A LONGITUDINAL EXAMINATION OF THE EFFECTS OF PERFORMANCE GOAL PRACTICES ON FEMALE STUDENTS' SELF EFFICACY AND VALUING OF MATHEMATICS

A Dissertation

by

MEREDITH MCKINSEY JONES

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Chair of Committee,	Cynthia A. Riccio
Committee Members,	Mary Margaret Capraro
	Oi-Man Kwok
	Jeffrey Liew
	Anita Sohn McCormick
Head of Department,	Victor Willson

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ABSTRACT

Female students are underrepresented in science, technology, engineering and mathematics majors and careers despite indicators of comparable performance. The purpose of the present study is to examine the implications of teacher-reported performance goal practices on students' mathematics self-efficacy, valuing of mathematics, and mathematics achievement. Previous research has shown that performance goal practices may affect these student variables; however, this has not been explored extensively with regard to gender differences or at the elementary-school level.

Data were collected from a sample of 692 students located in three school districts in southeastern Texas. Students were eligible for participation if they scored below the median score on a district-administered early literacy assessment. Students' mathematics self-efficacy and valuing of mathematics were assessed through self-report questionnaires. Mathematics achievement was assessed through an individually-administered achievement test. Classroom performance goal practices were assessed through a teacher self-report. Analyses were conducted using hierarchical linear modeling to account for classroom-level effects on student-level outcomes.

Results indicated that gender differences in students' mathematics self-efficacy emerged at grade 4 and were also evident at grade 5, with male students reporting significantly higher mathematics self-efficacy at grades 4 and 5. There were no statistically significant gender differences in students' valuing of mathematics across grades 3-5. Results indicated that performance goal practices did not exert any statistically significant effects on student-level outcomes. At the same time, consistent with prior research, students' mathematics self-efficacy was found to be a significant predictor of mathematics achievement, when controlling for achievement during the prior school year. Implications and future research directions are discussed.

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CHAPTER I

INTRODUCTION

Statement of the Problem

Women continue to be underrepresented in science, technology, engineering, and mathematics (STEM) majors and careers (Hill, Corbett, & St. Rose, 2010; Schiebinger, 2010). Despite making up almost half (48%) of the workforce, only a quarter of workers in STEM occupations are female. Across STEM occupations, the largest percentage of women are in jobs related to physical and life sciences (46.1%) with the fewest in engineering (13.5%; U.S. Department of Labor, 2009). Although in the past males have been reported to have higher mathematics achievement than females, results of more recent achievement tests have not supported a gender gap in achievement (Hyde, Lindberg, Linn, Ellis, & Williams, 2008). Thus while female students appear to be achieving at similar levels to males in STEM fields during K-12 education, they are not persisting in STEM fields at the same rate.

Numerous factors have been proposed to explain why a gender gap persists in STEM fields. One factor identified as contributing is female students' attitudes towards mathematics (Gunderson, Ramirez, Levine & Beilock, 2012). Researchers have proposed that the development of early negative attitudes about mathematics can precipitate a trajectory of negative mathematics attitudes and behaviors, which can result in lower levels of mathematics course-taking and ultimately participation in STEM careers (Cvencek, Meltzoff, & Greenwald, 2011; Gunderson et al., 2012).

Two of the constructs that may be considered under the umbrella of "mathematics attitudes" are mathematics self-efficacy and subjective task values. Studies show that by early elementary school, many female students already report having lower mathematics self-efficacy than male students; these gender differences in self-efficacy continue to persist in young adolescence (Cvencek et al., 2011; Frederick & Eccles, 2002; Herbert & Stipek, 2005; Wang, 2012; Wigfield et al., 1997). Due to the reciprocal relationship between self-efficacy and valuing of an academic subject, lower levels of mathematics self-efficacy can lead to lower valuing of mathematics (Eccles, 2011). Ultimately, students' mathematics self-efficacy beliefs and subjective task values play a critical role in mathematics course enrollment decisions, choice of college major, and occupational decisions (Simpkins & Davis-Kean, 2005; Wang, 2012).

Gender differences in students' mathematics self-efficacy and subjective task values emerge partially as a function of the socialization process (Cvencek et al., 2011; Eccles, Wigfield, Harold, & Blumenfeld, 1993). Two major influences on the socialization process are parents and teachers. Research shows that as early as first grade, mothers and children believe that boys are better at math, while girls are better at reading (Lummis & Stevenson, 1990). Tiedemann (2000) found that parents' gender-role stereotypes influenced their perceptions of their children's mathematical competence, which in turn, influenced students' self-perceptions of their mathematics competence.

Within the classroom context, teachers also have been found to hold gender-stereotyped beliefs about students' mathematics abilities. Teachers tend to overrate male students’ mathematics abilities and underestimate female students’ mathematics abilities. In this regard, research has shown that teachers tend to hold gender attribution biases when explaining male versus female performance in math. To this end, male students’ failures in math are attributed to lack of effort, while female’ students failures are attributed to lack of ability (Espinoza, da Luz Fontes, & Arms-Chavez, 2014). In general, there is less expectation for female students to have high math achievement than male students (Li, 1999). Studies indicate that parents’ and teachers’ beliefs about gender and mathematics ability influence their behavior, which in turn, influences students’ attitudes towards math (Gunderson et al., 2012; Tiedemann, 2000).

Given the differential gender expectations for mathematics performance, research examining the classroom context has indicated that female students may need more support in order to develop a high mathematics self-efficacy (Wang, 2012). In addition, female students may be more likely to be undermined by negative feedback in the mathematics classroom environment. Studies also suggest that female students may respond more favorably to mathematics instruction if it is taught in an environment that provides opportunities for cooperation rather than competition and is individualized to match the needs of the student (Geist & King, 2008; Wang, 2012). Thus, classroom context may play a critical role in either fostering or undermining students’ attitudes towards mathematics.

Conceptual Model

The purpose of the research conducted in this dissertation study was to examine how the classroom goal structure, which refers to whether teachers emphasize ability or effort in their instructional practices, affected female students' mathematics self-efficacy and their valuing of mathematics. The next section will explain expectancy-value theory, which served as the theoretical framework for the present study.

Expectancy-Value Theory

Expectancy-value theory is a theory of academic motivation, which posits that students' expectancies for success and their subjective task values directly influence their educational and occupational choices (Wigfield & Eccles, 2000). The present study uses the term "self-efficacy" to refer to the construct of expectancies in expectancy-value theory. Bandura (1997) defined self-efficacy as an individual's belief about their ability to successfully complete a given task or behavior. According to Bandura, the construct of self-efficacy is conceptually similar to expectancies for success and is more predictive of performance and choice than outcome expectations (Bandura, 1997; Pajares, 1996; Wigfield & Eccles, 2000). Subjective task values refer to students' incentives or the values they perceive for engaging in different tasks (Eccles et al., 1983).

Expectancy-value theory posits that achievement-related behavior is directly influenced by students' expectancies for success (self-efficacy) and subjective task values (Eccles et al., 1983; Eccles & Wigfield, 1995). Indeed, previous research has shown that individuals who pursue math-related courses and occupations are more likely to report high mathematics self-efficacy and valuing of mathematics (Simpkins & Davis-Kean, 2005).

Classroom Goal Structure

One important influence on students' development of mathematics self-efficacy and valuing of mathematics may be teachers' instructional practices as communicated through the classroom goal structure (Church, Elliot, & Gable, 2001). The construct of classroom goal structure is defined as the instructional practices that make either mastery or performance goals salient in the learning environment (Ames, 1992; Kaplan, Middleton, Urdan, & Midgley, 2002). A classroom mastery goal structure communicates to students that effort, improvement, and intrinsic understanding is of primary importance. In contrast, a classroom performance goal structure communicates to students that demonstrating one's ability is of primary importance (Ames, 1992; Anderman & Midgley, 1997; Wolters, 2004).

The classroom goal structure is communicated to students through the classroom's instructional, grouping, and evaluation practices. A mastery goal structure is characterized by such practices as giving a range of assignments matched to students' needs and level, recognizing students' progress and effort, and providing students with choices and thus supporting their sense of autonomy in the classroom. Conversely, a performance goal structure is characterized by such practices as providing public performance feedback, valuing performance over effort, displaying the work of only the highest-performing students, pointing out students who are a model for others, giving special privileges to the highest-achieving students and grouping students by ability (Anderman & Midgley, 1997; Urdan, Midgley & Anderman, 1998).

Prior research has shown that the achievement goals emphasized by teachers at the classroom level (i.e., mastery versus performance goal structure) relate to a variety of important student outcomes (Anderman, Maehr, & Midgley, 1999; Anderman & Young, 1994; Shim, Cho, & Wang, 2013). Mastery-oriented classrooms have been consistently associated with more positive outcomes for students, including increased self-efficacy, more adaptive use of learning strategies, a preference for challenging tasks, positive affect, and adoption of mastery-oriented personal goal orientation (Anderman, 1999; Kaplan & Maehr, 1999; Kaplan & Midgley, 1999; Urdan & Midgley, 2003).

In contrast, performance-oriented classrooms have been associated with more maladaptive outcomes for students (Kaplan & Maehr, 1999; Urdan et al., 1998; Wolters, 2004). Studies have shown that the presence of a performance goal structure is related to lower self-efficacy, increased academic-self-consciousness or fear of making a mistake, engagement in self-handicapping behavior (i.e. procrastinating or goofing off) higher incidence of disruptive behavior, negative affect, and adoption of a performance-oriented personal goal orientation (Kaplan & Maehr, 1999; Roeser, Midgley & Urdan, 1996; Urdan et al., 1998).

Classroom Goal Structure and Mathematics Self-Efficacy. Existing research indicates that the classroom goal structure may influence students' mathematics self-efficacy. In this regard, it is expected that a mastery goal structure may positively influence students' mathematics self-efficacy because of the emphasis on effort, improvement and the intrinsic value of learning. In contrast, it is expected that a performance goal structure may negatively influence students' mathematics self-efficacy because of the emphasis on ability and competition with peers.

According to Bandura (1993) the comparative ability evaluations that occur in the classroom and the feedback from important socializers, including teachers, about one's ability have strong implications for the development of self-efficacy. Feedback from others that highlights perceived learning progress supports the development of self-efficacy; whereas, feedback that focuses on perceived shortfalls has a negative influence on the development of self-efficacy. In this regard, Bandura (1993) posited, "learning environments that construe ability as an acquirable skill, deemphasize competitive social comparison, and highlight self-comparison of progress and personal accomplishments are well-suited for building a sense of self-efficacy that promotes academic achievement" (p. 125).

Indeed, previous studies have shown that children's self-evaluations of their ability are more positive when they perceive the classroom environment as emphasizing personal improvement and are more negative when the classroom environment emphasizes the demonstration of competence relative to others (Ames, 1992; Roeser et al., 1996). The effects of a performance goal structure may be particularly detrimental for low-achieving students due to the emphasis on ability and comparison to peers (Ames, 1992; Dweck & Leggett, 1988).

Classroom Goal Structure and Mathematics Subjective Task Values. There are few studies examining the relationship between classroom goal structure and students' mathematics subjective task values (Anderman et al., 2001). There is reason to believe, however, that the classroom goal structure may impact students' valuing of mathematics in the same way as other academic content. In this regard, it is expected that students who experience mathematics classroom environments that emphasize effort and intrinsic understanding, will develop a more positive valuing of mathematics. In contrast, it is expected that students who experience mathematics classroom environments that emphasize the outcome of efforts, will experience a decline in their valuing of mathematics.

Previous research has documented the importance of specific instructional practices that represent a mastery-oriented goal structure (i.e. providing students with opportunities for choice and autonomy and collaboration with peers) for student interest (Ames & Archer, 1988; Wang, 2012). As subjective task values are believed to be an important contributor to enrollment in advanced courses and ultimately to career choices, the effect of performance goal structure is an important consideration in examining the gender gap in STEM careers.

Study Purposes and Hypotheses

Research indicates that females are less likely to pursue STEM occupations, despite indicators of comparable mathmatics achievement (Hill et al., 2010; Schiebinger, 2010). Theorists have proposed that females' lower participation rates in STEM can be partially explained by their attitudes towards mathematics, including their mathematics self-efficacy and valuing of mathematics (Eccles et al., 1983; Eccles, 1987). Existing research indicates that the achievement goals emphasized by teachers in the classroom can influence students' learning experiences, their interpretations of these experiences, and ultimately their academic beliefs and learning behaviors.

Although research suggests that a classroom performance goal structure can affect mathematics self-efficacy and subjective task values, this has not been explored extensively with regard to gender differences or at the elementary-school level (Anderman et al, 2001; Friedel, Cortina, Turner, & Midgley, 2010). Of note, the majority of research on classroom goal structures and student outcomes has been conducted across the transition period from elementary to middle school. Furthermore, most empirical studies of classroom goal structure have been conducted by obtaining students' self-reports of their own perceptions of the performance goal structure within the classroom rather than by obtaining teacher reports of their own practices. This student-report practice has yielded criticism due to the finding that students' reports of teacher performance goal structure are more reflective of students' subjective interpretations than actual variability at the classroom-level (Hughes, Wu, & West, 2011; Lau & Nie, 2008).

Therefore, the purpose of the present study is to examine the effect of teacher-reported performance goal practices on female students' self-efficacy and valuing of mathematics in elementary school. Figure 1 provides a visual depiction of the anticipated relations among performance goal practices and students' self-efficacy beliefs and subjective task values. This conceptual model hypothesizes that mathematics self-efficacy mediates the effect of performance goal practices on mathematics achievement. The dashed line between valuing of mathematics and mathematics achievement indicates that valuing of mathematics is not expected to have a significant influence on mathematics achievement. If classroom-level factors contributing to female students' disengagement in mathematics can be better understood, then more effective interventions could be designed and implemented.

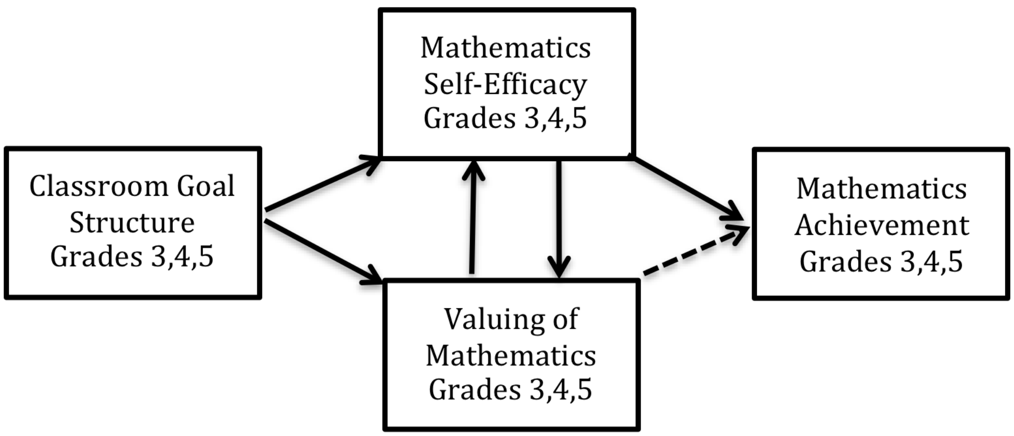

Figure 1. Anticipated relations among variables in conceptual model.

Implications of the Proposed Study

The most direct implication of the present study is an increased understanding of how performance goal practices affect students' mathematics self-efficacy beliefs, subjective task values and mathematics achievement. With greater knowledge of the relationship between classroom goal structure and student motivational variables, the results of the present study can be used to inform the need for teacher professional development programs to reduce performance goal practices and cultivate a mastery goal structure in the classroom. Teacher professional development programs can specifically target the instructional practices associated with a mastery goal structure. Ultimately, if the classroom environment can support female students' self-efficacy and valuing of mathematics, then more female students will be retained in the STEM fields.

CHAPTER II

REVIEW OF LITERATURE

In the past decade, national reports such as *Rising Above the Gathering Storm* have called attention to the need to prepare students for careers in science, technology, engineering and mathematics (STEM) fields (National Academy of Sciences, National Academy of Engineering, & Institute of Medicine, 2005). Amidst growing concern about a workforce shortage in STEM careers, there has been attention to the question of why women remain underrepresented in STEM fields. Despite the tremendous progress women have made in obtaining STEM-related college degrees, research indicates that there are still fewer females who pursue STEM careers than males (Hill et al., 2010; Schiebinger, 2010).

There has been extensive research examining the factors that contribute to the underrepresentation of females in STEM fields. Research has generally identified a diverse set of factors including biological differences, early experiences, educational policy, and cultural context that contribute to the gender disparity in STEM (Halpern et al., 2007). The pathway into STEM has been characterized as a “leaky pipeline” in which students progress from early schooling through postsecondary education to STEM careers, with many students “leaking out” at various stages (Blickenstaff, 2005).

Previous research focused on gender differences in mathematics achievement as the explanation for gender disparity in STEM occupations. However, more recent research shows there is no longer a gender gap in mathematics performance (Hyde &

Mertz, 2009). A recent meta-analysis of gender and mathematics performance conducted by Lindberg, Hyde and Petersen (2010) found the weighted effect size was $d = +.05$ for gender differences in mathematics performance. Overall, the authors reported that gender performance in mathematics is very similar.

Despite indicators of comparable mathematics achievement, gender differences in mathematics-related educational and occupational choices continue to persist. These differences are particularly evident at the high-school level in advanced course-taking. This is concerning because high school course selection is an important predictor of college coursework and ultimately pursuit of a mathematics-related career.

Influence of Self-Efficacy and Subjective Task Values on Career Outcomes

Two important factors that contribute to continuation in STEM fields are self-efficacy beliefs and subjective task values (Eccles, 2011). As students progress through schooling, they have the opportunity to make educational choices related to their career interests. Research has shown that adolescents who have high mathematics self-efficacy are more likely to enroll in advanced math courses than students with moderate or low self-efficacy; they also report higher intentions to pursue STEM careers (Simpkins & Davis-Kean, 2005; Wang, 2012). A study by Simpkins and Davis-Kean (2005) showed that male and female students with a high mathematics self-concept were equally as likely to enroll in advanced classes; however, male students were more likely to endorse a high self-concept in mathematics.

Importantly, research shows that students form self-efficacy beliefs and valuing of academic subjects very early in schooling (Jacobs, Lanza, Osgood, Eccles, &

Wigfield, 2002). Studies demonstrate that middle childhood is the critical period when these beliefs become firmly established (Wigfield et al., 1997). Ultimately, female students are less likely to enter STEM careers because they have less confidence in their mathematics abilities and lower subjective task values for these fields (Eccles, 2011). Therefore, it is important to examine the emergence of gender differences in students' mathematics self-efficacy and subjective task values and the ecological factors, such as the classroom context, that influence change in these self-beliefs

Expectancy-Value Theory

Expectancy-value theory is a theory of academic motivation, which can be utilized to explain how gender differences in expectancies for success (self-efficacy) and subjective task values relate to the choices that male and female students make in mathematics course taking and careers (Eccles et al., 1983). This theory posits that expectancies for success and subjective task values are positively related, such that students who endorse higher expectancies for success in a subject also report higher valuing of that subject.

Self-Efficacy

Within an academic context, self-efficacy refers to a student's beliefs about how capable they are of performing specific academic tasks or succeeding in academic tasks (Pajares & Graham, 1999). Self-efficacy beliefs often vary across academic domains. Research has shown that students' academic self-efficacy beliefs are an important predictor of their academic achievement, motivation, and learning outcomes (Wigfield & Eccles, 2000; Zimmerman, 2000). Students' self-efficacy beliefs have been found to predict their academic achievement even when controlling for their previous performance (Pajares & Graham, 1999).

Self-efficacy beliefs also influence an individual's cognitions and emotional reactions regarding specific tasks. In this regard, individuals with low self-efficacy beliefs about a particular task tend to believe that tasks are more difficult than they actually are, which can lead to heightened stress or depression associated with the task. In contrast, individuals with high self-efficacy beliefs are more likely to approach difficult tasks with positive feelings (Pajares, 1996).

Students acquire self-efficacy beliefs through the interaction of four primary sources of information: actual performance, vicarious experiences, forms of persuasion, and physiological reactions. Students' interpretation of their previous performance is thought to have the most direct effect on self-efficacy because it serves as a tangible indicator of one's ability. Vicarious experiences, such as observing others' performance, can also exert an influence on self-efficacy. For example, observing a similar peer perform poorly on a task can reduce one's self-efficacy. Forms of persuasion, such as verbal feedback can also influence self-efficacy. Positive verbal feedback can raise self-efficacy, while negative verbal feedback can reduce self-efficacy. Physiological states, including emotional and physical reactions, such as heart rate and feelings of anxiety also provide information about one's self-efficacy. Symptoms of anxiety such as a rapid heart rate can serve as an indicator that one lacks ability (Schunk & Meece, 2006).

Self-Efficacy in Mathematics. Students' mathematics self-efficacy has received significant research attention. Studies have shown that mathematics self-efficacy is related to a variety of important outcomes including mathematics achievement, effective problem-solving and strategy use, advanced mathematics course-taking, selection of college major and career choices (Lopez, Lent, Brown, & Gore, 1997; Pajares, 2005). Students who have high mathematics self-efficacy demonstrate greater persistence on difficult math problems and more efficient problem solving (Hoffman & Schraw, 2009). Mathematics self-efficacy has been found to predict mathematics achievement when controlling for existing skills and previous performance. In a study of middle school students, Pajares and Graham (1999) found that students' mathematics self-efficacy predicted their year-end mathematics performance.

Gender Differences in Mathematics Self-Efficacy. In the domain of mathematics, research has generally found that female students report lower mathematics self-efficacy than male students (Frenzel, Goetz, Pekrun, & Watt, 2010; Herbert & Stipek, 2005; Muzzatti & Agnoli, 2007; Wigfield et al., 1997). While the gender gap has narrowed over time, studies continue to show that males report higher mathematics self-efficacy than females. In a recent cross-national comparison, Else-Quest, Hyde, and Linn (2010) found that males scored one-third standard deviation higher on a measure of mathematics self-efficacy.

Gender differences in mathematics self-efficacy have been found to exist irrespective of differences in mathematics achievement. In this regard, Correll (2001) examined male and female students' perceived self-efficacy in mathematics while controlling for previous mathematics test scores and grades. This study found that male students were more likely to assess their mathematics ability higher than female students. Importantly, the higher a student assessed their mathematical ability, the more likely they were to enroll in higher-level mathematics courses in high school and pursue a STEM-related college major.

Studies have yielded mixed findings regarding when gender differences in mathematics self-efficacy beliefs emerge. Overall findings indicate that early to mid-elementary school is the starting point. Wigfield et al. (1997) utilized a cross-sectional design to study the developmental trajectory of competence beliefs from first through sixth grade. This study found that female students reported significantly lower ratings of their competence in mathematics compared to males and this gap was maintained over time. In a longitudinal study conducted by Herbert and Stipek (2005), gender differences were found to emerge in third grade, with female students rating their mathematics competence lower than males. Similar results were found by Muzzatti and Agnoli (2007), with gender differences in mathematics self-efficacy emerging at grade 3 and continuing to persist over time.

Subjective Task Values

Subjective task values can be broadly defined as students' incentives or reasons for engaging in different tasks (Eccles et al., 1983). There are four primary components of subjective task values: interest-enjoyment value, attainment value, utility value and relative cost. In this regard, when attaching a "value" to the task, a student considers how much they enjoy the task or their subjective interest in the task (interest-enjoyment value), the importance of being good at the task (attainment value), their perception of the usefulness of the task (utility value), and the costs of engaging in the task (relative cost; Eccles, 2005). The first three components are associated with a positive valence to the task, while the relative cost is associated with a negative valence to the task. Research has shown that students' subjective task values predict their current and future engagement in activities, course enrollment and career decisions (Wigfield & Eccles, 2000).

Subjective task values are theorized to emerge as a function of a complex interaction between students' ability beliefs (i.e. self efficacy), previous achievement-related experiences, environment and important socializers' beliefs and behavior (Wigfield & Eccles, 1994). Studies have shown that as early as first grade, students hold different subjective task values for various activities. However, research also indicates that during early childhood students' perceptions of subjective task values are overly positive and then as students progress through elementary school, their subjective task values tend to more closely correspond to their actual performance (Wigfield & Eccles, 1992).

Subjective Task Values in Mathematics. Previous research has documented a relationship between students' mathematics subjective task values and achievement-related outcomes. Indeed, previous research has shown that students' valuing of mathematics is positively related to their mathematics achievement (Gottfried, 1990; Wigfield & Eccles, 2000). A study by Metallidou and Vlachou (2010) found that elementary students who reported high mathematics task values were described by their teachers as more cognitively competent learners than students who reported lower mathematics task values. In addition, research shows a strong association between students' mathematics subjective task values and subsequent enrollment in advanced mathematics courses and college majors (Eccles, 1994).

Gender Differences in Mathematics Subjective Task Values. Research examining gender differences in students' valuing of mathematics has yielded mixed findings. Some studies have found that boys value math more than females (e.g. Eccles et al., 1993; Frenzel et al., 2010; Watt, 2005), while other studies have found no differences (e.g. Jacobs et al., 2002). In this regard, a study conducted by Frenzel et al. (2010) among students in 5^{th} grade through 9^{th} grade found that male students reported significantly higher mathematics interest than female students. Importantly, both male and female students' reported interest in mathematics followed a similar downwards trend across time (Frenzel et al., 2010).

In contrast, Jacobs et al. (2002) conducted a longitudinal study of mathematics subjective task values across students in grades first through twelfth and found that there were no significant differences between male and female students in their valuing of mathematics. Overall, the relation between gender and valuing of mathematics is less consistent than the relation between gender and mathematics self-efficacy. At the same time, research does show a consistent decline in students' valuing of mathematics as they progress through schooling, regardless of gender.

Factors that Influence Self-Efficacy and Subjective Task Values

Achievement Goal Theory

Achievement goal theory has become one of the leading theories of student motivation in educational research (Ames, 1992; Dweck & Leggett, 1988). This theory is grounded in a social-cognitive approach towards motivation and focuses on the purposes that students perceive for engaging, choosing, and persisting at different learning activities (Meece, Anderman, & Anderman, 2006). “Goals provide a framework within which individuals interpret and react to events, and result in different patterns of cognition, affect and behavior” (Midgley et al., 1998, p. 114).

Initially, research focused on two contrasting personal achievement goals that individuals could adopt in achievement situations, namely, mastery versus performance. A mastery-goal orientation refers to a desire to learn and improve skills and a willingness to expend effort on challenging tasks. In contrast, a performance-goal orientation refers to a desire to demonstrate high ability relative to peers and the use of social comparison to make judgments of one’s own ability or performance. More recently, the performance-oriented goal orientation has been differentiated into approach and avoidance tendencies. A performance-approach orientation refers to a focus on demonstrating competence relative to others, whereas, a performance-avoidance orientation refers to a focus on avoiding appearing incompetent relative to peers (Elliot & Harackiewicz, 1996; Meece et al., 2006).

In general, a mastery-goal orientation is associated with more adaptive outcomes, such as enhanced competence, emotional well-being, cognitive engagement, and achievement (Kaplan & Midgley, 1997; Linnenbrink, 2005). Conversely, a performance-goal orientation is associated with more maladaptive outcomes, such as engagement in self-handicapping behaviors, use of surface-level learning strategies (e.g., memorizing and rehearsing information), and academic cheating (Elliot & Harackiewicz, 1996; Urdan et al., 1998).

Classroom Goal Structure

Research on personal achievement goal orientations was later extended to the classroom-level instructional practices or policies that make achievement goals salient in the learning environment, which were labeled “classroom goal structure” (Ames, 1992; Kaplan et al., 2002). Research shows that teachers create different goal structures in their classroom through their use of instructional, grouping and evaluation practices (Meece et al., 2006; Urdan & Midgley, 2003). Classroom goal structures influence students’ learning outcomes and achievement-related behavior by shaping students’ goal orientations and learning behaviors (Eccles & Midgley, 1989; Meece et al., 2006). To this end, classroom goal structures are typically viewed as the precursors to students’ personal goal orientations.

A mastery goal structure describes a classroom environment in which instructional practices emphasize the importance of learning, improving, and developing one’s skills. Research suggests that a mastery goal structure is more likely to emerge when students are provided with choices, opportunities exist for peer interaction and cooperation, grouping of students is based on students’ interests or other needs rather than ability, and “success” is defined by improvement and effort (Maehr & Midgley, 1991; Wolters, 2004).

Conversely, a performance goal structure describes a classroom environment in which instructional practices emphasize the importance of doing well on tests, demonstrating high ability, and doing better than other students (Anderman & Midgley, 1997; Wolters, 2004). Research suggests that a performance goal structure is likely to develop when there is an emphasis on social comparison and competition, students are provided little choice in tasks, ability grouping is utilized, and cooperation and interaction among students is discouraged (Maehr & Midgley, 1991).

More recently, the construct of performance goal structure has been further differentiated into performance-approach and performance-avoidance orientations (Church et al., 2001; Midgley, Kaplan, & Middleton, 2001). The performance-approach goal structure describes a classroom emphasis on demonstrating one's ability. Conversely, the performance-avoidance goal structure describes a classroom emphasis towards avoiding appearing incompetent or displaying lack of ability. Although research is limited, there is some evidence to suggest that a performance-approach goal structure may have positive benefits for some student behaviors, such as cognitive engagement with learning and achievement. However, researchers continue to believe that overall, a performance-approach goal structure is less adaptive than a mastery goal structure (Linnenbrink, 2005).

Patrick, Anderman, Ryan, Edelin and Midgley (2001) examined the implicit and explicit communication of classroom goal structure in four fourth-grade classrooms. In this study, the researchers examined associations between students' perceptions of the goal structure within the classroom and teacher practices within the classroom. The purpose was to identify the specific teacher practices associated with students' perceptions of a mastery or performance goal structure within the classroom. The results showed considerable stability in student perceptions of teacher practices throughout the school year. Overall, teachers who were perceived as having a strong mastery focus tended to talk about learning as an active process requiring student involvement, emphasize effort, and encourage student collaboration. High-mastery teachers also emphasized high expectations and their confidence in students' ability to meet those expectations. Conversely, teachers within the high performance classrooms tended to emphasize learning through direct instruction and remembering.

The TARGET system was developed by Ames (1992) to identify specific instructional practices and policies associated with a mastery or performance goal structure in the classroom. The TARGET system identifies six primary categories of instructional practices and policies that contribute to the classroom goal structure: (T) task, (A) authority, (R) recognition, (G) grouping, (E) evaluation, and (T) time (Ames, 1992; Patrick et al., 2001).

Influence of Classroom Goal Structure on Achievement-Relevant Outcomes

Mathematics Self-Efficacy

Existing research indicates that the classroom goal structure may influence students' mathematics self-efficacy. In this regard, it is expected that a mastery goal structure will positively influence students' mathematics self-efficacy because of the emphasis on effort and the intrinsic value of learning. Such an environment reduces students' focus on grades and performance relative to other students and instead focuses them on understanding and improving (Fast et al., 2010). Indeed, prior research has shown that students are more motivated when they perceive they are making progress in their learning. Thus, as students work on tasks and make progress, they maintain or develop their sense of efficacy (Schunk, 1991).

In contrast, it is expected that a performance goal structure may negatively influence students' mathematics self-efficacy because of the emphasis on ability and competition in relation to peers. To this end, in classrooms characterized by performance goal practices, there is frequent public performance feedback, competition between students, and emphasis on grades and test scores (Urdan et al., 1998). Research shows that students in performance-oriented classrooms are more aware of their classmates' abilities and their relative standing in comparison to them (Filby & Barnett, 1982). Furthermore, studies have shown that children's self-evaluations of their ability are more negative when they are focused on outperforming one another (Ames, 1992).

The effect of a performance goal structure may be particularly detrimental for low-achieving students (Ames, 1992; Dweck & Leggett, 1988; Elliot & Dweck, 1988). In this regard, performance goal practices focus students' attention on how they are performing relative to their peers. Failure at a task and social comparison may lower a student's self-efficacy and discourage them from working at a task or lead them to engage in self-handicapping behavior. Previous research has documented a relationship between the presence of a performance goal structure and students' engagement in self-handicapping behavior (Midgley & Urdan, 2001; Schunk, 1991). In addition, research has shown that classroom experiences that raise anxiety lead to lower self-efficacy (Usher, 2009). Thus, a performance goal structure may be particularly detrimental for lower-achieving students who tend to have lower mathematics self-efficacy.

Several studies have found a positive relationship between the presence of a mastery goal structure within the classroom and students' academic self-efficacy (Anderman & Midgley, 1997; Friedel, Cortina, Turner, & Midgley, 2007; Midgley & Urdan, 1995; Roeser et al., 1996; Wolters, 2004). For example, Fast et al. (2010) found that upper elementary and middle school students who perceived their mathematics classroom environments as more mastery-oriented, caring, and challenging reported higher mathematics self-efficacy than students who perceived lower levels of these constructs.

Research examining the relationship between performance goal structure and students' academic self-efficacy has been less consistent (Anderman & Midgley, 1997; Anderman & Young, 1994; Friedel et al., 2007; Urdan & Midgley, 2003). Some studies have found the presence of a performance goal structure to be related to a decline in self-efficacy (e.g., Ames & Archer, 1988; Anderman & Young, 1994), while other studies have found it to be unrelated (e.g. Friedel et al., 2007).

In the study conducted by Anderman and Young (1994), researchers examined the relationship between classroom goal structure in sixth and seventh grade science classrooms and students' self-efficacy. Results of this study showed that classrooms in which teachers used performance-oriented instructional practices, such as displaying the work of the highest-performing students, giving special privileges to the highest-performing students, and pointing out certain students as a model for others, tended to have students who endorsed slightly more performance-oriented goal orientations.

Ames and Archer (1988) found that middle and high school students who perceived an emphasis on performance goal practices in their classroom tended to focus on their ability, have a negative evaluation of their ability, and attribute their failure to lack of ability. In contrast, students who perceived a mastery structure as being most salient in their classroom reported having a more positive attitude. Similarly, Urdan and Midgley (2003) found that students' perception of a decline in mastery goal structure across the transition from 5th to 6th grade was associated with a decline in academic self-efficacy

Mathematics Subjective Task Values

There has been limited research examining the relationship between classroom goal structure and mathematics subjective task values. There is reason to believe that students who learn math in classroom environments that emphasize a mastery-goal structure will experience an increase in their valuing of mathematics, while students who experience a performance goal structure will experience a decline in their valuing of mathematics. In this regard, mastery goal structures reflect an emphasis on effort and the intrinsic value of learning (Meece et al., 2006).

Previous research has shown that specific instructional practices that are characterized by a mastery goal structure, such as cooperative learning, collaboration with peers, and providing opportunities for autonomy, are associated with increased intrinsic interest (Wang, 2012). In contrast, research indicates that performance goal practices place an emphasis on students' performance, such as through test scores, which has been previously shown to undermine students' intrinsic interest.

Although limited, studies to date have shown a relationship between the classroom goal structure and students' valuing of mathematics. In this regard, Anderman et al. (2001) examined the relationship between classroom goal structure and students' valuing of different academic subjects. This study found that students in performance-oriented classrooms experienced declines in their valuing of mathematics over the course of the academic year. Importantly, this study found that students' self-perceptions of their mathematics ability were positively related to gains in their valuing of mathematics.

Aunola, Leskinen and Nurmi (2006) conducted a similar longitudinal study with preschool and early-elementary students, measuring the classroom goal structure and students' valuing of mathematics. This study found that mathematics task values were significantly enhanced in classroom environments where teachers reported emphasizing mastery goals. Importantly, mathematics task values were also found to predict subsequent achievement when students were in second grade.

To summarize, the current literature suggests that the performance goal practices may impact students' mathematics self-efficacy and valuing of mathematics, but these variables have not been explored extensively at the elementary level or through teacher-report of the classroom goal structure. Thus, the purpose of the present study is to examine the effects of teacher-reported goal practices on elementary students' mathematics self-efficacy and valuing of mathematics over a longitudinal period with mathematics achievement as an outcome.

CHAPTER III

METHODOLOGY

The present study utilizes a retrospective longitudinal design in which existing data were utilized. The data in the present study were collected as part of an ongoing study on the impact of grade retention on academic achievement.

Participants

Participants are comprised of a subsample of students participating in a longitudinal study of the impact of grade retention on academic achievement. Children in the larger study were recruited as first grade students in two sequential cohorts in the fall of 2001 and 2002. These students came from one of three school districts located in Southeastern Texas. Students were eligible for participation in the study if they had a score below the median on a state-approved, district-administered literacy measure, were not currently receiving special education services, and had not been previously retained in first grade. Based upon these criteria, a total of 1,374 students were eligible for participation. Teachers distributed consent forms to all eligible children. A total of 784 parents provided written consent for their child to participate (n=447 for the first cohort and n=337 for the second cohort). Eligible students with and without consent did not differ on variables of age, gender, ethnicity, eligibility for free or reduced lunch, bilingual class placement, or district-administered literacy test scores (Wu, West, & Hughes, 2010).

The present study includes a sample of participants from times 3, 4, and 5 of the longitudinal study when students were in 3rd, 4th and 5th grade. The criteria for inclusion in the sample were data for one measure of teacher performance goal practices and one measure of mathematics achievement for at least one time period across the three-year study period. This yielded an overall sample of 692 student participants. Descriptive information on the participants is provided in Table 1.

Table 1

Demographic Characteristics of Sample

Sample (*n*=692)	Percentage
Male	52.9%
Ethnicity	
Asian/Pacific Islander	3.0%
African American	23.4%
Caucasian	33.4%
Hispanic	38.9%
Native American/Alaskan Native	0.1%
Other	1.2%
Economic-Disadvantage Status	
Year 3	63.2%
Year 4	65.8%
Year 5	65.8%

Design Overview

Data for the present study were obtained at Times 3, 4 and 5 when students were in grades 3, 4, and 5. Student assessments were conducted annually between November and May by trained examiners with at least eight months spacing between assessments. Examiners were undergraduate and graduate students who received approximately 20 hours of training prior to the administration of assessments. Each test protocol was reviewed twice for accuracy by a trained graduate student and an undergraduate research assistant. Teachers of study participants were mailed questionnaires in the spring with a pre-addressed stamped envelope. Teachers were provided with $25.00 compensation for completing and returning questionnaires.

Measures

Classroom Performance Goal Structure

Performance goal structure was assessed using the *Pattern for Adaptive Learning Scales – Approaches to Instruction Scale* (Midgley et al., 2000). The purpose of this scale is to assess the degree to which teachers' instructional practices convey to students that the purpose of engaging in academic work is to demonstrate ability. Teachers were asked to indicate on a 5-point Likert-type scale the degree to which they engage in performance-oriented instructional practices. Items on the scale were anchored at 1= "strongly disagree," 3= "somewhat agree," and 5= "strongly agree." The alpha coefficient was .69 for the standardization sample of this scale.

Mathematics Self-Efficacy and Subjective Task Values

Students' perceptions of their mathematics self-efficacy and mathematics subjective task values were assessed using an abbreviated version of the *Competency Beliefs and Subjective Task Values Questionnaire* (Wigfield et al., 1997). The present study used only the items measuring academic competence and subjective task values in the area of mathematics. The Mathematics Competence Beliefs scale is comprised of five items. Students were presented with a 30-point rating scale and asked to rate how competent they felt in the area of math. Items on the scale were anchored at 1 = "not at all good" and 30 = "one of the best." Specifically, students were asked how good they were at math, how good they were at math relative to the other things they do, how good they were at math relative to other children, how well they expected to do in the future in math, and how good they thought they would be at learning something new in math. The internal consistency reliabilities of the Mathematics Competence Beliefs scale for the study sample were .82 (Grade 3), .85 (Grade 4) and .87 (Grade 5).

The Subjective Task Values scale for mathematics is comprised of three items. Students were presented with a 30-point rating scale and asked to rate their valuing of math. Specifically, students were asked how interesting/fun math was, how important they thought being good in activity was compared to other activities, and how useful they thought each activity was. The internal consistency reliabilities of the Mathematics Subjective Task Values were .63 (Grade 3), .63 (Grade 4) and .62 (Grade 5).

Academic Achievement

The *Woodcock Johnson Tests of Achievement, Third Edition* (WJ-III; Woodcock, McGrew, & Mather, 2001) is an individually administered measure of academic achievement for individuals aged 2 through adulthood. For the purpose of this study, the WJ-III Broad Math score (comprised of Calculations, Math Calculations Skills and Math Fluency subtests) was used. Analyses in the present study were conducted using Rasch-based “W” scores, which provide a more sensitive assessment of change in longitudinal studies (McArdle, Ferrer-Caja, Hamagami & Woodcock, 2002). The internal consistency reliability estimate, as reported in the manual, is .92 (ages 8 to 10) for the Broad Math score.

The *Batería III: Woodcock- Muñoz: Pruebas de Aprovechamiento* (Muñoz-Sandoval, Woodcock, McGrew, & Mather, 2005) is a measure of academic achievement that parallels the WJ-III but in Spanish. Students who spoke any Spanish were administered the *Woodcock-Muñoz Language Test* to determine if they were more proficient in Spanish than in English (Woodcock & Muñoz-Sandoval, 1996). On the basis of this administration, Spanish-language dominant students, were administered the *Batería III Woodcock-Muñoz* (Muñoz-Sandoval et al., 2005). The *Batería III Woodcock-Muñoz* yields a Broad Math score that is comparable to the WJ-III. The internal consistency reliability estimate, as reported in the manual, is .95 for the Broad Math score.

Data Analysis

This is a retrospective study and data will be examined for normality and to ensure that assumptions are met. Missing data will be addressed through pair-wise deletion by analysis. Descriptive statistics, correlational analyses, and hypothesized models (with the exception of the hypothesized mediation model) will be tested using SPSS 21 and SAS. HLM is a multilevel-regression technique that is well suited for examining student and classroom-level relationships simultaneously (Hox, 2010). The hypothesized mediation model (see Figure 1) will be estimated using Mplus (Version 7.1). An expanded version of the primary model is depicted in Figure. 2.

Research Questions, Hypotheses and Proposed Analyses

1) Are there gender differences in students' mathematics self-efficacy beliefs, valuing of mathematics and/or mathematics achievement across grades 3, 4, and 5?
    a. It is hypothesized that there will be gender differences in mathematics self-efficacy beliefs and valuing of mathematics across grades 3, 4, and 5 such that female students report lower mathematics self-efficacy and valuing of mathematics than male students.
    b. It is hypothesized that there will be no statistically significant gender differences in mathematics achievement across grades 3, 4, and 5.
    c. This will be determined through the use of t-tests.
2) Do students' mathematics self-efficacy, valuing of mathematics and mathematics achievement change across grades 3, 4 and 5?

a. It is hypothesized that students' mathematics self-efficacy and valuing of mathematics will decline across grades 3, 4, and 5. It is hypothesized that mathematics achievement will remain constant across grades 3, 4, and 5.

b. This will be determined by examining the descriptive statistics (mean and standard deviation) for mathematics self-efficacy, valuing of mathematics, and mathematics achievement) and plotting the data points for these student-level variables across grades 3, 4, and 5.

3) Do mathematics self-efficacy, mathematics valuing and mathematics achievement vary between classrooms across grades 3, 4, and 5?

    a. It is hypothesized that mathematics self-efficacy, mathematics valuing and mathematics achievement will vary across classrooms.

    b. An intraclass correlation (ICC) will be conducted for each grade level to determine the percentage of variance between classrooms.

4) Do performance goal practices predict students' mathematics self-efficacy across grades 3, 4, and 5 when controlling for mathematics achievement?

    a. It is hypothesized that students' experience of performance goal practices will account for additional variance not accounted for by actual math achievement in students' mathematics self-efficacy.

    b. Hierarchical linear modeling will be used to examine the relationship between performance goal practices (classroom-level predictor) and students' mathematics self-efficacy (student-level outcome). Concurrent mathematics achievement will be included in the analysis as a student-level control.

5) Do performance goal practices predict students' valuing of mathematics across grades 3, 4, and 5 when controlling for mathematics achievement?
    a. It is hypothesized that students' experience of performance goal practices will account for additional variance not accounted for by actual math achievement in students' valuing of mathematics.
    b. Hierarchical linear modeling will be used to examine the relationship between performance goal practices (classroom-level predictor) and students' valuing of mathematics (student-level predictor). Concurrent mathematics achievement will be included in the analysis as a student-level control.
6) Do performance goal practices predict students' mathematics achievement across grades 3, 4, and 5 when controlling for the previous year's achievement?
    a. It is hypothesized that students' experience of performance goal practices will account for additional variance not accounted for by students' previous mathematics achievement for grades 3, 4, and 5.
    b. Hierarchical linear modeling will be used to examine the relationship between performance goal practices (classroom-level predictor) and students' mathematics achievement (student-level predictor). The independent variable will be performance goal practices and the dependent variable will be mathematics achievement. The previous year's mathematics achievement will be included in the analyses as a student-level control.
7) Does mathematics self-efficacy mediate the effect of performance goal practices on mathematics achievement across years 3, 4, and 5?

a. It is hypothesized that the effect of higher levels of performance goal practices will be mediated by students' mathematics self-efficacy beliefs, which will then predict mathematics achievement. In effect it is expected that higher performance goal practices will have a direct and negative influence on self-efficacy, which will in turn, have a direct and negative influence on mathematics achievement. Valuing of mathematics is not believed to have the same direct effect on mathematics achievement; but rather to directly affect self-efficacy (see Figure 1).

b. Structural equation modeling will be used to test this mediation model. First, analyses will be conducted to determine whether performance goal practices are significantly related to mathematics self-efficacy and mathematics achievement. Second, an analysis will be conducted to determine whether mathematics self-efficacy is significantly related to mathematics achievement. This model will control for the previous year's mathematics achievement. In order to establish mediation, mathematics self-efficacy should significantly influence mathematics achievement and it should be robust to the inclusion of performance goal practices in the model (Fast et al., 2010).

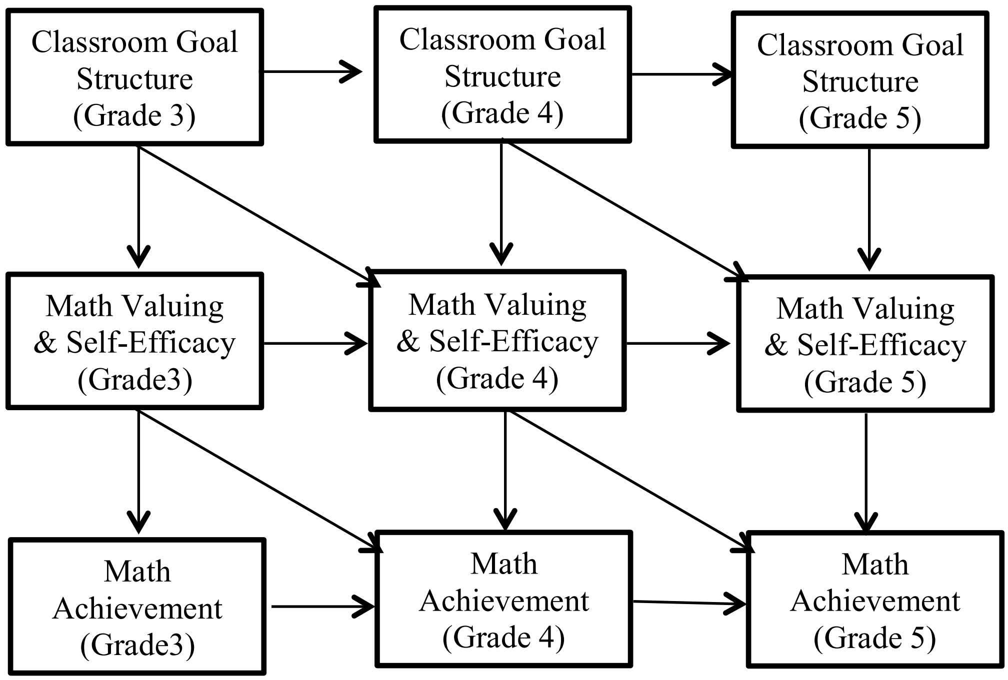

Figure 2. Classroom goal structure.

CHAPTER IV

RESULTS

This study used retrospective data from a larger study examining the impact of grade retention on students' achievement-related outcomes. Prior to data analysis, the data were examined for normality and to ensure that all assumptions were met. Missing data were managed using pair-wise deletion in SPSS.

Descriptive information by variable for participants in this study is presented in Table 2. Teacher-reported Performance Goal Practices were rated on a 5-point Likert scale with higher scores indicating greater use of performance goal practices. Across grades 3-5, the mean score for performance goal practices was between 2-3 on the Likert scale indicating moderate use of performance goal practices. Teachers' reported usage of performance goal practices is similar across grades 3-5. Mathematics Self-Efficacy and Mathematics Subjective Task Values were scored on a scale ranging from 1-30 with 1 being "not at all good," 15 being "ok" and 30 being "very good." The results show that on average, students' rated their mathematics self-efficacy and mathematics subjective task value scores as moderately positive. The mean Mathematics Achievement score fell within the average range across grades 3-5.

Table 2

Descriptive Statistics for Analysis Variables

Variables		N	Mean	Std. Dev.
Performance Goal Practices	Grade 3	536	2.52	0.79
	Grade 4	527	2.55	0.78
	Grade 5	534	2.68	0.86
Mathematics Self-Efficacy	Grade 3	659	22.63	6.26
	Grade 4	658	22.23	6.05
	Grade 5	634	22.22	5.86
Mathematics Subjective Task Values	Grade 3	659	23.81	6.26
	Grade 4	658	24.11	5.67
	Grade 5	634	24.18	5.49
Mathematics Achievement	Grade 3	656	486.59	11.01
	Grade 4	653	496.28	10.84
	Grade 5	635	504.41	10.62

Zero-order bivariate correlation results for variables across grades 3-5 are presented in Tables 3 - 5. At grade 3, results indicated a significant correlation between mathematics self-efficacy and mathematics subjective task values ($r = .64$, $p < .05$). Mathematics achievement was also significantly correlated with both mathematics subjective task values ($r = .17$, $p < .05$) and mathematics self-efficacy ($r = .16$, $p < .05$).

Table 3

Zero-Order Bivariate Correlations at Grade 3

	2	3	4	5
Performance Goal Practices	_			
Math Self-Efficacy	.01	_		
Math Subjective Task Value	-.02	.64**	_	
Math Achievement	-.07	.16**	.17**	_

* $p < .05$ ** $p < .01$

At grade 4, there continued to be a significant correlation between mathematics self-efficacy and mathematics subjective task values ($r = .64$, $p < .01$). Mathematics achievement also continued to be significantly correlated with both mathematics subjective task values ($r = .14$, $p < .01$) and mathematics self-efficacy ($r = .18$, $p < .01$).

Table 4

Zero-Order Bivariate Correlations at Grade 4

	1	2	3	4
Performance Goal Practices	_			
Math Self-Efficacy	.01	_		
Math Subjective Task Values	.02	.64**	_	
Math Achievement	-.01	.18**	.14**	_

* $p < .05$ ** $p < .01$

At grade 5, there continued to be a significant correlation between mathematics self-efficacy and mathematics subjective task values ($r = .63, p < .01$). Mathematics achievement also continued to be significantly correlated with both mathematics subjective task values ($r = .15, p < .01$) and mathematics self-efficacy ($r = .27, p < .01$).

Table 5

Zero-Order Bivariate Correlations at Grade 5

	1	2	3	4
Performance Goal Practices	_			
Math Self-Efficacy	-.03	_		
Math Subjective Task Values	-.01	.63**	_	
Math Achievement	-.04	.27**	.15**	_

$* p < .05$ $**p < .01$

Research Question 1

Are there gender differences in students' mathematics self-efficacy beliefs, valuing of mathematics and/or mathematics achievement across grades 3, 4, and 5? It was hypothesized that there would be gender differences in mathematics self-efficacy beliefs and valuing of mathematics across grades 3, 4, and 5 such that female students report lower mathematics self-efficacy and valuing of mathematics than male students. It was hypothesized that there would be no statistically significant gender differences in mathematics achievement across grades 3, 4, and 5. Independent samples t-tests were conducted to examine gender differences in students' mathematics self-efficacy, mathematics subjective task values, and mathematics achievement across grades 3, 4, and 5. Results of the analyses are displayed in Table 6. There was a significant difference in male and female students' mathematics self-efficacy scores at grades 4 and 5, but not at grade 3. At grade 4, male students reported significantly higher mean mathematics self-efficacy than female students. At grade 5, male students continued to report significantly higher mean mathematics self-efficacy. There were no gender differences in mathematics subjective task values and mathematics achievement at grades 3, 4, or 5 as seen in Table 7.

Table 6

Gender Differences for Outcome Variables: Independent Samples T-Tests

	t	*df*	Sig. (2-tailed)	*Cohen's d*
Math Self-Efficacy				
Grade 3	1.43	657	.15	0.11
Grade 4	2.16	656	.03*	0.17
Grade 5	2.52	632	.01*	0.20
Math Subjective Task Values				
Grade 3	-.35	657	.73	0.03
Grade 4	.50	656	.62	0.04
Grade 5	.20	632	.84	0.02

Table 6 Continued

	t	df	Sig. (2-tailed)	*Cohen's d*
Math Achievement				
Grade 3	.83	654	.41	0.07
Grade 4	.93	651	.35	0.07
Grade 5	.99	633	.32	0.08

* $p < .05$, **$p < .01$

Research Question 2

Do students' mathematics self-efficacy, valuing of mathematics and mathematics achievement change across grades 3, 4 and 5? It was hypothesized that students' mathematics self-efficacy and valuing of mathematics would decline across grades 3, 4, and 5. It was hypothesized that mathematics achievement would remain constant across grades 3, 4, and 5. This was determined by examining the descriptive statistics (mean and standard deviation) for mathematics self-efficacy, valuing of mathematics, and mathematics achievement) and plotting the data points for these student-level variables across grades 3, 4, and 5. These results are displayed in Figures 3 - 5. The results show that students' mathematics self-efficacy declines across grades 3, 4, and 5, with the most notable decline occurring between grade 3 and grade 4. In contrast, students' mathematics subjective task values increase across grades 3, 4, and 5.

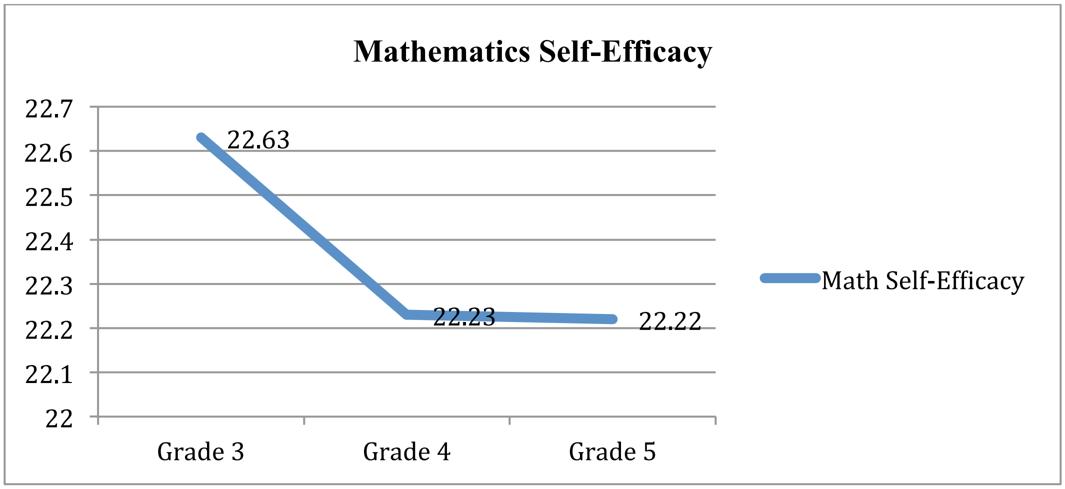

Figure 3. Mean level of math self-efficacy across grades 3, 4, and 5.

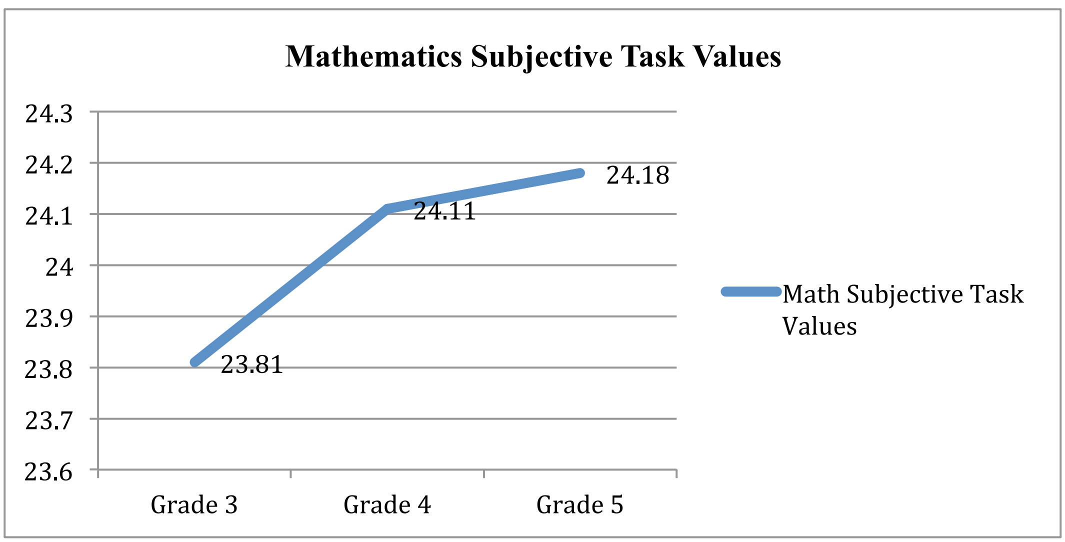

Figure 4. Mean level of mathematics subjective task values across grades 3, 4, and 5.

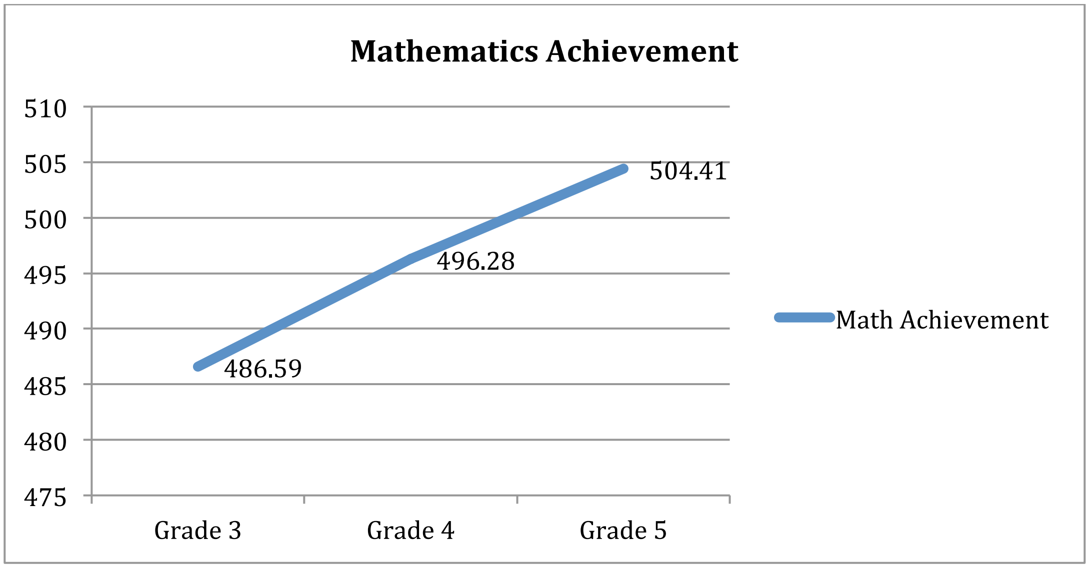

Figure 5. Mean level of mathematics achievement across grades 3, 4, and 5.

Research Question 3

Do mathematics self-efficacy, mathematics valuing and mathematics achievement vary between classrooms across grades 3, 4, and 5? It was hypothesized that mathematics self-efficacy, mathematics valuing and mathematics achievement would vary across classrooms. The intraclass correlation (ICC) at the classroom-level was calculated for each student-level outcome using an excel spreadsheet and the results are displayed in Table 7. At grade 3, the ICC was 0.01 for Mathematics Self-Efficacy, <0.01 for Mathematics Subjective Task Values, and 0.43 for Mathematics Achievement. The between-level variance was non-significant for Mathematics Self-Efficacy and Mathematics Subjective Task Values, and was statistically-significant for Mathematics Achievement. At grade 4, the ICC was <0.01 for Mathematics Self-Efficacy, 0.14 for Mathematics Subjective Task Values, and 0.42 for Mathematics Achievement. The between-level variance was non-significant for Mathematics Self-Efficacy and was statistically-significant for Mathematics Subjective Task Values and At Grade 5, the ICC was <0.01 for Mathematics Self-Efficacy, 0.02 for Mathematics Subjective Task Values, and 0.29 for Mathematics Achievement. The between-level variance was non-significant for Mathematics Self-Efficacy and Mathematics Subjective Task Values, and was statistically significant for Mathematics Achievement. These results indicate that there is minimal variance between classrooms mathematics self-efficacy and mathematics subjective task values across grades 3, 4 and 5. In contrast, there is substantial variance between classrooms when examining the mathematics achievement of students across grades 3, 4, and 5.

Table 7

Intraclass Correlations for Outcome Variables

Outcome Variables	Grade 3	Grade 4	Grade 5
Math Self-Efficacy	0.01	<0.01	<0.01
Math Subjective Task Values	<0.01	0.14	0.02
Math Achievement	0.43	0.42	0.29

Research Question 4

Do performance goal practices predict students' mathematics self-efficacy across grades 3, 4, and 5, controlling for mathematics achievement? It was hypothesized that students' experiences of performance goal practices will account for additional variance not accounted for by actual math achievement in students' mathematics self-efficacy. This was tested by fitting two-level hierarchical linear models (HLM) with random intercepts in SAS (Version 9.3). The direct effect of performance goal practices (classroom-level predictor) on mathematics self-efficacy (student-level outcome) was examined across grades 3, 4, and 5, controlling for concurrent math achievement at grades 3, 4, and 5. For all hypothesized models, HLM were fitted using the SAS PROC MIXED routine with Restricted Maximum Likelihood (REML) estimation. As shown in Table 8, the results indicated that performance goal practices (classroom-level predictor) were not a significant predictor of students' mathematics self-efficacy at grades 3, 4 or 5, controlling for concurrent math achievement at grades 3, 4, and 5.

Table 8
Performance Goal Practices and Mathematics Self-Efficacy

Outcomes	Estimate	*SE*	*P*
Grade 3			
Intercept (Grade 3 Math Self-Efficacy)	-20.11	12.49	0.11
Predictor (Performance Goal Practices)	-0.01	0.37	0.98
Covariate (Grade 3 Math Achievement)	0.09	0.03	<0.01
Grade 4			
Intercept (Grade 4 Math Self-Efficacy)	-33.81	12.38	<0.01
Predictor (Performance Goal Practices)	0.12	0.34	0.74

Table 8 Continued

Outcomes	Estimate	*SE*	*P*
Covariate (Grade 4 Math Achievement)	0.11	0.02	<0.01
Grade 5			
Intercept (Grade 5 Math Self-Efficacy)	-57.27	11.86	<0.01
Predictor (Performance Goal Practices)	-0.11	0.29	0.71
Covariate (Grade 4 Math Achievement)	0.16	0.02	<0.01

Research Question 5

Do performance goal practices predict students' valuing of mathematics across grades 3, 4, and 5 when controlling for mathematics achievement? It was hypothesized that students' experiences of performance goal practices would account for additional variance not accounted for by actual math achievement in students' valuing of mathematics. This was tested by fitting two-level hierarchical linear models (HLM) with random intercepts in SAS (Version 9.3). The direct effect of performance goal practices (classroom-level predictor) on students' valuing of mathematics (student-level outcome) was examined across grades 3, 4, and 5, controlling for concurrent math achievement at grades 3, 4, and 5. For all hypothesized models, HLM were fitted using the SAS PROC MIXED routine with Restricted Maximum Likelihood (REML) estimation. As shown in Table 9, the results indicated that performance goal practices (classroom-level predictor) were not a significant predictor of student's valuing of mathematics.

Table 9

Performance Goal Practices and Mathematics Subjective Task Values

Outcomes	Estimate	*SE*	*P*
Grade 3			
Intercept (Grade 3 Math STV)	-21.47	12.28	0.08
Predictor (Performance Goal Practices)	0.08	0.36	0.82
Covariate (Grade 3 Math Achievement)	0.09	0.03	<0.01
Grade 4			
Intercept (Grade 4 STV)	-13.59	12.06	0.26
Predictor (Performance Goal Practices)	0.20	0.36	0.59
Covariate (Grade 4 Math Achievement)	0.07	0.02	<0.01
Grade 5			
Intercept (Grade 5 Math STV)	-14.58	11.41	0.20
Predictor (Performance Goal Practices)	-0.02	0.28	0.95
Covariate (Grade 4 Math Achievement)	0.08	0.02	<0.01

Research Question 6

Do performance goal practices predict students' mathematics achievement across grades 3, 4, and 5 when controlling for the previous year's mathematics achievement? It was hypothesized that students' experience of performance goal practices will account for additional variance not accounted for by students' previous mathematics achievement for grades 3, 4, and 5. This was tested by fitting two-level hierarchical linear models (HLM) with random intercepts in SAS (Version 9.3). The direct effect of performance goal practices (classroom-level predictor) on students' mathematics achievement (student-level outcome) was examined across grades 3, 4, and 5, controlling for previous mathematics achievement. For all hypothesized models, HLM were fitted using the SAS PROC MIXED routine with Restricted Maximum Likelihood (REML) estimation. As shown in Table 10, the results indicated that performance goal practices (classroom-level predictor) were not a significant predictor of students' mathematics achievement.

Table 10

Performance Goal Practices and Mathematics Achievement

Outcomes	Estimate	*SE*	*P*
Grade 3			
Intercept (Grade 3 Math Achievement)	135.98	14.75	<0.01
Predictor (Performance Goal Practices)	0.14	0.48	0.77
Covariate (Grade 2 Math Achievement)	0.74	0.03	<0.01
Grade 4			
Intercept (Grade 4 Math Achievement)	115.63	11.75	<0.01

Table 10 Continued

Outcomes	Estimate	*SE*	*P*
Predictor (Performance Goal Practices)	0.28	0.37	0.45
Covariate (Grade 3 Math Achievement)	0.78	0.02	<0.01
Grade 5			
Intercept (Grade 5 Math Achievement)	104.00	12.54	<0.01
Predictor (Performance Goal Practices)	-0.27	0.35	0.44
Covariate (Grade 4 Math Achievement)	0.81	0.03	<0.01

Research Question 7

Does mathematics self-efficacy mediate the effect of performance goal practices on mathematics achievement across grades 3, 4, and 5? It was hypothesized that the effect of higher levels of performance goal practices will be mediated by students' mathematics self-efficacy beliefs, which will then predict mathematics achievement. This question was tested using mediation guidelines provided by Baron and Kenny (1986). These researchers proposed a four-step approach to establishing mediation. First, there must be a statistically-significant relationship between performance goal practices and students' mathematics achievement. As indicated in Table 10, performance goal practices were not a statistically significant predictor of students' mathematics achievement. Second, there must be a statistically significant relationship between performance goal practices and students' mathematics self-efficacy. As indicated in

Table 8, performance goal practices were not a statistically significant predictor of students' mathematics self-efficacy. Third, students' mathematics self-efficacy must be a statistically-significant predictor of students' mathematics achievement. As shown in Table 11, students' mathematics' self-efficacy was a statistically significant predictor of students' mathematics achievement across grades 3, 4, and 5, even when controlling for students' previous mathematics achievement. In the present study, the first two conditions were not met, and thus the full mediation model was not tested.

Table 11

Mathematics Self-Efficacy and Mathematics Achievement

Outcomes	Estimate	*SE*	*P*
Grade 3			
Intercept (Grade 3 Math Achievement)	138.30	12.73	<0.01
Predictor (Grade 3 Self-Efficacy)	0.16	0.04	<0.01
Covariate (Grade 2 Math Achievement)	0.72	0.03	<0.01
Grade 4			
Intercept (Grade 4 Math Achievement)	117.21	10.77	<0.01
Predictor (Grade 4 Self-Efficacy)	0.13	0.04	<0.01
Covariate (Grade 3 Math Achievement)	0.77	0.02	<0.01
Grade 5			
Intercept (Grade 5 Math STV)	107.88	11.39	<0.01

Table 11 Continued

Outcomes	Estimate	*SE*	*P*
Predictor (Performance Goal Practices)	0.14	0.04	<0.01
Covariate (Grade 4 Math Achievement)	0.79	0.02	<0.01

CHAPTER V

SUMMARY AND CONCLUSIONS

Female students continue to be underrepresented in advanced mathematics courses and receive fewer math-related undergraduate and graduate degrees than male students (Hill et al., 2010). The classroom environment has been identified as a critical context in shaping the development of students' academic and career interests. Specifically, the classroom goal structure, which refers to whether teachers emphasize effort or ability in their instructional practices, has been identified as a possible factor that influences students' development of self-efficacy and valuing of mathematics (Ames, 1992; Kaplan, et al., 2002; Wang, 2012). In this regard, goal theorists have hypothesized that students are sensitive to the instructional emphases on effort versus ability in the classroom and how teachers respond to their academic successes and failures. The present study sought to examine the role of teacher-reported performance goal practices on female students' valuing of mathematics and mathematics self-efficacy across grades 3, 4, and 5.

Based on a review of literature, it was hypothesized that female students would report lower mathematics self-efficacy and valuing of mathematics across grades 3, 4, and 5. In addition, it was hypothesized that performance goal practices would exert a negative effect on students' mathematics self-efficacy and valuing of mathematics. Lastly, it was hypothesized that students' mathematics self-efficacy would mediate the effects of performance goal practices on mathematics achievement across grades 3, 4, and 5.

Discussion of Results

Findings showed that gender differences in students' mathematics self-efficacy beliefs emerged at grade 4 and remained at grade 5. There were no significant gender differences in mathematics self-efficacy at grade 3. Consistent with hypotheses, female students reported significantly lower mathematics self-efficacy than male students at grades 4 and 5. It should be noted that these results were obtained through independent samples *t*-tests, and therefore, Type I error may have been inflated. These findings are consistent with previous studies by Herbert and Stipek (2005) and Muzzatti and Agnoli (2007) showing that gender differences in mathematics self-efficacy appear during the middle to late elementary years

Researchers have theorized that these early gender differences in mathematics self-efficacy may emerge partially as a consequence of the internalization of gender-stereotyped experiences and messages that students receive from parents and teachers (Cvencek et al., 2011; Gunderson et al., 2011; Herbert & Stipek, 2005). The first few years of formal schooling have been proposed as particularly influential in students' development of their mathematics self-efficacy, as students begin to receive feedback from parents and teachers regarding their abilities and begin comparing their abilities to their peers (Lindberg et al., 2010). A study of math-gender stereotypes among elementary-aged students using both an Implicit Association Test and a self-report measure showed that both male and female elementary students associated mathematics more with males than females (Cvencek et al., 2011). Gunderson et al. (2012) provides a review of research that more fully discusses how early experiences shape math-gender stereotypes and contribute to the emergence of gender differences in attitudes among male and female students.

Contrary to expectations, there were no statistically significant gender differences in students' mathematics subjective task values across grades 3-5. This is an important finding as it suggests that in elementary school, male and female students hold similar beliefs about the importance of mathematics. These results are consistent with more recent studies conducted within the past decade, showing that although gender differences in mathematics self-efficacy continue to persist; there are no longer such observed gender differences in mathematics subjective task values (Jacobs et al. 2002; Wang, 2012).

Similar results were found in the study conducted by Jacobs et al. (2002) who examined changes in mathematics subjective task values across grades 1-12. Although the researchers expected to find gender differences in mathematics subjective task values, there were no significant gender differences across time. Importantly, Wang (2012) found that while there were no significant differences in mathematics subjective task values for males and female students, female students reported lower intentions to pursue math-related careers. Therefore, it may be helpful for future research to examine students' mathematics subjective task values as well as their educational and career interest in mathematics.

An examination of teacher-reported use of performance goal practices indicated that it was not a statistically-significant predictor of any of the student-level outcomes measured in this study, including mathematics self-efficacy, mathematics subjective task values and mathematics achievement across grades 3, 4, and 5. This finding was not entirely unexpected, as previous research on performance goal structure and students' achievement beliefs and behaviors has yielded inconsistent effects of a performance goal structure on student outcomes, while more consistently positive effects for a mastery goal structure (Anderman & Midgley, 1997; Anderman & Young, 1994; Friedel et al., 2007; Urdan & Midgley, 2003). There are several possible explanations that may account for the lack of significant findings.

First, previous research has found that students and teachers perceive more emphasis on performance goal practices at the middle-school level than the elementary-school level, particularly with greater usage of ability grouping at the middle -school level, more frequent evaluation and fewer opportunities for collaborative work (Midgley, Anderman, & Hicks, 1995). Thus, the role of performance goal practices at the elementary school level may be less salient for elementary-aged students than it is for middle school students. Indeed, much of the research examining the role of performance goal practices and students' self-efficacy and other achievement-related beliefs has been conducted at the transition point between elementary school and middle school due to the decline that frequently occurs in academic motivation in early adolescence (Anderman & Midgley, 1997; Urdan & Midgley, 2003).

Another factor that may explain the non-significant findings is the lack of differentiation of the performance goal structure into performance-approach versus performance-avoidance components. A performance-approach orientation refers to a focus on out-performing others. Conversely, a performance-avoidance orientation refers to a focus on avoiding appearing incompetent. Researchers have theorized that a performance-approach goal structure may be associated with more adaptive outcomes for students than a performance-avoidance goal structure (Linnenbrink, 2005). Much of the research on the performance-approach and performance-avoidance components has been conducted on personal goal orientations. Research on performance-avoidance and performance-approach goal structures is still in its infancy.

The measurement of the performance goal structure may also partially explain the non-significant findings. Much of the research that has examined the relationship between classroom goal structure and students' achievement attitudes and behaviors has measured the classroom goal structure from the student perspective rather than the teacher. Previous researchers have theorized that students' perceptions of the classroom goal structure may be more influential on students' achievement beliefs and behaviors than the teacher-reported goal structure as students may perceive and respond differently to goal messages within the classroom (Urdan, 2004).

It is also noteworthy to mention that the present study found that students' self-efficacy was significantly related to their following year's mathematics achievement, even while controlling for their previous year's achievement. Although this finding was not a focus in this study, it provides further support for the importance of students' mathematics self-efficacy (Pajares & Graham, 1999).

Limitations

It is important to note the limitations of the present study. One limitation of this study is that the sample is comprised of low-achieving students and thus is not representative of students with a wider range of achievement levels. In this regard, the students in this study scored below the median on a district-administered literacy test and therefore comprise a non-normative sample of at-risk students. Thus, the results obtained in this study may not generalize to a sample of students with varying levels of academic ability. Furthermore, data were not collected on students' personal goal orientations, which previous research has shown may mediate the effect of performance goal practices on self-efficacy and valuing of mathematics (Church et al., 2001; Midgley et al., 2001). Another limitation of the present study is that the classroom performance goal structure was only measured from the perception of teachers rather than students. Previous research has primarily measured classroom goal structure from the perceptions of students rather than teachers.

Implications

There are several implications to draw from the findings of the present study. Consistent with previous research, results indicated that mid-way through elementary school, female students began reporting lower self-efficacy in mathematics than males. This is an important finding as research has shown that students with poor mathematics self-efficacy are less likely to enroll in advanced mathematics courses, and subsequently to pursue mathematics majors or careers (Lopez et al., 1997; Pajares, 2005). The emergence of gender differences in mathematics self-efficacy during the mid-elementary years provides strong support for the importance of early intervention to promote more positive attitudes towards mathematics. Previous research has shown that teachers exert an important influence on students' development of attitudes towards mathematics and therefore are one important target of intervention (Gunderson et al., 2012; Li, 1999). In this regard, the math gender-role stereotypes held by teachers influences the attributions they make for male and female students' successes and failures in math, which in turn influences students' attitudes. Importantly, studies have found that challenging the gender-stereotypes about mathematics performance through intervention can yield long-lasting benefits. This is a potential avenue for intervention in the school setting.

Although the present study did not find a relationship between performance goal practices and students' self- efficacy, previous research has supported a link between a mastery goal structure and students' mathematics self-efficacy (Midgley et al., 1995). Thus in developing interventions to improve students' mathematics self-efficacy, it may be most efficacious to work with teachers and administrators on fostering mastery goal practices in the classroom rather than on decreasing performance goal practices. The TARGET system outlined by Ames (1992) provides a framework for supporting the mastery goal structure in the six instructional areas, including: tasks (i.e. variety, challenge, organization), authority (i.e. opportunities for students to be responsible for their own learning and make decisions), recognition (incentives and rewards based upon effort), grouping (i.e. heterogeneous grouping of students aimed at promoting collaboration), evaluation practices (i.e. evaluation that is varied, private, and based on progress over time, improvement and mastery), and time (opportunities to complete assignments at own rate).

Findings also provided further research support for the importance of students' mathematics self-efficacy in predicting their future mathematics achievement (Pajares & Graham, 1999). This finding has implications as we seek ways to encourage students to remain in the STEM pipeline through post-secondary schooling and pursue STEM careers. Despite the significant progress that has been made in narrowing the gender gap in mathematics performance, research continues to demonstrate that male students participate in advanced mathematics courses in secondary school at higher rates than females and receive a higher proportion of mathematics-related undergraduate and graduate degrees. Thus, focusing on building female students' self-efficacy in mathematics through classroom and school-level interventions should be a goal.

Directions for Future Research

There are several directions for future research. First, further research should be undertaken to understand potential factors that contribute to the emergence of gender differences in mathematics self-efficacy during the middle elementary years. Knowledge of the factors that contribute the emergence of gender differences could be used to inform prevention and intervention efforts. In accordance with a limitation of the present study, it is recommended that future research examine the implications of the classroom performance goal structure when it is differentiated into performance-approach and performance-avoidance components. More recent research has indicated that a performance-approach classroom goal structure may be more adaptive for students than a performance-avoidance classroom goal structure.

It is also important for future research to examine the impact of different goal structures (i.e. mastery, performance-approach, and performance-avoidance) for students of varying achievement levels. Existing research suggests that performance goal structures may be most harmful for lower-achieving students, while less harmful for higher-achieving students. In this regard, higher-achieving students may benefit more from a more autonomous classroom environment where more recognition is received for their individual performance. In contrast, lower-achieving students may adopt self-handicapping strategies in a classroom environment that emphasizes more strongly individual performance over effort and progress (Wang, 2012). The current study was not able to examine this question due to the study sample being comprised of students at-risk of grade retention.

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