting for the effects of Efficacy, Classroom Quality, and Usefulness Stereotype (Figures 3 and 4), indicating that only partial mediation was achieved.

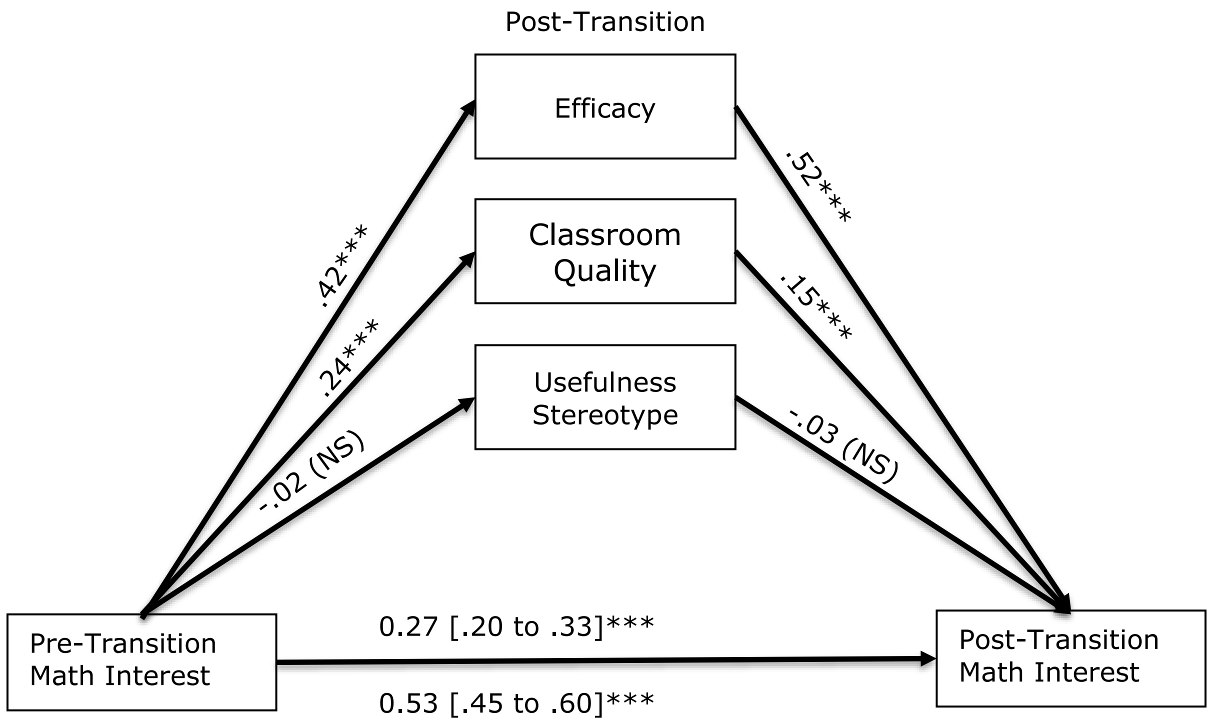

Figure 4. Accounting for change in math Interest with post-transition Efficacy, Classroom Quality and, Usefulness Stereotype. Results are for all grade levels and genders combined. For the path between pre- and post-transition Interest, the coefficient above the line is the remaining direct effect after taking into account the three other indirect paths. The coefficient below the line is the total effect of pre-transition Interest on post-transition Interest. 95% CIs are in brackets. Negative coefficients for Usefulness Stereotype indicate more traditional stereotypical beliefs are associated with lower Interest.
$^*p \leq .05$; $^{**}p \leq .01$; $^{***}p \leq .001$.

DISCUSSION

This study examined factors that affect change in children's interest in math and science during key educational transitions. Prior research shows that students' academic motivation and self-concept are vulnerable to decline during educational transitions (e.g., Blyth et al., 1983; Eccles et al., 1993; 1984; Wilkins & Ma, 2003). However, much of the research surrounding this topic is dated, and relative to the transition to middle school or junior high, there is less research on the transition to high school and experiences in the last two years of high school, especially as they relate to math and science interest. Consequently, the first objective sought to validate previously reported declines in interest and self-efficacy over different transition periods, as well as previously reported gender differences before and after the transitions. The second objective was to examine how self-efficacy, perceived classroom quality, and stereotypes associated with the utility of math and science are related to changes in interest over transitions, as well as gender differences therein.

With respect to the first objective, although there were declines in Interest and Efficacy over school transitions, they were not as substantial or pervasive compared to previous research. Declines in interest were significant for students making the transition to middle school, consistent with past research, but not for the other grades. For Efficacy, results indicated a decline for girls' science Efficacy, but not boys', which is generally consistent with past research that showed declines in global self-esteem (Blyth et al., 1983). Our finding that math Efficacy did not change over time is similar to some prior work (Friedel, Cortina, Turner, & Midgley, 2010), although self-efficacy did not vary across grade level, as other work might suggest (Anderman & Midgley, 1997). Moreover, the effect sizes were generally small (although still significant), suggesting that on average declines were perhaps less substantial than reported in previous research.

We were especially interested in examining gender differences because college enrollment in some STEM fields remains lower for girls than boys, despite similar academic preparation. Our results suggest that gender differences in self-efficacy and interest become more salient as children get older. Girls' Interest and Efficacy in math and science were comparable across grade levels, while older boys had higher Interest and Efficacy than younger boys (Figures 1 and 2). Similar to this study, previous research has documented an increase in academic interests and self-concept for boys over school transitions (Blyth et al., 1983). However, our findings for the stability in girls' self-efficacy over transitions is inconsistent with some previous research that suggests girls are more adversely affected by school transitions as a whole (Blyth et al., 1983; Crockett, Petersen, Graber, Schulenberg, & Ebata, 1989; Watt, 2004). They are also at odds with research suggesting that gender differences in math self-competence beliefs decline over schooling (Fredricks & Eccles, 2002).

Our results highlight the importance of considering changes in interests and attitudes during late high school. Importantly, in this study, boys and girls were recruited from the same math and science courses in high school, so gender differences cannot be explained by course-taking. Unfortunately, this study did not have the resources to follow the students who entered high school through their senior year. Based on the cross-sectional data available in this study, gender differences in science and math interest and self-efficacy may strengthen over high school.

To summarize, we did not find strong support for the hypothesis that interest and self-efficacy decline over each transition or across grade levels, and there was limited support for gender differences favoring males across grade levels and transitions. Nevertheless, gender differences in self-perceived abilities, efficacy, and interest are well documented (e.g., Cunningham et al., 2015; Watt, 2004; Watt et al., 2006), and the challenge before researchers is explaining why methodologically sound studies find different results. Several factors might explain the differences between our findings and those of previous research. Gender role norms and educational practices are highly influenced by secular and historical changes, which in turn impact children's socialization and subsequent behaviors (Bronfenbrenner & Evans, 2000). Significantly, the data in the current study were collected at a time (2008-2010) when national educational statistics indicated that the gender gap in math course taking was minimal, the gap for science course taking was on the decline (Cunningham et al., 2015), and the gender gap in some STEM fields, most notably Biology, had weakened (NSF, 2017). These historical shifts may be due to many factors, for example, efforts by educators to directly intervene, the availability of more female role models in STEM occupations, especially in popular media, or changes in the larger society's expectations for girls. Conjecture based on stage-environment fit theory points to qualities of the post-transition school setting, such as greater teacher support and engaging, age-appropriate classroom practices, both of which were found to mediate interest outcomes in this study.

A second factor accounting for inconsistencies across studies may be due to regional differences in educational approaches or gender role norms. Participants in this study attended public schools in the Southeastern U.S., but much of the previous research was conducted in the upper Midwest (e.g., studies using the MSALT database or Blyth and colleagues' research based in Wisconsin). Southern states consistently lag behind Northern and Midwestern states on most academic indicators, and this could affect how math and science are taught (e.g., focusing on basics, lower expectations for achievement, fewer opportunities for taking advanced math and science classes). It is possible that the emphasis on gender role norms also varies across regional contexts throughout the United States, again with the expectation that residents in Southern states might hold more traditional beliefs. Both of these explanations point to the need to revisit educational outcomes and gender differences related to school transitions periodically and to include samples that represent different sectors of the U.S. The Bronfenbrenner and Evans (2000) social-ecological model provides a framework to interpret differences over time and across geographic regions.

The second objective examined how self-efficacy, perceived classroom quality, and gender stereotypes for the utility of math and science explained change in interest over transitions. Although each of the three factors were correlated with math and science interest, analyses both within time point and across time points confirmed that Efficacy was the strongest predictor of math and science Interest, followed by Classroom Quality. Our regression analyses predicting pre- and post-transition Interest in math and science are similar, attesting to the reliability of the relationships within our sample and increasing our confidence in the predictive ability of Efficacy, Perceived Classroom Quality, and gender stereotypes. Gender stereotypes added explanatory power only for science Interest. Importantly, Efficacy, Classroom Quality, and Usefulness Stereotypes partially mediated changes in science interest; whereas Efficacy and Classroom Quality showed partial mediation effects for change in math Interest. Despite mean level gender and grade differences, Efficacy, Classroom Quality and Usefulness Stereotype were related to changes in interest similarly across these groups. Moreover, the findings for Classroom Quality support the tenets of the stage-environment fit theory (Eccles et al., 1993) and suggest that positive teacher-student relationships and engaging instructional approaches can help maintain interest in STEM at all grade levels.

The results for Usefulness Stereotype are interesting because of the differences in its relation to math and science Interest and because the measures were similarly related to Interest for boys and girls. Prior research has found a substantial amount of shared variance between math-related gender stereotypes and math self-concept, which could explain why gender stereotypes were not predictive for math interest (e.g., Kurtz-Costes et al., 2008; Schmader et al., 2004). Additionally, the utility value for math may have become more equivalent across genders in recent years, compared to science. For example, in high school, girls and boys take calculus at the same rate, but boys are more likely to take physics than girls (Cunningham et al., 2015). Indeed, mathematics may serve as a basis for many academic subjects and careers (e.g., accounting, STEM, social science research), while science is narrower and leads to fewer non-science careers. Additionally, the findings for gender stereotypes contradict some theorizing that boys benefit from endorsing STEM gender stereotypes (Nosek et al., 2002; Walton & Cohen, 2003). However, our results are consistent with some past research on occupation stereotypes (Barth et al., 2018). Overall, our finding that the effects of Classroom Quality and Usefulness Stereotype did not differ for males and females suggests that both boys and girls would benefit from interventions that target these factors.

To summarize, a major conclusion of this study is that self-efficacy is a powerful predictor of math and science interest, while classroom quality and stereotypes play a secondary role. This conclusion held across gender and grade levels and is consistent with expectancy value theory (Eccles, 2011) and social cognitive theory (Bandura et al., 2001). A significant additional contribution of this study is that it also supports other aspects of these models that propose that classroom experiences and gender stereotypes are associated with interest across a range of grade levels and for both males and females. Together, these findings contribute to our understanding of the stage-environment fit theory (Eccles et al., 1993) and have implications for educators. Prior interventions have focused on improving elementary classroom quality (Gershenson, Lyon, & Budd, 2010; Spilt, Koomen, Thijs, & van der Leij, 2012). Our work suggests that interventions should focus on improving classroom quality across grade levels.

Limitations and Future Directions

We acknowledge some limitations of our study and suggest directions for future research. The cross-sectional nature of the grade comparisons does not allow us to make inferences on what happens to individuals over multiple school transitions. Thus, there is a need for longitudinal data to support grade-related changes found in this study, similar to the research conducted in past decades (Blyth et al., 1983; Crockett et al., 1989; Eccles et al., 1984). Recent longitudinal studies have focused on academic engagement (Wang & Eccles, 2013), self-esteem (Booth & Gerard, 2014), and family relations (Gutman & Eccles, 2007), but not math and science self-efficacy and interest. Additionally, it would be valuable for future research to include indicators of academic achievement as potential moderators of change over transitions.

Additionally, stereotyping was assessed by the use of a single straightforward item ("Math/Science is more useful for boys than girls"). This measure was selected because of its direct mapping onto utility values associated with expectancy value theory. It is not an uncommon practice to use a single-item scale to measure constructs, such as gender stereotypes (e.g., Tiedemann, 2000). However, the use of a single-item scale provides only a conservative test of the effects of stereotyping. Future studies should replicate our findings with multi-item measures that explore other aspects of gender stereotypes. Finally, we only found support for a partial mediation, suggesting that there is still a lot to learn about why interest changes over time. Future work might explore factors represented in other research paradigms, such as peer support (Robnett, 2013), belonging (Cheryan, Plaut, Davies, & Steele, 2009), values, and perceptions of discrimination (Hayes & Bigler, 2013).

Despite these limitations, this study makes an important contribution to the research on school transitions. First, this study updates the increasingly dated school transition literature. The present study provided support for stage-environment fit theory (Eccles et al., 1993) and social cognitive theory (Bandura et al., 2001). The findings highlighted above underscore the importance of self-efficacy, classroom quality, and stereotypes on changes in math and science interest across ages and gender.

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