INVESTIGATING GENDER DIFFERENCES IN ACHIEVEMENT GOAL ORIENTATION IN EXAMPLE-BASED ALGEBRA LEARNING

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by
Melissa H. Oyer

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Examining Committee Members:

Dr. Erin Rotheram-Fuller, Advisory Chair Arizona State University
Dr. Julie Booth, Advisory Co-Chair, Educational Psychology
Dr. Catherine Fiorello, School Psychology
Dr. Avi Kaplan, Educational Psychology
Dr. Laura Pendergast, School Psychology

ABSTRACT

This study was designed to compare the effects of the use of worked examples and self-explanation on motivation for male and female students. More specifically, the present study examines whether there are differences between males and females with regards to their achievement goals and if gender plays a role in how students respond to questions about their motivation in the presence of other male or female students. Comparisons of student responses on Achievement Goal Questionnaire-Revised (AGQ-R) and the Patterns of Adaptive Learning Scales (PALS) were also conducted. Participants were 147 seventh-, eighth- and ninth-grade non-honors Algebra I students (82 girls and 65 boys) from three schools and eight classrooms within the same school district on the east cost of the United States of America. Results replicated the finding that females have more mastery goals than males, however no gender differences were found for either performance. In addition, it appears that students respond differently to some questions about their motivation in the presence of other male or female students. Finally, the AGQ-R and the PALS appear to be consistent representations of students' achievement goals.

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CHAPTER 1

INTRODUCTION TO THE STUDY

Educators are constantly interested in student motivation, but motivation can be a vague term, especially when attempting to study or manipulate it. For the purposes of this study, motivation is conceptualized as the *energization* and *direction* of behavior (Elliot, 2006). Within this definition, *energization* refers to the initial instigation or "spring to action" (James, 1890/1950, vol. 2, p. 555) of behavior, and *direction* refers to the guiding or channeling of behavior (Elliot, 2006). Using this definition, this study will examine motivation through the dominant approach for achievement goals, a conceptualization that is vastly prevalent in education and psychology literature.

Achievement goals refer to the specific types of goals students possess that guide their behaviors with regards to academics and competence (Nicholls, 1984; Dweck & Leggett, 1988; Elliot, 1999; Pintrich, 2000a); or specifically, the purpose of competence-relevant behavior (Maehr, 1989). Research has suggested that there are two basic types of achievement goals that may be employed by students in a learning environment. *Mastery goals* focus on developing skills and employing self-regulated learning strategies, while *performance goals* focus on seeking positive judgments regarding one's performance and competence (Dweck, 1986; Dweck & Elliot, 1983; Dweck & Leggett, 1988). For example, a *mastery goal* may be: "one of my goals is to master a lot of new skills in the course." where as a *performance goal* may be: "it is important to me that I look smart compared to others in this class." Within these goals a distinction can be made between *approach* goals and *avoidance* goals; an *approach* goal is "the energization of behavior by, or the direction of behavior toward, positive stimuli (objects, events, and

possibilities)" and *avoidance* is "the energization of behavior by, or the direction of behavior away from, negative stimuli (objects, events, possibilities)" (Elliot, 2006 p. 112). Specifically, *performance-approach* describes goals that are characteristic of students being motivated to perform better than their peers and demonstrate their competence, and *performance-avoidance* goals describes goals that are characteristic of students being motivated to avoid failure or avoid looking incompetent (Elliot, 1999). For example, a *performance-approach goal* may be: "one of my goals is to show others that I'm good at my coursework in this class" while a *performance-avoidance goal* may be: "one of my goals in this class is to avoid looking like I have trouble doing the work." Students' goal pursuit impacts how they approach the task of learning as well as the level of learning that subsequently occurs (Ames & Archer, 1988).

Improving Performance and Motivation with Example-Based Assignments

One instructional intervention that has the potential to increase both student performance and motivation is the use of assignments that include worked examples with prompts for self-explanation (Sweller & Cooper, 1985; see Chi, 2000, for a review); "A worked example is a step-by-step demonstration of how to perform a task or how to solve a problem" (Clark, Nguyen & Sweller, 2006, p. 190). Worked examples are used to model correct and incorrect solutions to problems (Siegler & Chen, 2008). Worked example problems may also incorporate many features that can impact both student motivation and performance, and also contribute to sex differences in these areas.

The Present Study

The current research study has been designed to compare the effects of the use of worked examples and self-explanation on motivation between male and female students.

More specifically, this study sought to examine whether there are differences between males and females with regards to their achievement goals and examine if gender plays a role in the way in which students respond to questions about their motivation in the presence of opposite and same sex peers. Outcome measures in this study were student responses to survey items, student responses during focus groups as well as student performance on the related algebra assessment. With this study, the following research questions were specifically examined:

1. Are there differences in achievement goals between males and females?

    1b) Do males and females respond differently to questions about their achievement goals in single- versus mixed-sex groups?

2. How are gender differences in achievement goals related to learning?

    2b) Does that vary based on measurement tool?

CHAPTER 2

REVIEW OF RELATED LITERATURE

Educators and researchers are highly interested in student motivation and achievement. Not surprisingly, students who are motivated learn more than students with lower motivation (Pintrich & Schunk, 1996). Over the last few decades, researchers have extensively investigated the larger construct of student motivation with some focusing on several distinct facets, one of which is achievement goals. Achievement goals refer to the specific types of goals students possess that guide their behaviors with regards to academics and competence (Nicholls, 1984; Dweck & Leggett, 1988; Elliot, 1999; Pintrich, 2000a); or specifically, the purpose of competence-relevant behavior (Maehr, 1989). One's goal orientation is a representation of the standard they use to evaluate their performance as well as success or failure on attainting a specific goal (Elliot, 1997). Research has suggested that there are two basic types of achievement goals that may be employed by students in a learning environment, *mastery* and *performance*. *Mastery* goals focus on developing skills and employing self-regulated learning strategies, while *performance* goals focus on seeking positive judgments regarding performance and competence (Dweck, 1986; Dweck & Elliot, 1983; Dweck & Leggett, 1988). Beyond *mastery* and *performance* goals we can distinguish between approach goals and avoidance goals. The difference between *approach* and *avoidance* motivation is related to valence, which is the direction of the goal (Elliot, 1999). *Approach* motivation is directed towards positive or desirable events/actions whereas *avoidance* motivation is directed away from negative or undesirable events/actions (Elliot, 1999). Students with a *performance-approach* orientation are motivated to perform better than their peers and

demonstrate their competence (Elliot, 1999). On the other hand, students with a *performance-avoidance* orientation are motivated to avoid failure and looking incompetent. The same distinction can be made for *mastery* goals; students with *mastery-approach* goals are striving to master the material and learn new skills. Students with *mastery-avoidance* goals are concerned with their performance and failure due the high standards they set for themselves; the emphasis here is avoiding failure and incompetence as opposed to gaining success or achieving competence as with a mastery-approach goal. *Mastery-avoidance* goals are often overlooked in the literature since many believe mastery goals to be an approach from of regulation in general, as well as adaptive overall. Furthermore, given the overarching notion of a *mastery* goal, many find the notion of a *mastery-avoidance* goal counterintuitive (Elliot, 1999). Regardless of specific types of goals, students' goal pursuit impacts how they approach the task of learning as well as the level of learning that subsequently occurs (Ames & Archer, 1988).

Factors that Can Impact Gender Differences in Achievement Goals

In their paper on gender and motivation Meece, Bower Glienke and Burg (2006) examine gender differences in four theories of achievement motivation: attribution theory, expectancy-value theory, self-efficacy and achievement goals. The authors highlight that though all of the theories research has shown that gender differences in motivation follow gender role stereotypes and gender effects are moderated by ability, classroom context and ethnicity. In addition, the authors discuss the role of the home and school environments as well as sociocultural influences on gender differences in achievement motivation.

Parental influences. Research has demonstrated that parent's beliefs have a

significant influence on their children's beliefs of themselves with regards to their academic abilities (Eccles, Wigfield, & Schiefele, 1998; Jacobs 199; Jacobs & Eccles, 1992; Bleeker & Jacobs, 2004). Furthermore, parental beliefs and perceptions of their child's abilities are influenced by cultural stereotypes (i.e.; Parsons, Adler, Kaczala (1982). In addition, Bleeker and Jacobs (2004) found that parents are more likely to be involved with their daughter's math and science work/activities than their son's math and science work, suggesting that parents feel their daughters need more help for these subjects than their sons. Clearly all of these factors are in line with existing gender stereotypes and if routinely exposed to these practices and beliefs, children will naturally internalize them.

Schooling influences. In terms of schooling, teachers tend to higher expectations for achievement for males in certain subjects than females (Meece, Blumenfled, & Hoyle 1988) and tend to overestimate the effort that female students put into math, which results in female students believing their success is more associated with their effort than ability (Madon, Jussim, Keiper, Eccles, Smith, & Palumbo, 1998). Naturally, if teachers treat their male and females differently based on their beliefs, students will notice and they can influence how students perceive their abilities. In addition, teachers who employed more ability-focused teaching practices created an environment were students were less learning (*mastery*) focused (Anderman & Young, 1994). Meece, Bower Glienke and Burg (2006) note that of the four theories, gender differences in achievement goals have only been examined in a few studies but clearly they are influenced by many factors.

Sociocultural influences. While Meece, Bower Glienke and Burg (2006) do not address the effect of sociocultural influences on achievement goals directly, they do

discuss how sociocultural factors can contribute to difference gender differences in different cultures, which ultimately may explain why gender differences in achievement goals could be different for different ethnicities. According to Meece and Kurtz-Costes (2001), although schools are becoming increasingly culturally diverse, little research is done on how gender differences in motivation vary by race, ethnicity or socioeconomic status. However, since gender socialization patterns and expectations are different amongst Asian, African American and Hispanic youth, gender differences in their motivational tendencies are likely different; for example African American female youth are expected to be self-reliant, assertive and resourceful where as Latina and Asian female youth are socialized to be dependent, submissive, and obedient (Collins, 1998; Weiler, 2000). The socialization tendencies of the Asian and Latino communities are more in line with expectations in school and therefore they may have an easier time adjusting to school expectations than African American female youth. These differences in addition to existing stereotypes of these populations, could influence how the students engage with, and react to, the classroom environment as well as what they find motivating and how they perform academically.

Establishing the History of Achievement Goals

Achievement motivation research focuses on behaviors that surround an individual's competence (Elliot & Harackiewicz, 1996); specifically how individuals strive to obtain competence or avoid incompetence. This distinction between acquiring competence versus avoiding incompetence has been part of achievement motivation in its earliest forms.

Precursors to achievement goals. Lewin and colleagues identified the notion of desiring success or the desire to avoid failure as crucial aspects of behavior (Hoppe, cited in Lewin, Dembo, Festinger, & Sears, 1944). McClelland (1951) also proposed a similar idea that at least two kinds of achievement motivation existed, one focused on avoiding failure with the other focused around attaining success. Atkinson's (1957) need achievement theory used the theories of Lewin and McClelland for its foundation. This theory used a mathematical based framework, which separated the notions of the desire to avoid failure, and the desire to obtain success as independent motivational tendencies, yet both were seen as important factors in the achievement related behavior.

Achievement goals in the 1970's and 1980's. The early ideas of theorists like Atkinson, McClelland and Lewin served as the foundation from which achievement goals were developed in the late 1970's and early 1980's by theorists such as Carole Ames, Carol Dweck, Marty Maehr and John Nicholls (Dweck & Bempechat, 1983; Ames, 1984; Dweck, 1986; Maehr & Nicholls, 1980; Nicholls, 1979, 1984). Individually and through collaboration, these theorists moved the field forward, operationalizing the two specific and distinct goal constructs, which became referred to as "the dichotomous achievement goal model" (or normative goal theory as it is referred to presently [Harackiewicz, Barron, Carter, Lehto, & Elliot, 1997]). Within this model, they defined achievement goal as the reason for, or purpose of engaging in competence-relevant behavior (Maehr, 1989), with two different types of goals: *mastery* goals and *performance* goals. The function of *mastery* goals is to acquire competence and mastery of the material while the function of performance goals is to demonstrate competence (typically normative in comparison) (Ames & Archer, 1987). At this point many theories also made reference to

both types of goals being approach forms of motivation (Ames, 1992; Meece, Blumenfeld, & Hoyle, 1988; Nicholls et al., 1989). This meant that they saw individuals as working towards achieving a specific goal, whether it be mastering the material and gaining a thorough understanding or performing well and demonstrating competence, as opposed avoiding failure and appearing incompetent.

Shift Towards Present Day Conceptualization. As achievement goal research progressed in the 1990's and 2000's, the mere dichotomy between *mastery* and *performance* goals began to expand and was extended by Elliot and colleagues to also include the distinction between *approach* and *avoidance* goals (e.g. Elliot & Harackiewicz, 1996; Elliot & Church, 1997). The difference between *approach* and a*voidance* motivation is related to valence, which is the direction of the goal (Elliot, 1999). *Approach* motivation is directed towards positive or desirable events/actions where as *avoidance* motivation is directed by negative or undesirable events/actions (Elliot, 1999). At the start of this bifurcation within the overarching goals, the focus was primarily on performance goals. Specifically, at this time three types of achievement goals were suggested; one focused on developing competence and mastering a task (*mastery* orientation), a second on attaining favorable judgments (*performance-approach* orientation) and the third on avoiding unfavorable judgments (*performance-avoidance* orientation) (Elliot & Harackiewicz, 1996). Eventually Elliot (1999) explored this approach and avoidance distinction for mastery goals as well.

Approach and Avoidance Goal Distinction. The notion of *approach* and *avoidance* has a long history, one dating back to Democritus and ancient Greek philosopher (460-370 B.C.), who offered that central to human behavior was the pursuit of pleasure and the

avoidance of pain (Elliot & Covington, 2001). This distinction can also be seen in the work of psychologists such as Freud (1915), Pavlov (1927) and Skinner (1938). Freud (1915) posited that like other animals, humans sought to seek pleasure and avoid pain. Pavlov (1927) highlighted that within classical conditioning the being is responding toward the stimulus or trying to move away from the stimulus. In his law of effect, Skinner (1938) offered that observable reinforcers increase the likelihood of a specific behavior while observable negative reinforcers decreased the likelihood of a behavior. In all of these examples there is one factor that can be seen as positive, or as a push towards an event/ stimulus as well as one factor that can be seen as negative or a push away from an event/stimulus; the same notion continues today within the context of *approach* and *avoidance* motivation. Over time, researchers came to conceptualize *approach* motivation as directed by positive or desirable events/actions whereas *avoidance* motivation is directed by negative or undesirable events/actions (Elliot, 1999).

Elliot and Harackiewicz (1996) looked to extend the state of achievement goals beyond merely *mastery* and *performance* goals to include *performance-approach* goals and *performance-avoidance* goals. They emphasized that *performance* goals targeted at avoiding failure and incompetence have deleterious effects compared to *mastery* goals and *performance* goals targeted at achievement competence and success (*performance-approach* goals); specifically, these *avoidance* goals undermine intrinsic motivation. Although those attempting to avoid failure and those focused on attaining success did not differ on how motivated they were it was the nature of the motivation that ultimately played the influential and differing role. This notion that *performance-avoidance* goals are detrimental for learning and intrinsic motivation still persists in the literature.

Elliot and Church (1997) expanded upon the 1996 findings from a laboratory study to measure three achievement goal constructs in the context of a college classroom. The authors proposed and tested a hierarchical model of *approach* and *avoidance* motivation specifically examining *mastery* goals, *performance-avoidance* goals and *performance-approach* goals. The results of the study did support the proposed model and the presence of the three distinct achievement goal factors. Through a path analysis they also found that *mastery* goals and *performance-avoidance* goals were each underlined by a single (but different) construct (achievement motivation and fear of failure, respectively) whereas underlying *performance-approach* goals were both the constructs of achievement motivation and fear of failure, thus making a connection between *performance-approach* and *mastery* goals as well as *performance approach* and *performance-avoidance* goals. The authors put forth that goals that share an underlying construct (either mastery, performance, approach or avoidance) are related either by goal (mastery or performance) or by valence (approach or avoidance).

Elliot (1999) proposed the use of a 2 x 2 achievement goal model in which there was not only an approach-avoidance distinction for performance goals, but for mastery goals as well. Students with *performance-approach* goals are motivated to perform better than their peers and demonstrate their competence. On the other hand, students with *performance-avoidance* goals are motivated to avoid failure and looking incompetent. In this article, Elliot suggested that the same distinction could be made for mastery goals; students with *mastery-approach* goals are striving to master the material and learn new skills. Students with *mastery-avoidance* goals are motivated by trying to avoid not gaining full understanding or not meeting the high expectations they set for themselves;

the emphasis here is avoiding failure and incompetence as opposed to gaining success or achieving competence as with a mastery-approach goal. *Mastery-avoidance* goals are often overlooked in the literature since many believe mastery goals to be an approach form of regulation in general, as well as adaptive overall.

In 2000, Midgley and colleagues published a revised version of their manual for their Patterns of Adaptive Learning Scales (PALS). Overall, the PALS is a group of scales that uses goal orientation as a vehicle for examining the relationship between the learning environment and student motivation, affect and behavior. This revision of their 1997 publication improved the individual personal goal scales by focusing on the goals themselves and eliminating references to specific behaviors and assessment of intrinsic value. The authors validated the new scales by conducting a confirmatory factor analysis of the 14 personal goal orientation items and examined the factor structure for *mastery* goals, *performance-approach* goals and *performance-avoidance* goals; the three goals loaded on different factors. One of the benefits of this scale is that is was designed to be used with early adolescents.

Just as there have been discussions regarding the role and place for *mastery-avoidance* goals, a debate over the effects of *performance-approach* goals has occurred as well. Midgley, Kaplan and Middleton (2001) discussed the idea that some researchers believe a reconceptualization of achievement goal theory that addresses the positive influences of *performance-approach* goals is necessary. The authors examined and reviewed many studies that highlight the positive features and adaptive learning patterns associated with *performance-approach* goals but also took care to note that some studies have not found these results or find just the opposite. The authors believed that it is

important to take into consideration under what circumstances and for who *performance-approach* goals may be beneficial and those in which they are not. While they noted that some data has indicated that *performance-approach* goals may be more beneficial for boys than girls, for older students than younger students, in competitive learning environments, and if *mastery* goals are simultaneously espoused, this does not necessitate a reconceptualization of achievement goal theory. The authors indicated that the approach-avoidance distinction is informative enough and has altered conceptualization of achievement goal theory enough that an additional revision to say that both *mastery* and *performance* goals are good is not justifiable. By indicating that demonstration of ability (performance goals) is good, we take away from the important notion educators strive for, which is, we must help increase *mastery* goals to help development of ability as opposed to fostering mere demonstration of ability.

In response to the paper by Midgley, Kaplan and Middleton (2001), Harackiewicz, Barron, Pintrich, Elliot and Thrash (2002) published a paper highlighting why they believed revision and reconceptualization of achievement goal theory is necessary, and in fact had already begun. The authors addressed three reasons that the revision is necessary: (1) the importance of the approach-avoidance distinction, (2) the potential positive effects of *performance-approach* goals, and (3) the ways in which *performance-approach* and *mastery* goals can combine to result in optimal motivation. The authors criticized the arguments made by Midgley, Kaplan and Middleton (2001) and ultimately indicate that while these authors had begun an important discussion regarding the future of achievement goal theory, the change they did not believe is necessary was already underway. One of their main points was that these authors and

others, had already incorporated the approach-avoidance distinction in their work and by merely clumping all performance goals together they were reverting back to the normative goal theory, which is merely *mastery* and *performance* goals. It is already widely accepted that *mastery* goals are adaptive for learning and *performance-avoidance* goals are detrimental so it is only logical to give due focus of *performance-approach* goals.

Elliot and Covington (2001) highlighted the presence of *approach* and *avoidance* behaviors in the work of various psychological theorists over time as one means for demonstrating the importance of this construct. They also provided additional reasons for the importance of this distinction including, applicability across life forms, immediacy of motivational processes, neurophysiological differentiations in the brain for approach and avoidance systems and lastly that the overall notion is highly intuitive. The authors emphasized that more attention should be focused on this distinction within the field (for the previously stated reasons) and that failure to do so is detrimental to this area of research. Though it may be named differently within various field or by different researchers, clearly the approach-avoidance distinction has a long history and plays a significant role in motivation and behavior.

Elliot and Thrash (2001) saw a need to scrutinize and reexamine the state of achievement goals at the time; specifically they believed that not enough time was spent examining how the antecedents combine to produce competence based self-regulation. Two definitions of achievement goals routinely used in the literature are addressed and then another is offered by the authors: (1) the purpose for which a person engages in achievement behavior (Dweck, 1986; Maehr, 1989) and (2) a network or integrated

pattern of variables that together create an orientation toward achievement tasks (Ames, 1992; Ames and Archer, 1987). Most theorists have come to view achievement goals as the amalgamation of the reason for the behavior as well as the goal one wishes to attain (Pintrich, 2000b; Urdan & Maehr, 1995); as such *performance* goals are about demonstrating competence whereas *mastery* goals are about developing competence. The authors addressed what they saw as the limitations of these conceptualizations and argued that to move the field forward and keep it as the prominent motivational approach, it is imperative to define the construct of achievement goals in a more explicit manner. The author's definition comes from Elliot (1999), "an achievement goal is a specific type of goal, one in which the focal end state or result is competence. As such, 'achievement goal' may be straightforwardly defined as a cognitive representation of a competence-based possibility that an individual seeks to attain" (p. 144). They go on to detail the hierarchical approach to achievement motivation discussed in past works (difference between absolute, intrapersonal and interpersonal competence and the valence dimension) and the conceptual notion that one's goal and reason behind it should in fact be different. The authors emphasized that the competence definition and valence dimensions within the hierarchical model sufficiently represent the various conceptual underpinnings of competence-based goals.

Elliot and McGregor (2001) conducted three studies to examine achievement goals within a 2 x 2 framework to see if the four goals are in fact distinct constructs with specific focus on *mastery-avoidance* goals. Ultimately, the authors wanted to examine the intercorrelations amongst the goals and see how *mastery-avoidance* goals fit into the overall framework. They devised a measure, the Achievement Goal Questionnaire (AGQ)

from preexisting measures (Elliot, 1999; Elliot & Church, 1997) for *mastery-approach*, *performance-approach* and *performance-avoidance* goals and devised new items for *mastery-avoidance* goals. Overall, they demonstrated that the 2 x 2 system was in fact an appropriate framework for the goals and that supported the existence of the fourth construct. The new measure provided to be useful and *mastery-avoidance* was correlated appropriately with *mastery-approach* goals and *performance-avoidance* goals. Since goals that share an underlying construct (either mastery, performance, approach or avoidance) are related either by core (mastery or performance) or by valence (approach or avoidance), as such, they should demonstrate a certain level of relatedness.

Elliot (2006) discussed many of the same points raised in the paper by Elliot and Covington (2001). The article detailed the difference between *approach* and *avoidance* motivation, and emphasized how this fits into and plays an important role in an overall hierarchical model of *approach* and *avoidance* motivation. Elliot emphasized the role of *approach* and *avoidance* motivation in all aspects of life for all living beings regardless of size. As such, in order to examine motivation, especially achievement goal motivation, we must take these aspects of motivation into account. In addition, the primary assumption of the hierarchical model is that, from a conceptual frame of reference, one's goals and their underling motivations for those goals should be seen as different entities. For the purpose of the present study, it is the definition provided here by Elliot that is used to conceptualize these motivational constructs.

Elliot and Murayama (2008) identified issues with the original version of the AGQ (Elliot & McGregor, 2001), and sought to address these issues by developing the Achievement Goal Questionnaire- Revised (AGQ-R) and subsequently examined the

structural validity of the new measure. They also discussed criticisms of achievement goal measures in general and used those criticisms to help improve their own measure. The new measure had internal consistencies greater than .80, which is higher than the original AGQ; drastic improvement was demonstrated for *performance-avoidance*, which increased from an α of .84 to .94. The authors emphasized that the four goal constructs should not be correlated unless they are measuring the same thing (goal or valence construct); specifically, *mastery-approach* and *mastery-avoidance* goals should be correlated, *performance-approach* goals and *performance-avoidance* goals should be correlated and *mastery-approach* and *performance-approach* goals should be correlated. While *mastery-avoidance* goals are assessed using both versions of this measure, they are the least well understood and studied of the achievement goals; as such they are often not addressed in the literature or assessed as frequently as the other three constructs. Despite these improvements, this measure was still only examined using a population of undergraduate college students; as such it is unclear how this will fare with young adolescents.

Over time, we can see the development of achievement goals that encompasses the differentiation between *mastery* and *performance* goals with a bifurcation to encapsulate *performance-approach* and *performance-avoidance* goals. Currently, *mastery* goals are considered those that focus on developing skills and competence, while *performance* goals focus on demonstrating competence (Elliot, 1999). *Performance-approach* goals are characterized by motivation to perform better than their peers and demonstrate competence, while *performance-avoidance* goals are characterized by motivation towards avoiding failure and appearing incompetent (Elliot, 1999). While

mastery-avoidance goals have been discussed in the paragraphs above, they are not as thoroughly addressed as the other goal orientations. Given that they are the least well understood of the goals, in addition to the fact that the construct is complicated---avoiding lack of understanding and competence--- it may be difficult for adolescents to understand and reflect upon. As such, *mastery-avoidance* goals will not be examined in this study, instead the focus will be on *mastery-approach* goals, *performance-approach* goals and *performance-avoidance* goals.

An Alternative Approach to Achievement Goal Theory: 3 x 2 Model

An alternative approach to viewing achievement goal orientations was been put forth by Elliot, Murayama and Pekrun (2011) as an attempt to extend and clarify the examination of achievement goals. This model of achievement goals uses a 3 x 2 model for goal orientation as opposed to the 2 x 2 model. In their article the authors proposed and evaluated this new model, which is composed of 6 goal constructs: task-approach, task-avoidance, self-approach, self-avoidance, other-approach and other-avoidance. Like with the 2 x 2 model for achievement goals, there are dimensions of the constructs and competence valence constructs; in this case task, self and other as opposed to mastery and performance, but the valence remained unchanged still incorporating approach and avoidance based goals. Here the authors argued for different constructs to represent task-based, other-based and self-based goals, each with their own competence evaluation. Task-based goals are focused on the demands of a specific task in terms of evaluation, specifically factors such as getting an answer correct or understanding an idea being conveyed. As such, for goals that are task-based, competence is seen in terms of doing well or poorly relative to what the task itself demands. Self-based goals are considered in

relation to one's own goals and evaluated in relation to how well or poorly that individual has done in the past or how they may be able to perform in the future (this is intrapersonal evaluation). Other-based goals are evaluated in an interpersonal fashion in which competence is determined by comparing how poorly or how well an individual performs in relation to others.

While this model of achievement goals is new to the literature and may prove to be a useful conceptualization of the theory in the future, it will not be used in the present study to examine the achievement goal orientation of adolescents. There is still much research to be done with this new alternative model to demonstrate its effectiveness in assessing achievement goals and proving as a meaningful way for conceptualizing these constructs. In addition, since this model is so new we have no way of ensuring that it will become an accepted approach to examining achievement goal orientation. As such, for the purposes of this study, achievement goals of young adolescents will be examined using the theoretical approach in which we already have a solid foundation; this will allow for a comparison of trends in the age groups and a better understanding of young adolescent's goals.

Achievement Goal Orientation and Gender Differences

Research examining achievement goals has yet to reach a consensus regarding gender differences in achievement motivation. Some researchers do not believe that gender differences exist within achievement goals because some studies report females as possessing more *mastery* goals than males and others saying females have more *performance* goals than males (or vice versa), it is really unclear whether or not there are actual differences and if so, what those differences are (Eccles, 1983; Eccles, Wigfield, &

Schiefele, 1998). Meece, Bower Glienke & Burg (2006), offer that there are no clear pattern of gender differences in achievement goals, and differences that are found are moderated by factors such as ability, race, classroom context/instructional practices and parents.

Gender differences in adults. Some researchers have found adult females to adopt higher levels of goals than males, and often specifically display *mastery* goals, (e.g., Bouffard, Boisvert, Vezau, & Larouche, 1995; Elliot & Church, 1997).

While not consistent with the findings from other studies, Harackiewicz, Barron, Carter, Lehto, and Elliot (1997) examined personality predictors of achievement goals in an undergraduate introductory psychology class and found differences in gender with regards to achievement goals. They found that females were more likely to possess *performance* goals than males.

Gender differences in young adolescents. Research on gender differences in achievement goals has also been conducted with adolescents. Ablard and Lipschultz (1998) examined the relationship between achievement and self-regulated learning, part of which included achievement goals (*mastery* and *performance*) in the context of math. Using the 1997 version of the PALS (Midgley et al., 1997), they found a gender difference in mastery goal orientation for 7th grade students, specifically that girls had higher levels of *mastery* goals than boys. However, there were no gender differences for *performance* goals.

Fitting with this trend in gender differences, similar results were also found by Meece and Holt (1993) who conducted cluster analyses to see where a group of predominantly white 5th and 6th graders would fall in terms of goals. Unlike other

findings that indicated that girls (especially in math and science) tend to have motivation patters that are not conducive to high levels of academic achievement (Dweck, 1986; Steinkamp, 1984), the authors found that more girls than boys were in the *mastery* goal focused group.

Anderman and Young (1994) examined motivation and strategy use in 6th and 7th grade science classes. The results of their study indicated that females were more learning (*mastery)* focused but also less ability focused than their male counterparts. They also found that teachers who employed more ability-focused teaching practices created an environment were students were less learning (mastery) focused. This emphasizes how influential teaching practices can be, not only on student learning, but also on motivational tendencies.

Roeser, Midgley, and Urdan (1996) examined how achievement goals and feelings of belongingness in school are related to perceptions of the school psychological environment as well as their school-related beliefs. The authors used 1997 version of the PALS (Midgley et al., 1997) as their measure of achievement goals and one of their findings indicated that boys possess more *performance goals* than girls in both 6th and 8th grade.

In their exploration of *performance-avoidance* goals Middleton and Midgley (1997) studied the role that gender, race and GPA play in the context of math within each the three goals. Using the original version of the PALS (Midgley et al., 1997), the authors found that African American girls had higher learning (*mastery)* goals than African American boys but no differences were found for European American students

Pajares, Britner, and Valiante (2000) sought to expand upon Middleton and Midgley's (1997) findings by examining the relationships between, motivation, achievement goals, past academic achievement and gender in the context of science and writing with a group of middle school students. Also using the 1997 version of the PALS (Midgley et al., 1997) as their measure of achievement goals, they found that girls had higher task (or *mastery*) goals and boys had higher *performance-approach* goals.

Pajares and Valiante (2001) examined motivational and achievement differences between middle schools boys and girls in the context of writing via the 1997 PALS measure (Midgley et al., 1997). Amongst their many finding was a gender difference in *performance-approach* goals. Using the PALS, they found that boys reported higher levels of *performance-approach* goals than their female classmates.

Despite the argument that gender differences do not exist, there is presence of literature that references gender differences in achievement goals that seem to be moderated by domain, race, classroom context/ teaching practices. Overall however, for adults there appear to be gender differences for *mastery* goals, but in adolescents we see differences for *mastery* goals as well as *performance-approach* goals. Beyond the moderating factors, these studies have also suggested that competence beliefs fall in line with gender stereotypes.

Stereotype Threat and its Impact on Gender Differences in Math

Stereotype threat is when a negative stereotype exists about a group, those who identify with that group may perceive the stereotype as a threat and fear being judged or treated stereotypically or that they may conform to the stereotype (Steele, 1997). Stereotype threat refers strictly to situational cues, which are triggered by mere

recognition that a given stereotype could apply. For example, women face negative stereotypes about their abilities in math and physical sciences. However, it is important to recognize that there is no difference in math performance for males and females throughout elementary and middle school, but then in high school males start to outperform their female counterparts. In addition, recent research has shown that the gender gap in math and science performance in secondary school has decreased significantly (in some cases are totally gone) and high school females are just as likely as males to take challenging math and science (except physics) classes in high school (National Center of Education Statistics [NCES], 2004). Regardless of the progress being made, the effects of stereotype threat are still of concern. The theory is based on the on the assumption that to experience success in school one must identify with school achievement in the sense that the individual incorporates into their self-definition which they use as a means for self-evaluation and accountability; or more simply, success is dependent on valuing your academic achievement (Steele, 1997). Individuals must feel a sense of belonging and value that particular domain; if this is not established or it damaged, achievement may suffer. Chronic exposure to stereotype threat in a given situation may result in dissidentification, which is the reconceptualization of the self and one's values so as to remove a specific domain/situation from one's self-identity; basically the individual stops caring about that domain. This dissidentification can ultimately undermine sustained motivation in that domain and subsequently result in underperformance. To make matters worse, even when the stereotype threat has been removed, the dissidentified individual will likely continue to underperform. Other negative effects of long-term exposure to negative stereotypes about a group to which an

individual belongs can lead to internalization of these stereotypes, which results in a sense of inadequacy being incorporated into their personality and may ultimately cause self-hate or rejection of one's own group.

Given that negative stereotypes regarding female's abilities in the domain of math are common it is of the utmost importance that we understand the motivational differences between males and females starting at an early age so that we can attempt to help prevent the deleterious effects of stereotype threat in math for females. In addition, by understanding the motivational gender differences in the domain of math, we can attempt to create learning environments that help females develop and foster positive perceptions of their math abilities and interest in math. Beyond what can be done in school, Meece et al.(2006) referenced many studies that demonstrated the significant influence parents have a on their children's beliefs of themselves with regards to their academic abilities (Eccles, Wigfield, & Schiefele, 1998; Jacobs 199; Jacobs & Eccles, 1992; Bleeker & Jacobs, 2004). Given this research, if we can understand motivational gender differences in students and the damages that stereotype threat can cause from these differences we can help parents see how their beliefs impact their children and how they can work to ensure they do not project beliefs that can exacerbate stereotype threats in the domain of math. Clearly, it is not a secret that negative stereotypes exist for females in the domain of math, but if we can understand the motivational gender differences that exist we can attempt to help prevent against the negative consequences of stereotype threat.

Peer Influences and Impact on Reporting of Goals

Varying responses to questions regarding goals and math may partially reflect (a) the expectations about behavior norms created by peers and (b) the social image the student wishes to project to others (Ryan, 2001; Younger, Warrington & Williams, 2000; Nelson & DeBacker, 2008). For example, research has found that feeling peer pressure in relation to school involvement is related to student attitudes and behaviors. Further, boys and girls may pressure their peers in different ways (Ryan, 2001; Younger, Warrington & Williams 2000).

Younger, Warrington and Williams (2000) found that males and females differ with regards to their desired social image; males seek to have a uniform "macho" image that provides them with a good reputation for standing up for themselves, being assertive and noticed by all. Females on the other hand strive for two different social images; they want to be "cool" outside of school yet seen as hard-working and diligent individuals while in school. These desired social images may be reflective of and individual's peer group; students seem to be highly influenced by their peers.

Research has shown that students tend to engage in homophily, that is "the tendency of individuals to affiliate with others who are similar on various attributes" (Ryan, 2001). However, this homophily does not protect adolescents from peer pressure. Adolescents indicate that they experience peer pressure with regards to involvement in school and these pressures are significantly correlated to individuals' behavior and attitudes towards school (Brown, Clasen, & Eicher, 1986 as cited in Ryan, 2001, p. 1136). Therefore, students may alter their opinions and what they have to say about their

achievement goal orientation and math based on who is present when asked based on the social image they are striving to project.

In particular, peer climate may be influential in the achievement goal orientations that students report. Younger, Warrington and Williams (2000) conducted a three-year study in England of gender gaps in all subjects areas found that students have perceptions of their peers related to how they engage in schoolwork. For example, they found that both males and females believe that female students generally put more effort into their school work and that work is less of a priority for males. Male students believed their female counterparts have a stronger work ethic, are more involved and interested in school, better organized, more self-motivated and more conscientious. Female students believed that male students work less because they possess an innate ability for the subject, yet they saw themselves as caring more about school and taking their work more seriously. Female students also believed that for male students, if the material was too difficult they would stop, not worry about it again and tended to blame others (e.g. teachers) for their failures. And lastly, while competition motivates male students they withdraw from competition in order to avoid being seen failing. As we can see, student perceptions foster a peer climate that can influence how students choose to approach schoolwork. Clearly some of these factors can impact one's achievement goals; for example, avoiding being seen as failing is characteristic of *performance-avoidance* goals. These differences in perceptions of student behavior and intentions could emerge differently based on who is present when students are discussing these issues in order to fill perceived social roles.

It is not surprising that during young adolescence, peers are extremely influential. Clearly we can see that perceptions of peers and perceived social images can impact how one behaves and thinks. Due to peer influences such as desired social image, expectations of behavioral norms and/or comfort or competition felt around other boys or girls it is likely that based on whether other boys or girls are present, students may report different achievement goals and different opinions about math.

Context of the Study

SERP-MSAN. The Minority Student Achievement Network (MSAN) was created by a set of inner-ring suburban districts that have witnessed widening achievement gaps as their schools have become more diverse. The 25 participating districts have long been committed to narrowing this gap, and to improving college-going rates for their minority students. They sought out the involvement of the research community to inform their efforts.

The Strategic Education Research Partnership (SERP), an independent, non-profit organization incubated at the National Academy of Sciences, was established with a mission to conduct education research and development in "Pasteur's Quadrant" (Stokes, 1997), where new knowledge is generated in the interest of solving important problems of practice. The SERP work is carried out in "field sites" where partnerships between school districts and interdisciplinary research and design teams are created, nurtured, and sustained. MSAN requested that it be considered a SERP partner organization and SERP chose a subset of the MSAN districts to collectively become a field site. Currently this field site includes five districts which are participants in the present study: Evanston,

Illinois; Madison, Wisconsin; Arlington, Virginia; Ann Arbor, Michigan; and Shaker Heights, Ohio.

The MSAN partnership districts have sizable minority populations, ranging from 47% to 58% of the school population. Like many districts around the nation, they share the goal of introducing Algebra I earlier (in middle school) and raising the number of students who take a sequence of higher-level mathematics courses in high school. While the districts have made progress on these goals, they are struggling to reduce the disproportionate number of African American and Latino students who either fail middle school algebra, or are not on track to take the course until later. In the context of the field site partnership, the MSAN districts are working with SERP-recruited researchers to address the algebra achievement challenge.

The larger study. In the overarching project in which this study was based, two best practices with abundant support from the field of cognitive science are introduced into alternate versions of student assignments: Worked examples and self-explanation prompts. In a worked example, students are simply asked to study a problem solution rather than solve a problem on their own; positive effects of providing students with worked examples to study as well as problems to solve own their own, have been reported in a variety of contexts (Clark & Mayer, 2003), including Algebra (Sweller & Cooper, 1985). Self-explanation is, simply put, explaining information to oneself as one reads or attempts to learn; students who are prompted to self-explain while reading learn more than those who do not self-explain (Chi, deLeeuw, Chiu, & LaVancher, 1994).

Students also complete pretest and posttest measures composed of procedural and conceptual items that addressed the algebra content covered in the assignments.

Procedural knowledge is defined as the ability to carry out a series of actions in order to solve a problem (Hiebert, 1986; Rittle-Johnson, Siegler, & Alibali, 2001). Conceptual knowledge, on the other hand, is "an integrated and functional grasp of mathematical ideas" (National Research Council, 2001, p. 118). Consistent with this and other research on learning in mathematics, we view conceptual knowledge as recognizing and understanding the important principles of a domain as well as interrelations or connections between different pieces of knowledge in the domain (Carpenter, Franke, Jacobs, Fennema, & Empsom, 1998; Hiebert & Wearne, 1996; Rittle-Johnson & Star, 2007).

Pilot study. While it is likely that the effect of all of the practices used in this study (correct and incorrect examples and self-explanation prompts) may vary for students with different cognitive backgrounds (e.g., Grosse & Renkl, 2007), it stands to reason that students with different motivational backgrounds may receive varied benefit from these exercises as well, especially when gender is taken into consideration. For instance, a pilot study was conducted to examine which components of student motivation (achievement goals, enjoyment, and perceived competence) independently predict improvement in conceptual and procedural knowledge of algebra. It also aims to determine if those independent predictors vary for students who receive typical classroom assignments (i.e., consisting of problems to solve) compared with example-based assignments that incorporate correct and incorrect examples with prompts for self-explanation.

Participants in this study were 436 non-honors Algebra I students from school districts with a high proportion of minority students. Studies were conducted in a typical

course setting, with all testing done as part of normal classroom activities and all study activities administered as classroom assignments. Within the districts, 16 teachers and 26 classes participated in the study. Each class participated during one content unit (pre-algebra skills, linear equations, graphing, or quadratic equations). Prior to completing the study, students completed a motivation survey and then a math pretest for that content area that examined both their procedural and conceptual knowledge for the content area. After completing the pretest, the teacher proceeded with their lessons as usual. Within each class, students were randomly assigned to receive one of two types of in-class assignments. On the example-based assignments designed for this study, half of the items were correct or incorrect worked examples with prompts for students to explain what was shown in the example; the other half of the items were problems for students to solve. The control assignments contained the same number of items, but all were problems for students to solve on their own. When all lessons in the unit were finished, students completed the motivation survey again as well as a posttest for the math content area.

Student motivation was assessed using a pretest survey using task-specific variants of brief, but well-established measures in the achievement motivation literature: Perceived competence (Elliot & Church, 1997), interest (Elliot & Harackiewicz, 1996), and mastery, performance-approach, and performance-avoidance goals (Pekrun, Elliot, & Maier, 2006). Sample items for each measure can be found in Table 2. Scores for each of the Likert-type scale motivation measures were computed according to the guidelines set forth by Elliot and colleagues (Elliot & Church, 1997; Elliot & Harackiewicz, 1996; Pekrun et al., 2006).

The results of this study supported the notion that *mastery* goals are helpful for learning, in our case with both traditional and example-based assignments (Oyer, Booth, & Elliot, 2012). *Performance-approach* goals, however, may be more detrimental for students when attempting to learn with our example-based exercises, which, by their very nature, require deep thinking. Students likely cannot benefit fully from the examples without putting in effort towards learning. Interestingly, initial enjoyment of mathematics, while important for learning with traditional assignments, appears to be less of a concern with the example-based assignments. It is thus possible that the engaging nature of our exercises allowed students to succeed without necessarily enjoying the math content. In terms of gender, typically adult and adolescent females report higher levels of *mastery* goals, which have associated with interest and adolescent males report higher levels of *performance-approach* goals than females; as such, it would be expected that females demonstrate higher levels of *mastery* goals (and interest due to their connections) and males higher levels of *performance-approach* goals. However, when considering these results it is imperative to bear in mind that student feedback on the motivation measure suggests that the students did not fully understand what the questions were asking. Students reported that the many, if not all, of the questions were asking the same thing. While certain items are measuring the same goals and items from a scale do ask similar things, there as concern that the students were missing the differences between the items. As such, this lack of discrepancy between the measure's items may lead to an inaccurate representation of these students' motivation, which is the impetus for the present study. The measure used to examine achievement goals in this case was the Achievement Goal Questionnaire-Revised (AGQ-R) (Elliot & Murayama, 2008). While

this measure has been widely used, one potential issue with it is that its validity and reliability have not been examined with young adolescents. That said if students complete a measure like the AGQ-R and the PALS (Midgley et al., 2000) (which was intended for adolescents) we can begin to understand how a measure more widely used amongst adults compares to one designed for young adolescents.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

Participants

Participating in this study were 147 seventh, eighth and ninth grade non-honors Algebra I students (82 girls and 65 boys) from three schools and eight classrooms within the same school district on the east cost of the United States of America. All of the schools were part of a school district with a high proportion of minority students and a high proportion of low SES students and are comparable in terms of minority status and SES. Participating classrooms had a racial population representative of the district as a whole (American Indian/ Alaskan Native: 2%; Asian: 6.8%; Black/ African American: 5.4%; Hispanic: 15.5%; Native Hawaiian/ Other Pacific Islander: 0%; White: 64.9%; Multiple: 5.4%). The study was conducted in a typical class setting, with all testing done as part of normal classroom activities and all study activities administered as classroom assignments. The classes completed the study materials related to polynomials and factoring, a content unit typically covered as part Algebra I curriculum.

The school district's math coordinator recruited participating classrooms. The classroom teachers were individuals who expressed interest in participating in the larger project surrounding this study, but were not eligible due to factors such as class schedule. The overall study was approved by the IRB as exempt, as all of the activities associated with this study were part of what would normally happen in their classroom and focus groups were anonymous. Thus, parental consent was not required.

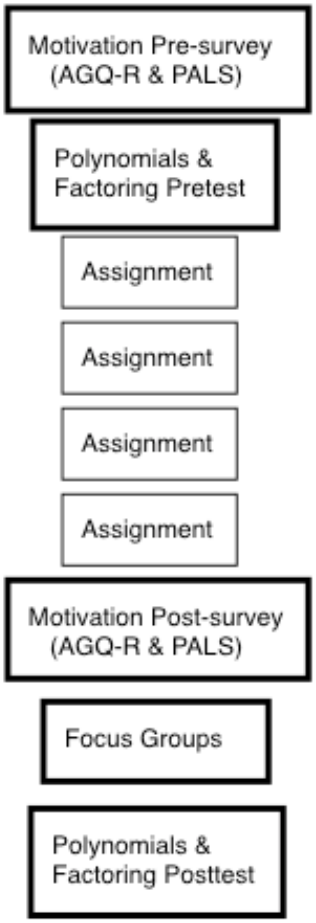
Design

Prior to completing the study materials for each content area, students completed a survey evaluating their motivation regarding math as well as a pretest that examined both their procedural and conceptual knowledge for the content area. After completing the pre-survey and pretest, the teachers proceeded with their lessons as usual. Each class completed four example-based assignments designed for this study. Half of the items on the assignments were correctly or incorrectly worked examples with prompts for students to explain what was shown in the example and the other half were problems for the students to solve on their own. The teachers gave these assignment to their students as they deemed appropriate; either immediately after instruction, as a warm-up during the next class or review a few days after instruction. When all lessons in the unit were finished, students again completed the student motivation survey. On a day following the completion of the post-survey measure, groups of four students from the same class period participated in focus groups led by a graduate student researcher; groups were either composed of four males, four females, or two males and two females. All of focus groups were conducted by the same graduate student researcher and held during class time. A total of eighteen groups were conducted: five all-male groups, six all-female groups, and seven mixed-sex groups. Participants for each of the focus groups were chosen at random. Any student who wished to participate in the focus groups put his/her study ID number on a piece of paper and a drawing happened in class; almost every single student entered his/her name. Once a student participated in a focus group he/she could not participate in a second focus group. The students selected to participate moved to a quiet room with the graduate student researcher to engage in conversation and

answer questions related to algebra class and the study materials. On the day following the focus groups, students completed the posttest. Surveys were completed before the focus groups so that discussions from the focus groups could not influence survey responses and the post-test followed the focus groups so that perceived performance on the test would not impact responses on the survey or during the focus groups. Figure 3.1 details the sequence of the study related activities. Everything in bold is the part of the present study and the non-bolded boxes represent aspects of the larger study within with this study was situated.

Figure 3.1.

Sequence of Study Related Activities



Measures

Algebra Content Assessments. The algebra pretests and posttests were composed of items that address the algebra content covered in the assignments. Sample items from the polynomials and factoring assessment can be found in Appendix A. To calculate a score for the pretest and posttest variables, students earned 1 point for each correct response provided; there was no penalty for incorrect response or not responding.

Student Motivation Survey. The survey, which was used at pretest and posttest to assess student motivation, was comprised of two existing measures, the Patterns of Adaptive Learning Scales (PALS) (Midgley et al., 2000) and the Achievement Goal Questionnaire–Revised (AGQ-R) (Elliot & Murayama, 2008). The PALS has been shown to be reliable (Cronbach's alpha of .85 (mastery), .89 (performance-avoidance) and .74 (performance-avoidance)) and valid (confirmatory factor analysis demonstrated that each goal loads on a different latent factor) (Midgley et al., 2000). The AGQ-R has been shown to be reliable (Cronbach's alpha > .80) and to be structurally valid (Elliot & Murayama, 2008). All of the questions employed a 5-point Likert scale, with 1 representing "not at all true" and 7 representing "very true". Scores for each of the Likert-type scale motivation measures were computed according to the guidelines set forth by Midgley and colleagues (Midgley et al., 2000) and Elliot and Murayama (2008), which can be found below in Table 3.1 and Table 3.2 respectively, as well as the interaction terms required to examine the effects of gender difference on motivation and the specific questions for each construct. The full measure can be found in Appendix B.

Table 3.1. Survey Items and Scoring Guidelines for Each Construct on the PALS

PALS	**Mastery Goals** Mean of these five items.	1. It's important to me that I learn a lot of new concepts in this course. 7. It's important to me that I improve my skills in algebra this semester. 13. One of my goals in this course is to learn as much as I can. 19. One of my goals is to master a lot of new skills in this course. 21. It's important to me that I thoroughly understand my coursework in this class.
	Performance-Approach Goals Mean of these five items.	3. One of my goals is to show others that I'm good at my coursework in this class. 8. It's important to me that I look smart compared to others in this class. 14. One of my goals is to show others that this course is easy for me. 18. It's important to me that other students in this class think I am good at my class work. 22. One of my goals is to look smart in comparison to the other students in this class.
	Performance-Avoidance Goals Mean of these four items.	4. One of my goals is to keep others from thinking I'm not smart in this class. 10. It's important to me that I don't look stupid in this class. 11. One of my goals in this class is to avoid looking like I have trouble doing the work 16. It's important to me that my teacher doesn't think that I know less than others in this class.
	Gender x Mastery Goals	Gender (1 = Male, 2 = Female) x Mastery Goal Score

Table 3.1, continued

	Gender x Performance-Approach Goals	Gender (1 = Male, 2 = Female) x Performance-Approach Goal Score
	Gender x Performance-Avoidance Goals	Gender (1 = Male, 2 = Female) x Performance-Avoidance Goal Score

Table 3.2. Survey Items and Scoring Guidelines for Each Construct on the AGQ-R

AGQ-R	**Mastery Goals** Mean of these 3 items.	2. My goal to learn as much algebra as possible. 17. I am striving to understand the content of this algebra course as thoroughly as possible. 23. My aim is to completely master the material presented in this class.
	Performance- Approach Goals Mean of these 3 items.	5. My goal is to perform better than other students. 9. My aim is to perform well relative to other students. 15. I am striving to do well compared to other students.
	Performance-Avoidance Goals Mean of these 3 items.	6. My goal is to avoid performing poorly compared to others. 12. My aim is to avoid doing worse than other students. 20. I am striving to avoid performing worse than others.
	Gender x Mastery Goals	Gender (1 = Male, 2 = Female) x Mastery Goal Score
	Gender x Performance-Approach Goals	Gender (1 = Male, 2 = Female) x Performance-Approach Goal Score
	Gender x Performance-Avoidance Goals	Gender (1 = Male, 2 = Female) x Performance-Avoidance Goal Score

Focus groups. The focus groups were conducted after the completion of the content block, and post-survey, but before the posttest. These were conducted based on the protocol that can be found in Appendix C. See Table 3.3 below for details regarding how the responses were coded. The data from the groups were double coded (38.8%) for reliability purposes. Both coders discussed any discrepancies until a consensus was reached.

Table 3.3. Focus Group Questions and Coding

Question	Coding
1. Tell me how you feel or what you think about math.	Frequency counts of the following terms: - Enjoy - Fun - Dislike - Boring - Easy - Hard Plus anecdotal information
2. Tell me how you feel or what you think about participating in our study.	Frequency counts of the following terms: - Fun - Enjoy - Boring - Neutral - Different than typical class work - Cool participating in research - Easy - Hard - Annoying Plus anecdotal information
1. Did you enjoy completing the SERP study assignments?	Yes No Both
2. Did you enjoy the SERP study assignments more than other classroom practice problems?	Yes No Both Plus anecdotal information
3. Do you think you learned better from the SERP study assignments than other classroom practice problems?	Yes No Both Plus anecdotal information

Table 3.3, continued

4. Do you think the SERP study assignments helped you understand the lessons more than classroom practice problems?	Yes No Both Plus anecdotal information
5. Do you think the SERP study assignments prepared you better for the test than other classroom practice problems?	Yes No Both Plus anecdotal information
6. Was it more important for you to answer the SERP study problems correctly than other classroom practice problems? Why?	Yes No Both Plus anecdotal information
7. What are your goals for math class?	Frequency counts of the following: - Mastering material - Understanding - Learn—As much as I can, learn new skills - Getting a good grade - Getting an A - Passing - Move up level - Not fail Plus anecdotal information
8. Are you trying to avoid anything specific in math class? If so, what?	Frequency counts of the following: - Looking stupid - Incompetent/ Looking bad - Avoid looking worse than others - Failing - Getting a bad grade Plus anecdotal information
9. Are you trying to achieve anything specific in math? If so, what?	Frequency counts of the following: - Looking good - Competent - Smart - Perform better than others - Passing - Getting a good grade - Getting an A - Understanding/Knowledge - Improving - Move up level - Not fail Plus anecdotal information

Table 3.3, continued

Gender x Mastery Goals	Gender (1 = Male, 2 = Female) x Mastery Goal Terms
Gender x Performance- Approach Goals	Gender (1 = Male, 2 = Female) x Performance-Approach Goal Terms
Gender x Performance-Avoid Goals	Gender (1 = Male, 2 = Female) x Performance-Avoid Goal Terms

CHAPTER 4

RESULTS

The primary purpose of this study was to examine gender differences in achievement goals in the context of example-based algebra learning. The main dependent variables of interest included: student responses to survey items, student responses during focus groups, and student performance on the related algebra assessment. Descriptive statistics for the variables of interest are provided in Table 4.1; intercorrelations among the variables are presented in Table 4.2.

Table 4.1. Means and Standard Deviations of all Variables of Interest

	Mean	Standard Deviation
Pretest Average	.33	1.04
Pre AGQ-R Mastery Goals	4.13	.77
Pre PALS Mastery Goals	4.23	.72
Pre AGQ-R Performance-Approach Goals	3.39	.85
Pre PALS Performance-Approach Goals	3.04	.93
Pre AGQ-R Performance-Avoidance Goals	3.27	1.04
Pre PALS Performance-Avoidance Goals	3.03	1.01
Posttest Average	.58	.17

Table 4.2. Intercorrelations Among all Variables of Interest

	Pretest Average	Pre AGQ-R Mastery Goals	Pre PALS Mastery Goals	Pre AGQ-R Performance -Approach Goals	Pre PALS Performance -Approach Goals	Pre AGQ-R Performance-Avoidance Goals	Pre PALS Performance -Avoidance Goals	Posttest Average
Pretest Average	1	.177*	.174*	-.045	.066	.028	.048	.212**
Pre AGQ-R Mastery Goals	.177*	1	.850**	.22**	.243**	.155*	.126	.175*
Pre PALS Mastery Goals	.174*	.850**	1	.175*	.241**	.115	.078	.179*
Pre AGQ-R Performance -Approach Goals	-.045	.22**	.175*	1	.657**	.650**	.507**	-.034
Pre PALS Performance -Approach Goals	.066	.243**	.241**	.657**	1	.538**	.683*	.013
Pre AGQ-R Performance-Avoidance Goals	.028	.165*	.115	.650**	.538**	1	.491**	-.026
Pre PALS Performance-Avoidance Goals	.048	.126	.078	.507**	.683**	.491**	1	.023
Posttest Average	.212**	.175*	.179*	-.034	.013	-.026	.023	1

* $p < 0.05$;** $p < 0.01$.

Since two of the three teachers that participated in this study had previously participated in another SERP AlgebraByExample study and one had not, a univariate ANOVA was conducted to compare student survey responses and math assessment performance between the three teachers. The means for each motivation construct and math pretest performance for each teacher are presented below in Table 4.3, and the ANOVA statistics are below in Table 4.4. The only significant difference that emerged was on pretest math scores. A follow-up post-hoc independent sample t-test with

Bonferroni correction indicated that the significant difference was between the two veteran teachers ($p < .05$). Thus, there is no reason to expect that the students in the novice teacher's class were at a disadvantage in the study.

Table 4.3. Teacher Means for Survey Constructs and Assessment Performance

	Teacher 1	Teacher 2	Teacher 3	Total
Pretest Average	.337	.310	.363	.329
Pre AGQ-R Mastery Goals	4.15	4.12	4.16	4.14
Pre PALS Mastery Goals	4.47	4.16	4.30	4.23
Pre AGQ-R Performance-Approach Goals	3.37	3.35	3.45	3.39
Pre PALS Performance-Approach Goals	3.33	2.99	3.07	3.04
Pre AGQ-R Performance-Avoidance Goals	2.89	3.34	3.20	3.27
Pre PALS Performance-Avoidance Goals	3.64	3.03	2.92	3.03

Note: Teachers 2 and 3 were veteran teachers.

Table 4.4. Univariate ANOVA Between Group Statistics

	df	*F*	η^2	*p*
Pretest Average	2	4.264	.056	.016*
Pre AGQ-R Mastery Goals	2	.042	.001	.959
Pre PALS Mastery Goals	2	1.120	.015	.329
Pre AGQ-R Performance-Approach Goals	2	.203	.003	.816
Pre PALS Performance-Approach Goals	2	.588	.008	.557
Pre AGQ-R Performance-Avoidance Goals	2	.927	.013	.398
Pre PALS Performance-Avoidance Goals	2	1.944	.026	.147

* $p < 0.05$;** $p < 0.01$.

Are there differences in achievement goals between males and females?

Prior studies with adults have shown that females tend have more mastery goals than males (e.g., Bouffard, Boisvert, Vezau, & Larouche, 1995; Elliot & Church, 1997). In addition, prior research conducted with adolescents has also found females to have more *mastery* goals than males (Ablard & Lipschultz, 1998; Meece & Holt, 1993) but also that males have more *performance-approach* goals than females (Roeser, Midgley, & Urdan, 1996; Middleton & Midgley, 1997; Pajares, Britner, & Valiante, 2000; Pajares & Valiante, 2001). In order to replicate these findings, responses to the motivation survey were collected and a series of three multivariate analyses of variance (MANOVAs) were conducted with gender as the independent variable and students' achievement goal scores from the two surveys as the dependent variables; one analysis was conducted for each of the three types of goals. The results indicated that there was a statistically significant multivariate effect of gender on *mastery* goals, $F(6,140)= 2.30$, $p< .05$, $\eta_p^2 = .09$; univariate ANOVAs confirmed that females had higher *mastery* scores than males on both the AGQ-R ($F(1,145 = 7.408$, $p < .01$, $\eta_p^2 = .049$) and the PALS ($F(1,145 = 4.129$, $p < .05$, $\eta_p^2 = .028$). There were no significant multivariate effects between males and females for *performance-approach* (AGQ-R $F(1, .145= .196$, $p =.659$; PALS $F(1, 145= .815$, $p =.368$) or *performance-avoidance* goals (AGQ-R $F(1, 145) = . 379$, $p = .539$; PALS $F(1, 145) = .262$, $p = .610$). See Table 4.5 below for full details of group means.

Table 4.5. Means for Male and Female Responses on the AGQ-R and the PALS

		Mastery Goals	Performance-Approach Goals	Performance-Avoidance Goals
AGQ-R	Male	3.95	3.42	3.21
	Female	4.29	3.36	3.32
PALS	Male	4.10	2.96	3.08
	Female	4.33	3.10	2.99

Do males and females respond differently to questions about their achievement goals in single- versus mixed sex groups?

In order to analyze the data from the focus groups, responses provided by the students were quantitatively coded (as detailed in the methods section) based on discrete responses (affirmative or negative) provided to the questions; frequency counts of key concepts and phrases were calculated for items that did not have a simple yes/no response. Additional information provided by the students was used as anecdotal descriptors to aid in the interpretation of the quantitative information. To examine if male and females respond differently to questions about their achievement goals in single versus mixed-sex groups, first an Independent-Samples Mann-Whitney U-test was conducted. The results indicated that there was a difference in distribution of responses between the groups for five response categories within three different questions: yes response for the question "Did you enjoy the SERP study assignments more than other classroom practice problems?" ($p < .05$); yes and both response categories for the question "Do you think you learned better from the SERP study assignments than other classroom practice problems?" ($ps < .05$); and both good grades and getting an A response categories for the question "What are your goals for math class?" ($ps < .05$). To examine the nature of the differences in distribution, follow-up nonparametric, independent samples tests on group composition were then conducted separately for males and females on just those items that were found to have a significant difference in distribution of responses. The results indicated that males responded differently in same- versus mixed-sex groups regarding their goals for math; specifically, males reported wanting to earn good grades in math when in a mixed-sex group, but mentioned wanting

to earn an A when just around their male peers. A difference in reporting was also found for females in same- versus mixed-sex groups regarding which assignments they felt they learned more from; specifically, when in female only groups, females reported that the learned more from the SERP study assignments than their typical classroom practice problems. While these trends do not align with the differences found in achievement goals based on the survey measure, they do indicate that males and females respond differently to questions about their motivation based on whom they are with.

How are gender differences in achievement goals related to learning?

In order to examine how achievement goals on each of the measures impacted learning, a series of partial correlations were conducted between each of the achievement goals scores on each measure and posttest math performance, controlling for pretest math performance. The results indicated that *mastery* goals on both the AGQ-R and the PALS marginally impacted learning while performance-approach and *performance-avoidance* goals did not impact learning at all. See Table 4.6 below.

Table 4.6. Partial Correlations Between Motivation Scores on the AGQ-R and the PALS

	Mastery Goals	Performance-Approach Goals	Performance-Avoidance Goals
AGQ-R	r = .143	r = -.025	r = -.032
	p = .085	p = .761	p = .698
PALS	r = .148	r = -.001	r = .013
	p = .075	p = .995	p = .875

Does that vary based on measurement tool?

As previously noted, the results of a series of partial correlations indicated that *mastery* goals were marginally related to learning while *performance-approach* and *performance-avoidance* goals were not related to learning at all. Since *performance-approach* and *performance-avoidance* were not related to learning, they were not examined further. To determine whether one measure of mastery goals was more related to learning than the other (PALS or AGQ-R), posttest math scores were regressed on *mastery* goals on both measures, controlling for pretest math scores. When both variables were included in the model, neither contributed a significant amount of variance. (AGQ-R $\beta = .062$, $p = .686$; PALS $\beta = .094$, $p = .541$), suggesting that while both may be related to learning independently, they are both explaining the same variance, and neither was more related to learning than the other

Because the two measures seemed to be capturing the same variance, further examination of the relationship between the achievement goal constructs on the AGQ-R and the PALS was undertaken. A series of Pearson product-moment correlations were conducted between the PALS and AGQ-R scores on the achievement goal constructs. The analyses indicated that there is a significant correlation between the same constructs on the AGQ-R and the PALS for *mastery* goals ($r= .850, p <.01$), *performance-approach* goals ($r=.657, p <.01$), *performance-avoidance* goals ($r= .491, p <.01$). As such, the AGQ-R and the PALS appeared to be consistent representations of students' achievement goals. Furthermore, these results demonstrated that even though the AGQ-R was originally intended for use with adults, it is a valid means for assessing achievement goals in young adolescents.

CHAPTER 5

DISCUSSION

There are many factors that can influence students achievement goals and they way they report these goals (parental influences (Eccles, Wigfield, & Schiefele, 1998; Jacobs & Eccles, 2002; Bleeker & Jacobs, 2004; Jacobs 2004), school influences (Meece, Blumenfled, & Hoyle 1988; Anderman & Young, 1994; Madon, Jussim, Keiper, Eccles, Smith, & Palumbo, 1998; Meece, Bower Glienke and Burg, 2006), sociocultural influences (Collins, 1998; Weiler, 2000; Meece and Kurtz-Costes, 2001), stereotype threat (Steele, 1997) and peer influences (Younger, Warrington & Williams, 2000; Ryan, 2001; Nelson & DeBacker, 2008). The results of the present study replicate some of the existing literature regarding young adolescents and adult's achievement goals but not all. Previous literature has identified adult females as having higher *mastery* goals than adult males and that adult females also possess higher levels of goals than males (e.g. Bouffard, Boisvert, Vezau, & Larouche, 1995; Elliot & Church, 1997). In addition, previous research has identified adolescent males as having higher levels of *performance-approach* goals than females (Roeser, Midgley, & Urdan, 1996; Middleton & Midgley, 1997; Pajares, Britner, & Valiante, 2000; Pajares & Valiante, 2001). While results from the achievement goal survey measure in this study indicated that the same pattern of gender differences were present for *mastery* goals, with young adolescent females as having more *mastery* goals than adolescent males (same pattern as adults), gender differences were not found for *performance-approach* or *performance-avoidance* goals at all.

The absence of gender differences for *performance-approach* goals overall, but especially on the PALS, is of great interest. All of the past research previously cited that identified males as being more *performance-approach* oriented than females were conducted using the 1997 version of the PALS (Midgley et al., 1997). Further research should continue to examine how achievement goals are related to learning as well as explore the discrepancy in expression of *performance-approach* gender difference between past literature and the current version of the PALS and AGQ-R.

Despite the lack of gender differences for *performance-approach* and *performance-avoidance* goals on the achievement goal survey measure, when asked during the focus groups about their goals for math class, males identified getting good grades or getting an A as two of their goals significantly more often than their female counterparts. This focus on earning good grades or an A is characteristic of *performance-approach* goals (Elliot, 1999) (or maybe extrinsic goals), thus focus group results are more consistent than survey results with the past literature suggesting that adolescent males are more performance oriented than females (Roeser, Midgley, & Urdan, 1996; Middleton & Midgley, 1997; Pajares, Britner, & Valiante, 2000; Pajares & Valiante, 2001). Specifically, males reported that they are trying to earn good grades at a higher frequency when in a mixed-sex group and that they wanted to earn an A when only in the presence of other males. Research has demonstrated that the ways in which students act or respond reflects (a) the expectations about behavior norms created by peers and (b) the social image the student wishes to project to others (Ryan, 2001; Younger, Warrington & Williams, 2000; Nelson & DeBacker, 2008). That said, the difference in reporting during the focus groups could be reflective of the desired social image that male students wish to

project. By saying that they are striving to earn an A, males project the image that math is extremely important to them and that they are very academically focused, but this may not be what young adolescent males want their female counterparts to see. Instead by saying they want to earn good grades in math, they demonstrate the same notion that school is important but the notion of good grades is ambiguous and allows for a wider range of social images. Then, when with members of the same sex, the male students are striving to portray a different social image and therefore are more ready to say they want to earn an A.

Females, on the other hand, responded differently to the question "Do you think you learned better from the SERP study assignments than other classroom practice problems?" when in same- versus mixed-sex groups. Specifically, when in a single-sex group, females reported at a higher frequency that they learned more from SERP assignments than typical classroom assignments. This difference in reporting may stem from the fact that young adolescent girls are more friendly with other female students than male students and as a result may feel more comfortable saying something that goes against what their teacher normally do in this setting. Taking these findings into consideration, it is evident that males and females do respond differently to questions about achievement goals in single- versus mixed-sex groups. An additional twist is that the differences in male reporting also highlights a difference in representation of achievement goals when using a survey versus conducting a focus group. While the survey yielded no gender differences for either type of *performance* goal, the contents of the focus groups tell a different story. One might assume that this difference in reporting of goals between the focus group and the survey is because focus groups allow for

students to be influenced by their peers. While taking the survey the students may have a very targeted and specific idea that leads to their response, but in the focus group they are exposed to what their classmates have to say, which may ultimately influence how they feel or interpret their thoughts on the given topic. It is widely accepted that adolescents are extremely susceptible to their peers, peer pressure and the desire for acceptance (Ryan, 2001; Younger, Warrington & Williams, 2000; Brown, Clasen, & Eicher, 1986 as cited in Ryan, 2001, p. 1136; Nelson & DeBacker, 2008). Thus, it is possible that students provided different information in the focus group than on their surveys due to the pressure associate with peer presence. However, another possibility is that the structural difference between the survey and the focus group allowed for a difference in responding. For instance, the rigid and structured nature of the surveys may not fully capture the students' thoughts about their math goals the way that more open-ended focus groups or interviews could. Because the focus group participants were anonymous, we are not able to determine in the present study whether individual students' responses differed between focus groups and surveys. Future studies should collect data in a way such that it is possible to match responses from the different data collection methods. In particular, it would be interesting to see if *performance-approach* goals are differentially expressed in a focus group versus on a survey for the same individual. Future research should also explore the lack of gender differences in young adolescents *for performance-approach* goals, especially on the PALS. It is interesting that when using the 1997 version of the PALS, a plethora of studies found that adolescent males have more *performance-approach* goals than females in the domains of math (Middleton & Midgley, 1997; Ablard & Lipschultz, 1998) writing (Pajares & Valiante, 2001), writing

and science (Pajares, Britner & Valiante, 2000) and psychological and behavioral functioning (Roeser, Midgley & Urdan, 1996) but that no such difference emerged in this study using the 2000 version. It is possible that the elimination of specific behaviors, removal of emotion and references to grades on the revised version of the measure (or some other alteration) decreased measure sensitivity for gender differences. Since the changes on the 2000 version decreased the emphasis on specific behaviors, removed all emotion and references to grades, student interpretation of the items may have been altered.

It is noteworthy that during the focus groups when students were asked what, if anything, they were avoiding in math class, there was a great deal of confusion and misunderstanding. In many cases students asked what was meant by "avoid" and common responses to the question were about certain mathematical content areas or math skills, doing homework or taking tests. However, some students did report things such as avoiding being called on if they do not know the answer to a problem or avoiding showing their work on the board in front if the class, but these types of responses were much more scarce. This might suggest that working towards trying to avoid something is not something students at this age are developmentally attuned to---this is a rather abstract notion and the students in the study appeared to be more concerned with concrete and tangible notions such as homework, formulas and tests. While Piaget argued that students of this age were capable of abstract, formal reasoning (e.g., Inhelder & Piaget, 1958), Roberge and Flexer (1979) demonstrated that, in reality, only approximately half of the 8th grade students they tested could truly be classified into the formal operations stage.

Results from the presented study indicated that there was a gender difference in *mastery* goals, but this difference was not related to math learning. Given that past research has indicated that achievement goals can impact learning in general (e.g., Dweck, 1986; Ames & Archer, 1988; Nicholls, Cheung, Lauer, & Patashnick, 1989; Nolen & Haladyna, 1990; Elliot & Harackiewicz, 1996; Wolters, Yu, & Pintrich, 1996), one would also expect to find that there is a relationship between goals and math learning, independent of gender. However, this examination did not yield results that were any more interesting. *Mastery* goals were only marginally related to math learning while *performance-approach* and *performance-avoidance* goals had no relationship. When we examined further, we found that neither *mastery* goals as measured on the PALS or AGQ-R were more related to math learning. These findings are surprising given that previous literature has indicated that, *mastery* goals are conducive to learning (Ames & Archer, 1988; Nicholls, Cheung, Lauer, & Patashnick, 1989; Nolen & Haladyna, 1990) *performance-approach* goals are also beneficial (though not to the same degree as mastery goals) (Wolters, Yu, & Pintrich, 1996) and *performance-avoidance* goals are detrimental to learning since they undermine intrinsic motivation (Elliot & Harackiewicz, 1996). None of these associations were borne out in our sample.

Given the fact that there was a significant correlation between the same constructs (*mastery* goals, *performance-approach* goals and *performance-avoidance* goals) from the different survey measures (the AGQ-R and the PALS) we can conclude that they are consistent representations of students' achievement goals. It appears that the past student feedback was misleading. While there was concern that the students did not fully understand what the questions were asking them (on the AGQ-R) because they

spontaneously reported believing that all of the questions were asking the same thing, it does not appear that this prevented them from understanding and being able to answer the questions. In fact the results indicate that the survey questions designed for adults and ones designed for adolescents elicit the same responses. As such, while not originally designed for use, or validated, with young adolescents, the results suggest that the AGQ-R is a valid measure of assessing achievement goals with this population.

Limitations and Further Research

One limitation of this study is that all of the data was collected from students in a single school district. While this is a diverse district and participating classrooms came from three different schools, we cannot necessarily generalize the finding to all districts across the country. For example, it is possible that we would not find gender differences for *mastery* goals for students attending a highly specialized magnet school or participating in a gifted classroom since the motivation for their placement is selective. Additionally, more gender differences may be found in highly affluent communities that highly emphasize education, but fewer or no gender differences may be present in low SES communities where school and academics are not as highly valued. Results from the present study, however, should be generalizable to other districts that participate in SERP-MSAN research, since these districts need to meet certain requirements for membership.

Another limitation of this study, especially considering the difference in findings regarding *performance* goals, is that the survey measures makes no explicit mention of grades, which is something that males reported a lot (earning good ones or an A) in the focus groups. While the survey measures do reference performance, this is not an explicit

means for asking about or eliciting information regarding grades. While asking directly about grades could result in information about performance goals and extrinsic goals, at this age grades are the primary means for assessing performance, we missed capturing information about this in the survey by not explicitly asking students about grades. Future studies should examine how students respond to questions about grades explicitly; they should also compare responses between these new items and existing items targeting more global performance.

Since the activities for this study took place over the course of just a few weeks the assignments and other study related activities were likely not incorporated well into the classroom routine. This may have influenced the effectiveness of the assignments on learning of the content. Furthermore, during the focus groups, one of the primary reasons students cited for thinking they learned better or understood more from their typical classroom assignments as opposed to the SERP assignments is that they did not have enough SERP assignments. Many students stated that if they were given more SERP assignments that they would be more influential in their learning and would help them learn/understand more and prepare them better for the unit test. In the future, it seems that using more example-based assignments for each content block would be beneficial for student learning.

A final limitation is that in this study is the presence of nested data; specifically, only three teachers taught the students, and students were grouped into classrooms. As a result, the assumption of independent observation was violated. One way to address this limitation would have been to use hierarchical linear modeling (HLM) to analyze the

data, however there were only eight participating classrooms in this study, which is insufficient for HLM analyses.

Implications

As has been discussed, there are many factors that can influence a student's performance and gender differences in motivation (achievement goals in this case) in school; specifically parental influences, school influences, sociocultural influences, stereotype threat and peers influences. By understanding the motivational gender differences for young adolescents we can work to modify instruction, classroom practices and the learning environment to address student's strengths and weaknesses and help students, especially girls to have positive view's of their math abilities. By doing so, we can help females to believe in their math abilities more and interested in pursuing careers in the fields of science, technology, engineering and math.

In sum, the results of the present study replicated some of the gender differences found in other studies for adults and adolescents. The survey measures in this study did replicate the finding that females have more *mastery* goals than males, but no differences were found for *performance-approach* goals. While the gender differences were not found for *performance-approach* or *performance-avoidance* goals on the survey measures, information provided in the focus groups regarding student's goals did indicate that young adolescent males might be more performance-approach oriented than females, which coincides with trends in existing literature. Though the surveys used in this study have been shown to be valid, the fact that the gender differences in *performance-approach* goals only appeared in the focus groups when previous literature has repeatedly found this gender difference suggests that maybe we are not gaining a full understanding

of young adolescents' achievement goals by solely relying on surveys to capture this information, especially with the 2000 version of the PALS. Future research should explore why the 1997 version of the PALS and the revised version appears to tell a different story about adolescent's *performance-approach* orientation, as well as why the AGQ-R is missing it entirely. More generally however, further research should continue to explore means for assessing student motivation beyond that of close-ended surveys, the various factors that can impact gender differences in achievement goals and how gender differences in achievement goals are related to learning.

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APPENDIX A

SAMPLE ASSESSMENT ITEMS

Table 1. Sample assessment items

Find the difference of the polynomial: $(2x^2 - x + 3) - (x^2 + 3x - 1)$
State whether of the following is lined up correctly to solve the following polynomial: $(2x^3 + 5x^2 - 3x) - (4x^3 - x + 3)$ a. $2x^3 + 5x^2 - 3x$ $-4x^3 - 0 + x + 3$ Yes No b. $2x^3 + 5x^2 - 3x$ $-4x^3 - 0 - x + 3$ Yes No c. $2x^3 + 5x^2 + 3x$ $-4x^3 - x + 3$ Yes No d. $2x^3 + 5x^2 + 3x$ $-4x^3 + x - 3$ Yes No e. $2x^3 + 5x^2 - 3x$ $-4x^3 - 0 + x - 3$ Yes No
Find the product. Show all of your work: $2x(3x^3 - x^2 - 5x)$
State which of the following is equivalent to: $-6x^8 - 3x^4 + 9x^2$ a. $x^2(-6x^4 - 3x^2 + 9)$ Yes No b. $3x^2(2x^6 - x^2 + 3)$ Yes No c. $x^2(-6x^6 - 3x^2 + 9x)$ Yes No d. $3x^2(-2x^6 - x^2 + 3)$ Yes No

APPENDIX B

STANDARD SURVEY

Table 2: Standard Survey (Elliot & Murayama, 2008 and Midgley et al., 2000).

Here are some questions about yourself as a student in this algebra class. Please circle the number that best describes how you are thinking and feeling about algebra RIGHT NOW. There are no right or wrong answers to these questions. All of your answers will be kept secret- no one will connect your name to your answers.

Some of these questions are very similar to each other—please just read each question carefully and answer honestly about how you are thinking and feeling at the moment.

	Not at all true		Somewhat true		Very true
1. It's important to me that I learn a lot of new concepts in this course.	1	2	3	4	5
2. My goal is to learn as much algebra as possible.	1	2	3	4	5
3. One of my goals is to show others that I'm good at my coursework in this class.	1	2	3	4	5
4. One of my goals is to keep others from thinking I'm not smart in this class.	1	2	3	4	5
5. My goal is to perform better than other students.	1	2	3	4	5
6. My goal is to avoid performing poorly compared to others.	1	2	3	4	5
7. It's important to me that I improve my skills in algebra this semester.	1	2	3	4	5
8. It's important to me that I look smart compared to others in this class.	1	2	3	4	5
9. My aim is to perform well relative to other students.	1	2	3	4	5
10. It's important to me that I don't look stupid in this class.	1	2	3	4	5
11. One of my goals in this class is to avoid looking like I have trouble doing the work.	1	2	3	4	5
12. My aim is to avoid doing worse than other students.	1	2	3	4	5
13. One of my goals in this course is to learn as much as I can.	1	2	3	4	5
14. One of my goals is to show others that this course is easy for me.	1	2	3	4	5
15. I am striving to do well compared to other students.	1	2	3	4	5

16. It's important to me that my teacher doesn't think that I know less than others in this class.	1	2	3	4	5
17. I am striving to understand the content of this algebra course as thoroughly as possible.	1	2	3	4	5
18. It's important to me that other students in this class think I am good at my class work.	1	2	3	4	5
19. One of my goals is to master a lot of new skills in this course.	1	2	3	4	5
20. I am striving to avoid performing worse than others.	1	2	3	4	5
21. It's important to me that I thoroughly understand my coursework in this class.	1	2	3	4	5
22. One of my goals is to look smart in comparison to the other students in this class.	1	2	3	4	5
23. My aim is to completely master the material presented in this class.	1	2	3	4	5

APPENDIX C

FOCUS GROUPS PROTOCOL

Initial Questions

1. Tell me how you feel or what you think about math.
2. Tell me how you feel or what you think about participating in our study.

Follow-Up Questions

1. Did you enjoy completing the SERP study assignments?
2. Did you enjoy the SERP study assignments more than other classroom practice problems?
3. Do you think you learned better from the SERP study assignments than other classroom practice problems?
4. Which helped you understand the lessons more, the SERP study assignments or other classroom practice problems?
5. Which do you think prepared you better for the test, the SERP study assignments or other classroom practice problems?
6. Which problems do you feel it was most important for you to get correct, the SERP study problems or other classroom problems? Why?
7. What are your goals for math class?
8. Are you trying to avoid anything specific in math class? If so, what?
9. Are you trying to achieve anything specific in math class? If so, what?