Georgia State University

ScholarWorks @ Georgia State University

Middle and Secondary Education Dissertations   Department of Middle and Secondary Education

5-11-2018

Mathematics Self-efficacy in High School Students and the Effects of Interim Goal Setting: How Goals and Efficacy are Linked in the Self-efficacy Goal Spectrum

Hannah H. Oldham
Georgia State University

Follow this and additional works at: https://scholarworks.gsu.edu/mse_diss

ACCEPTANCE

This dissertation, MATHEMATICS SELF-EFFICACY IN HIGH SCHOOL STUDENTS AND THE EFFECTS OF INTERIM GOAL SETTING: HOW GOALS AND EFFICACY ARE LINKED IN THE SELF-EFFICACY GOAL SPECTRUM, by HANNAH H. OLDHAM, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree, Doctor of Education, in the College of Education and Human Development, Georgia State University.

The Dissertation Advisory Committee and the student's Department Chairperson, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty.

_____
Pier Junor Clarke, Ph.D.
Committee Chair

_____   _____
Draga Vidakovic, Ph.D.   Chris Oshima, Ph.D.
Committee Member   Committee Member

_____
Date

_____
Gertrude Tinker-Sachs, Ph.D.
Chairperson, Department of Middle and
Secondary Education

_____
Paul A. Alberto, Ph. D
Dean
College of Education and Human Development

AUTHOR'S STATEMENT

By presenting this dissertation as a partial fulfillment of the requirements for the advanced degree from Georgia State University, I agree that the library of Georgia State University shall make it available for inspection and circulation in accordance with its regulations governing materials of this type. I agree that permission to quote, to copy from, or to publish this dissertation may be granted by the professor under whose direction it was written, by the College of Education and Human Development's Director of Graduate Studies, or by me. Such quoting, copying, or publishing must be solely for scholarly purposes and will not involve potential financial gain. It is understood that any copying from or publication of this dissertation which involves potential financial gain will not be allowed without my written permission.

Hannah H. Oldham

CURRICULUM VITAE

Hannah H. Oldham

ADDRESS: 1270 Morgan Chase Terrace
Marietta, GA 30066
oldham.hannah@gmail.com

EDUCATION:

Ed.D.	2018	Georgia State University Curriculum and Instruction
M.Ed.	2015	Georgia State University Mathematics Education
B.S.Ed.	2007	University of Georgia Social Science Education
B.A.	2007	University of Georgia History

PROFESSIONAL EXPERIENCE:

2010-present	**Mathematics Educator** Sprayberry High School Marietta, GA
2015-present	**Mathematics Professional Learning Manager** Cobb County School District
2017-present	**Woodrow Wilson Mentor Teacher** Kennesaw State University
2017	**Teacher Ambassador to Jamaica** Georgia State University
2017	**Research Lead** Testing/Assessment- Sprayberry High School
2017	**Graduate Research Assistant** Georgia State University
2015	**Assessment Designer** Cobb County School District
2008-2010	**Mathematics Educator** Kell High School Marietta, GA

PRESENTATIONS AND PUBLICATIONS:

Oldham, H. H. (2017, November). *Breaking barriers; Actionable approaches to reach each and every learner in mathematics. Interim goals and self-efficacy.*
        NCTM Innov8 Conference, Las Vegas, Nevada.

Oldham, H. H. (2017, October). *Making Problem Based Learning Work for you.*
        NCTM Regional Conference, Orlando, Florida.

Oldham, H. H. (2017, October). *A MUST in Your Toolbox: Exploring Geometry Classroom-Based Situations*
        GCTM, Rock Eagle, Georgia

Oldham, H. H. (2016, October). *Making Problem Based Learning Work for you.*
        GCTM, Rock Eagle, Georgia.

Oldham, H. H. (2015, October). *Advanced Mathematical Decision Making: Content through problem based learning*
        Cobb County District Development, Marietta, GA

Oldham, H. H. (2015, October). *Essential Strategies for Effective Team Teaching in the Mathematics Classroom*
        Cobb County District Development, Marietta, GA

Oldham, H. H. (In Press). The use of mathematics in gentlemen's clubs; How ethnomathematics can be used to observe unique applications of mathematics in unconventional settings
        Book Chapter, Chahine, I.C., & DeBeer, J. (Eds.). *Evidence-based inquiries in ethno-STEM research: Investigations in knowledge systems across disciplines and transcultural settings.* Charlotte, NC: Information Age Publishing Inc.

PROFESSIONAL SOCIETIES AND ORGANIZATIONS

2016-present	NCTM (National Council of Teachers of Mathematics)
2016-present	GCTM (Georgia Council of Teachers of Mathematics
2008-present	PAGE (Professional Association of Georgia Educators)
2015-present	Pi Lambda Theta Educational Honor Society
2015-present	PDK (Phi Delta Kappa International)
2015-present	Golden Key International Honor Society
2015-present	Middle and Secondary Education Doctoral Student Council

CERTIFICATIONS:

2007-present	T5 Teaching Certificate
	Mathematics 6-12
	History 6-12
	Curriculum and Instruction

MATHEMATICS SELF-EFFICACY IN HIGH SCHOOL STUDENTS AND THE EFFECTS OF

INTERIM GOAL SETTING: HOW GOALS AND EFFICACY ARE LINKED IN THE SELF-

EFFICACY GOAL SPECTRUM

By

HANNAH H. OLDHAM

Under the Direction of Pier Junor Clarke

ABSTRACT

Research has found that self-efficacy affects how a student behaves in class, how they choose to approach academic work, how long they persevere on a topic, and the type of goals they set for themselves. When students enter high school, opinions of self-efficacy (negative or positive) are strong and it becomes increasingly difficult for teachers to help students change their efficacious beliefs. This is apparent in secondary mathematics classrooms where students have years of previous experiences that have shaped opinions about their self-efficacy. A possibility in altering self-efficacy is by combining goal achievement theory and social learning theory. If more value is placed on interim (or short term) goals, teachers may be able to increase their student's self-efficacy through a scaffolded approach to larger achievement and mastery goals.

This study focused on the change in reported self-efficacy in high school mathematics students following a treatment of teacher promoted interim goals. Nine teachers with two classes each (N=377) from a suburban high school in the southeastern United States provided a common goal dialogue promoting short term goals in mathematics classes (ranging from ninth to twelfth grade courses) for four weeks. A survey was given to students to report their self-efficacy before and after the four-week goal treatment. Each teacher had a control class, which did not receive the goal dialogue. At the end of the four weeks a repeated measures ANOVA was conducted and found significance between the control and treatment classrooms. This indicates that students in classrooms where interim goals are promoted daily will have a higher increase in mathematics self-efficacy than students who do not receive daily goal prompts. This study also lays the groundwork for the Self-Efficacy Goal Spectrum (SEGS) which explains how to maximize mathematics self-efficacy through targeted interim goals.

INDEX WORDS: Mathematics Self-efficacy, Goals, Goal achievement theory, Social cognitive theory, Self-Efficacy Goal Spectrum (SEGS), Short term goals, Interim goals, Repeated measures, High school mathematics, Mathematics Self-Efficacy Survey

MATHEMATICS SELF-EFFICACY IN HIGH SCHOOL STUDENTS AND THE EFFECTS

OF INTERIM GOAL SETTING: HOW GOALS AND EFFICACY ARE LINKED IN THE

SELF-EFFICACY GOAL SPECTRUM

by

HANNAH H. OLDHAM

A Dissertation

Presented in Partial Fulfillment of Requirements for the

Degree of

Doctor of Education

in

Curriculum and Instruction

in

Middle and Secondary Education

in

The College of Education and Human Development

Georgia State University

Atlanta, GA
2018

DEDICATION

I dedicate this dissertation my husband Jared Oldham. I wake up every day with the joy of knowing I journey through this world with you by my side. Best of Husbands and Best of Men.

ACKNOWLEDGMENTS

I have multiple people that I need to thank that guided and supported me through the adventure that is a completed dissertation. To my husband, Jared Oldham, you have been my constant through the immeasurable late nights and weekends. You drove the car to let me work in the passenger seat, sat next to my desk when I worked every night, and sat by my side when I worked during vacations. You knew when to step in to have me take a break, I'm truly Helpless without you. This doctorate is as much yours as it is mine.

To my family, thank you for the years of support and listening to my constant educational discussions. To my dad, Greg Harlin, thank you for a lifetime of love and support. You were my first teacher and I will always remember your lessons. To my mother and father, Michelle and Gary Morrow, thank you for always listening to my educational discourse and valuing my knowledge. To my parents, Susan and Warren Oldham, thank you for opening your hearts so fully to me, and supporting me every step of the way. To my grandmother, Pamela Dawson, you are truly the materfamilias of our family. Your fire and wisdom has truly defined my path and I thank you. To my Aunt Jane and Uncle Mike your frequent support and love inspired me in times of struggle and I have kept every card you sent me.

To my doctoral family, Jen, Erica, Mariana, Julie, and Margaret, you amazing women have inspired me as an educator and as a woman. We have been through so much together including achievements and struggles. We are a small group but that has made us stronger. I am proud to have completed this journey with you.

To my committee chair Dr. Junor Clarke, you have been with me since my master's program. Your guidance through my years of graduate work has helped me grow as an educator,

writer, and researcher. You have never let me settle for good enough and while it caused nights of frantic edits, the end product is something to be truly proud of.

To my Georgia State professors, I truly am a better educator because of your guidance. Dr. Caroline Sullivan, Dr. Rhina Williams, Dr. Michelle Zoss, Dr. Chris Oshima, and Dr. Draga Vidakovic, you are all amazing women and I am honored to have been able to work with all of you. You have shown me the power of an educated woman and I hope to make you all proud.

Table of Contents

iv

List of Tables

List of Figures

Chapter 1: Introduction

Introduction

High school students in the state of Georgia are required to show competence on more mathematics standards throughout their high school career than any other group of high school students before them. Standards previously taught in junior year are now being taught to freshmen creating increased rigor for many students who are not yet ready for these concepts. Freshmen are comparing their mathematics ability to that of students with two additional years of experience in the subject. It is a similar comparison to the reading levels of young students. While both a third grader and a fifth grader are capable of reading, a fifth grader will be able to comprehend more complex passages than the third grader. If students do not academically perform to the level at which themselves think they should be then it fosters a negative attitude towards the subject and their own academic abilities. This *self-efficacy* is how well a person believes they can accomplish a given task (Bandura, 1997). The increased rigor of the curriculum combined with previous experiences in the subject has led to many students having a negative perception of their mathematical self-efficacy.

The importance of self-efficacy cannot be understated when examining the performance of students in high school mathematics. Self-efficacy affects how a student behaves in class, how they choose to approach academic work, how long they persevere on a topic, and the type of goals they set for themselves (Bong, 2001; Multon, Brown, & Lent, 1991; Pajares & Miller, 1994, Smith, Sinclair, & Chapman, 2002; Usher & Pajares, 2009). A student's perceived self-efficacy integrates into every part of who they are as a learner yet is rarely addressed in classroom environments, especially at the high school level. If students go through high school with weak efficacious beliefs then they are more likely to develop negative attitudes towards

school, academics, and themselves (Bandura & Schunk, 1981; Friedel, Cortina, Turner, & Midgley, 2010; Schunk, 1985).

<p style="text-align:center">Problem Statement</p>

Mathematical self-efficacy is an integral component of academic performance. High self-efficacy is positively linked with academic performance, perseverance, and challenging goal setting (Bandura, 1993; Bandura, 1997). Self-efficacy beliefs have a greater significance in determining future behavior in a subject than past experiences with the subject material (Parajes & Miller, 1994). Even if a student has had negative past experiences in mathematics, if her/his self-efficacy is high, they are more likely to exhibit positive behaviors in the subject that supersede past experience. When comparing multiple variables to mathematic performance, self-efficacy had the strongest direct link including outranking perceived usefulness and previous content knowledge (Bong, 2001; Bouffard-Bouchard, Parent, & Larivée, 1991; Pajares & Miller, 1994). These findings are vital to high school teachers who have little control over the previous content experiences their students have in mathematics. Since self-efficacy is an important indicator of future performance, the promotion of positive self-efficacious attitudes needs to be studied and encouraged in high school.

The dangers of ignoring the importance of promoting self-efficacy are seen in the behaviors of students who have low self-efficacy. Students with low-self efficacy exhibit handicapping and avoidance behaviors which lead to decreased performance and little to no perseverance in the face of challenges (Midgley & Urdan, 2001). Handicapping behaviors include avoiding studying for tests, not completing assignments, and overall willingness to reduce effort (Urdan, Midgley, & Anderman, 1998). These handicapping behaviors are often exhibited by students who choose to attribute their low performance to lack of trying as opposed

<p style="text-align:center">2</p>

to actual academic ability. Handicapping behaviors are typically exhibited by students with low

self-efficacy because they do not think they can complete the task at hand. Students use these

behaviors as an excuse for what they perceive as not succeeding academically (Midgley &

Urdan, 2001; Urdan et al., 1998). Students rationalize these setbacks by thinking *"I didn't fail

the test because I am not smart, I failed the test because I didn't study."*

It is important to note that low self-efficacy does not mean that a student does not

perform well academically. There is significant correlation between high self-efficacy and high

academic performance but they are not causal (Bong, 2001; Bouffard-Bouchard et al., 1991;

Multon et al., 1991; Pajares & Miller, 1994, Smith et al., 2002; Usher & Pajares, 2009). There

are students who have strong mathematical intelligence yet have low self-efficacy. The internal

creation of self-efficacy begins at an early age through three different sources. *Previous

experiences* with the subject or material. *Vicarious experiences* which describe how an

individual observes others and then compare's her/his own ability to these observations, and

social persuasions which are values promoted by the culture the individual identifies with (Usher

& Pajares, 2009). As students experience successes and failures in mathematics they begin to

self-analyze their abilities in the subject. They begin to internalize "If I was able to complete one

step subtraction problems, I should be able to complete two step subtraction problems." As a

student progresses through their school career, their academic experiences are also shaped by the

social constructs of their family, peer group, and school setting. Now their self-efficacy is not

only based on what they have experienced themselves but how they are internalizing what is of

value based on the culture they identify with.

The concepts that students have about their efficacy are related to the goals that they both

set for themselves and the goals promoted by the social groups around them (teachers, peers, and

parents). Goals can be categorized into three main types. *Mastery goals* that focus on learning for personal improvement, *performance-approach goals* which represent strategies students take in order to show they are more academically able compared to peers, and *performance-avoidance goals* which are goals where students do whatever they need to in order to not be seen as academically inferior to their peers (Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002a). Mastery goals, like favorable self-efficacy beliefs, are positively correlated with mathematical performance (Midgley, Kaplan, Middleton, Maehr, Urdan, Anderman, & Roeser, 1998; Wentzel & Wigfield, 1998). Goal orientation has been researched on a spectrum that shows that performance-avoidance leads to performance-approach, and finally to mastery goals. The stronger a student reports their self-efficacy, the higher level of goals they tend to pursue (Bong, 2001). Much like how self-efficacy is affected by social perceptions, so too are goal orientations (Friedel et al., 2010; Maehr & Anderman, 1993). The goals promoted by the culture of the student's school, family, and peer group impact the type of goals the student values.

The type of environment that is promoted by the school is often internalized by students (Maehr & Anderman, 1993). If a school values academic performance over anything else then a student will judge their own actions and behaviors based on that precedent. Students who are efficacious in other areas like English or the arts, but perhaps not mathematics, internalize this mindset as they judge their own academic abilities against what the school culture is promoting. While intentional or not, the climate of the classroom impacts how a student views her/his own abilities. Students enter high school with at least thirteen years of experiences that have molded their self-efficacy in mathematics. Research has shown the long term benefits of students with high self-efficacy, but what about the students who enter high school with a low mathematical assessment of themselves? Are teachers and schools promoting goals that seem unattainable to

students with low self-efficacy? Perhaps these lofty goals are further cementing negative efficacious beliefs which are distancing students further away from their academic potential. Identifying how goals impact students' self-efficacy is important in helping them reach their academic potential.

Purpose of the Study

The purpose of this study is to determine how promoting attainable goals through advocating smaller interim goals in the classroom affects mathematics self-efficacy in high school students.

Research Questions and Hypotheses

The overall research question that is driving this study is, What are the effects of teacher promoted interim goals on the mathematics self-efficacy of high school students? This is further broken down into the following sub-questions:

1) Is there a difference between reported mathematics self-efficacy for students who receive interim goals from their teachers and those who do not?

2) Is there a difference in reported mathematics self-efficacy between the four subgroups of mathematics self-efficacy for students who received interim goals from their teacher and those who did not?

3) What is the effect size of reported mathematics self-efficacy for students who receive interim goals from their teachers

The following null hypothesis were tested in relation to the above questions

H_0:   There is no difference between reported mathematics self-efficacy for students who receive interim goals from their teachers and those who do not.

H_0 :   There is no difference between reported mathematics self-efficacy between the four subgroups of mathematics self-efficacy for students who received interim goals from their teacher and those who did not.

H_0 :   There is no difference in effect size of reported mathematics self-efficacy for students who receive interim goals from their teachers

Term Definitions

Self-efficacy: The opinions that individuals hold about their academic capabilities

Vicarious Experiences: How students judge themselves in comparison to others. Students compare themselves to peers and make judgements about their own academic abilities based on this self-judgement

Social Persuasions: The way a student internalizes outside influences of praise and disappointments. These can come from parents, teachers, or peers.

Self-handicapping behaviors: Behaviors that students exhibit in order to have an excuse for not succeeding academically. Some of these behaviors include purposely not trying, procrastination, and excuses for not studying. These behaviors provide a reason for the student's shortcomings that is not based in academic ability

Mastery goals: Goals in which a student learns for their own enjoyment and betterment. Progress towards these goals is measured individually and not through the comparison of others

Performance-Approach goals: Goals in which a student learns to demonstrate their superior ability in comparison to peers.

Performance-Avoidance goals: Goals in which a student does the bare minimum to demonstrate that they are not worse than their peers.

Interim goals: Short term goals that serve as tangible markers to longer term goals. Interim

goals can be used for both performance and mastery goals

Significance of the study

Understanding the impact of goals on students' self-efficacy can help teachers modify

their classroom environment in ways that best reach all of their students no matter their level of

self-efficacy. The greatest risk factor for dropping out of high school is repeating classes from

freshman year, the most common of these classes being freshman mathematics (Balfanz &

Legters, 2004). The need of this research at the high school level is vital because freshmen enter

mathematics classrooms with years of previous experiences (both positive and negative) that

have shaped their efficacy about the subject. High school teachers have no control over the

amount of content a student has learned, her/his opinions about the subject, or even the students'

own ability to perform well in mathematics. Students who enter high school with negative self-

efficacy already have handicapping behaviors, which makes teaching new concepts to these

students difficult. Low self-efficacy paired with handicapping behaviors and increased rigor in

the high school mathematics classroom creates numerous barriers for these students to overcome

in order to succeed.

Increasing self-efficacy leads to multiple positive behaviors like higher goal setting (as in

mastery goals), increased perseverance, and academic performance. Since high school teachers

cannot control how a student has developed her/his self-efficacy, alternative methods to increase

self-efficacy once it has been formed need to be investigated. Promoting interim goals which lay

on a path to a larger goal in a high school setting is a treatment that can be implemented in all

types of mathematics classrooms. Finding a practical method to increase self-efficacy in

students is vital to creating long lasting benefits as students advance through high school and through their mathematics careers.

Conclusion

This chapter provided an overview of the problem to be investigated and its significance to the field of mathematical educational research. The following chapter will provide a detailed literature review over self-efficacy creation and goal orientation and how they are intimately connected in the theoretical framework of social cognitive theory and goal-achievement theory. Research shows that positive self-efficacious beliefs and mastery goals are related but there is a lack of research into how other goals effect self-efficacy.

Chapter 2: Literature Review

Introduction

Through this literature review I will demonstrate the connection between self-efficacy and academic performance as well as goal-setting and academic performance. Through examination of the development and behaviors associated with each I will show the need for research in connecting both social cognitive theory and goal-orientation theory into practical applications for teachers in high school mathematics classrooms.

Theoretical Framework

There are two main theories that will drive this research, social cognitive theory and goal achievement theory. Both theories focus on how an individual views themselves in connection with internal and external forces. Self-efficacy views make up major components of each theory.

Social Cognitive Theory

Social cognitive theory was first defined by Bandura (1977) in which he described human learning as being created through vicarious experiences and observations combined with self-reflecting and self-regulating behaviors. In other words, individuals learn by adapting what they see and experience around them with their own personal motivations and beliefs. Through constant interaction with the world, individuals can alter their knowledge on the current belief system they adhere to based on those interactions. How one views and builds their knowledge about the world is shaped by her/his daily interactions.

Bandura (2002) defined these interactions through the idea of agentic perspective. An agent can be the self, an outside individual, or a group. Direct agency is when an individual acts on their own motivations and goals. Since individuals do not have control over every part of their lives they sometimes have to rely on others to act in their best interests in what Bandura refers to

as proxy agency. In the context of schools, proxy agents are most commonly seen in the form of teachers. Teachers are meant to provide information and assistance towards knowledge acquisition when the student cannot form the knowledge on their own. Each type of agency affects the individual's actions as they internalize these interactions into their own self-determination and self-motivation. Through agentic perspective and social cognitive theory every individual determines and adapts the truth of their world based on their current time and cultural climate (Bandura, 1997, 2002). Agentic perspective is vital in a classroom setting because teachers are constantly agents for their student's social cognition about their own learning. How a teacher acts towards her/his students can have direct effect on how a student views her/his ability and self-efficacy. In the scope of this study, I will examine the impact of teachers' agentic influence in the mathematics classroom through the goals they promote in the classroom therefore it is important to understand the influence these goals can have on student's self-efficacy.

Goal Achievement Theory

Goal achievement theory is the idea that long-term academic performance is most directly related to the type of goals that students set for themselves (Maehr & Anderman, 1993). Academic goals can be separated into two main categories. *Mastery goals* (or task goals) are goals in which students learn for the sake of learning. They have internal motivation to want to learn without a need for extrinsic or social motivation (Bong, 2001). *Performance goals* are goals which students create in order to achieve a specific social and external reaction. Performance goals can even further be divided into two categories: performance-approach and performance-avoidance. Students with performance-approach goals (or ego-goals) are motivated to complete tasks that demonstrate their superior ability whereas students with performance-

avoidance goals are motivated by the desire to not show incompetence or failure in a social and public setting. The impact that each type of goal has will be discussed in more detail in the following sections but it is important to understand that goal achievement theory stresses the connection between goals and performance. Through goal achievement theory, I hope to find a link between different types of goals and their impacts on raising or lowering student self-efficacy in the secondary mathematics classroom.

Self-efficacy

Self-efficacy refers to the opinions that individuals hold about their academic capabilities. It is an important characteristic of Bandura's social cognitive theory because it describes how a person internalizes outside interactions into a personal belief structure.

Self-efficacy Creation, Development, and Evolution

Self-efficacy is a combination of three main factors, previous experiences, vicarious experiences, and social persuasions. Previous experiences refer to interactions a student has already had in the subject, vicarious experiences describe how a student judges their own ability by comparison to others, and social persuasions are the ways in which a student internalizes outside influences of praise and disappointments from their teachers, peers, and parents.

Previous experiences. The previous experiences of learners have a significant effect on the development and evaluation of their self-efficacy. When a student is evaluating how well she/he will do on a topic, they often will first compare how they did previously. The success or failure on that topic provides a basis for future attempts into that same area. Success in a previous topic lends students to predict success in future events and failure in an area leads to predictions of future failures (Zimmerman & Cleary, 2006). These successes and failures create the foundation in a student's sense of self-efficacy. However the experiences themselves are not

the sole contributor to how a student perceives' her/his ability. Each experience is framed in the context of the event (Bandura, 1997). For example, if a student did poorly on a math test but frames the experience through the lens that the failure was due to lack of studying rather than actual ability then that failure may not have an impact on her/his self-efficacy. However this same event through the lens of internal ability, *I failed because I am not smart enough*, as opposed to outside influences*, I would have passed if I studied*, could have serious negative impacts on self-efficacy. Unfortunately, researchers and teachers have no control over the previous experiences of the student or the lens through which they view their experiences. What one student views as a success, another may view as a failure so simply looking at previous grades or performance records cannot accurately predict self-efficacy because it is personal to the student. While it may seem intuitive to examine tangible evidence of student's previous experiences to define her/his efficacy, these records leave out two vital factors in self-efficacy development which exist only inside the student's perception through vicarious experiences and social persuasions.

       Vicarious experiences. Unlike previous experiences, vicarious experiences are not explicitly defined in terms of an observable experience. Vicarious experiences are how a student views their own abilities in comparison to those around them (Zimmerman & Cleary, 2006). A student will make judgements about their peer's ability on a topic. For example: she is smarter than me, I am about as smart as her, or I am smarter than her. Then, a student frames her/his ability on a topic by comparing themselves to that peer. In other words, a student will judge her/his own ability based on what they experience. If a student views a peer as academically superior and that student experiences a set-back, it could be internalized as *if even she cannot succeed then I have no chance.* It also works in the opposite way, if a student experiences

12

success where a peer they view as superior experiences failure, then it can increase self-efficacy, *she was not able to but I was, I must be better than I thought*.

The danger in vicarious experiences is how a student views their peers is based on their own personal judgements and not on the actual academic ability of the student they are comparing themselves to. A student may inflate or lower their impressions of their peers on a variety of factors outside of academic ability including effort, perseverance, and behavior (Schunk & Meece, 2006). These factors, while contributors to academic performance, do not necessarily affect academic performance. Let us look at an example in terms of two students Anna and Paul. Anna turns in her assignments early every day but consistently has errors in her computation. Her classmate Paul sees that Anna is always the first one done and believes she must be smart because she is always the first one done. However Paul has no idea that in her fast completion she has made numerous mathematical errors. He is simply judging his performance based on speed. Paul internalizes this vicarious experience negatively because he cannot complete problems as fast as Anna and this has a negative effect on his self-efficacy. Even though Paul may have more problems correct than Anna, Paul judged his ability on speed and not performance.

Vicarious experiences, like the ones mentioned above, can positively or negatively affect self-efficacy depending on how a student judges their own ability with the ability of their peers. Of the three factors influencing self-efficacy, the impact of vicarious experiences are the most difficult to track due to the internal nature and lens through which they are experienced by the students themselves (Bandura, 1997).

Social persuasions. Social persuasions refer to the positive and negative feedback received from peers, parents, and teachers (Usher & Pajares, 2009). Persuasions can come in the

13

form of explicit dialogue like "I know you can do it" or through actions, for example a teacher always calling on a particular student for an answer. (Zimmerman & Cleary, 2006). Social persuasions are vital in self-efficacy research because they are one of the only areas that social agents (teachers and researchers) have any control over. Isolating just the role of feedback, or dialogue, allows a social agent to help a student monitor their own learning processes (Zimmerman & Cleary, 2006). Essentially this means that by providing positive and reflective dialogue, a teacher can promote the student to really think about their own abilities in the context of the moment. If a student receives a low grade on a test a teacher could foster reflective dialogue with the student about what causes led to the low grade. By asking questions like, "how long did you study" a student may reflect that the reason that they received a low grade was not their ability, but rather a lack in preparation. Without this dialogue and self-reflection, students' self-efficacy could be negatively impacted because of lack of social interaction. However this same social persuasion can have a negative impact depending on the previous experiences of the student. If in the same situation a student had studied for many hours and still received a low grade, then a teacher comment of "I know you can do better" could have serious negative repercussions. While the teacher was implying that the student is capable of higher performance, the student views this feedback as demeaning to their effort. *I studied all night and it still wasn't good enough*. The internalized constructs of previous experiences, vicarious experiences, and social persuasions are all combined into how a student views their abilities and their efficacy. The interaction of all of these factors impacts the behaviors exhibited by students in relation to how strongly they believe in their ability to succeed academically.

Impacts of Self-efficacy

Self-efficacy is connected to many factors that influence a student's academic performance (Bong, 2001). Where students view their ability, whether high or low, affect their internal judgements about themselves as well as external actions they take (Harackiewicz, Barron, Tauer, & Elliot, 2002b).

Behaviors and perseverance. While self-efficacy is an internal construct, it affects the external behaviors a student exhibits (Bandura, 1997). In the academic realm, these behaviors can promote or hinder academic performance based on the self-efficacy of the student (Bong, 2001; Harackiewicz, et al., 2002b). Students who report high levels of self-efficacy are more likely to exhibit persistence behaviors like longer time spent on a task, more problems attempted, and higher motivation to complete the task (Bouffard-Bouchard et al., 1991; Multon et al., 1991; Schunk, 1990). In addition to these behaviors, students with high self-efficacy are more likely to persevere in the face of set-backs such as unsuccessfully solving problems and continuing to rework those missed problems until they are correct (Pajares & Miller, 1994). All of the positive behaviors of student with self-efficacy lead to long term academic successes through high school and into college (Harackiewicz et al., 2002b).

In contrast, students who have low self-efficacy commonly exhibit handicapping behaviors that limits their academic performance. These handicapping strategies can include purposely not studying or completing work so if failure occurs it can be blamed on the lack of preparation (Midgley & Urdan, 2001). It is important to note that these self-handicapping behaviors generally take place before academic success or failure has occurred (Urdan et al., 1998). In other words, these behaviors are only exhibited when a student has low self-efficacy and expects failure. Students with low self-efficacy put themselves into a cycle of negative

behaviors that impede academic performance. While their efficacy has no impact on their actual academic ability, the behaviors they exhibit due to the low opinion they have of themselves cause them to exhibit traits that lessen their performance. As they experience these failures in performance, their low perception of their ability to perform is justified and they continue to have low self-efficacy.

   Performance. Self-efficacy and its' effect on academic performance has been researched in many different capacities. In a meta-analysis of 53 studies on self-efficacy and academic performance during the past decade Honicke and Broadbent (2016) found that the connection between high self-efficacy and high academic performance was significant. In other words, these studies showed, on multiple occasions, across multiple grade levels, in different countries, and amongst varying academic abilities that students who report high self-efficacy also had high academic performance.

   It is important to note that while all of these studies were diverse in the nature of each sample they all repeatedly provided significant results between the link of self-efficacy and performance. The nature of performance in each study was different, some measured performance through GPA, some through final course grade, and some on a unit assessment (Honicke & Broadbent, 2016). But each of these performance instruments measured the students' performance and not their ability level because as has stated above, a student can be academically able but not perform well due to low self-efficacy. Additionally, 40% of all the studies used the same self-efficacy survey, the Motivated Strategies for Learning Questionnaire (MSLQ) originally developed by Pintrich and DeGroot (1990) allowing for more generalizability between the studies. Having the same self-efficacy instrument strengthens the

connection between all different forms of academic performance and the connection to self-efficacy.

The breadth of research into academic performance and self-efficacy leads to the next important question. If students with high self-efficacy perform better in an academic setting, then how can we increase self-efficacy in all students? Some studies have begun to answer this question by looking at possible directions of self-efficacy improvement. For example does academic performance influence self-efficacy or is it the other way around? These pathways are non-directional but research does show a connection between self-efficacy, self-esteem, motivation, goals, and academic performance. (Coutinho & Neuman, 2008; Crippen, Biesinger, Muis, & Orgill, 2009; Gebka, 2014; Phan, 2010). However, there is not a connection on how exactly the pathways work, specifically in relation to the goals the students adopt for themselves. Some studies have shown that students who already have high self-efficacy will naturally set more challenging goals which lead to higher academic performance, but in direct contrast, other studies have demonstrated that the pathway works in the opposite direction. Students who perform well academically will set challenging goals and if those goals are met it will increase self-efficacy (Bong, 2001; Midgley et. al., 1998). These inconsistences leave us with a chicken vs. egg situation. If the end result is academic performance, which came first, the high self-efficacy or the goal orientation? Which factor is truly mediating the increase in academic performance? There is no need to continue research into the connection between increased self-efficacy and increased academic performance but rather research now needs to delve into the mediating factors that affect self-efficacy itself. The discrepancies in the role that goal orientation has on self-efficacy offers an illuminating possibility in connecting the pieces from efficacy to performance.

Goal Orientation

Goal creation, Development, and Evolution

There is conflicting research in when and how students become goal oriented (Harackiewicz et al., 2002a; Senko & Harackiewicz, 2001).   This does not mean when students start working towards academic goals in general but rather what type of goals they strive for. This goal orientation refers to if students tend to pursue mastery or performance goals in an academic setting

Mastery goals and performance goals. Research has consistently shown a significant link between mastery goals and academic performance (Bong, 2001; Dweck & Leggett, 1988; Wentzel & Wigfield, 1998). These same studies highlight that when comparing goals and academic performance, mastery goals show a stronger link to academic performance than performance goals. However there are more factors at work than simply two forms of goals. Many of these studies do not separate the difference between performance-approach and performance-avoidance goals. This lack of distinction in performance goals has led researchers to question previously held beliefs about their true effects on student performance. A revision of goal theory highlights that there are vital differences between performance-avoidance and performance-approach goals and they cannot be lumped together into one category. In this revisionist view of goal theory, Senko and Harackiewicz (2001) demonstrated that performance goals, when separated by ability and approach, can show positive connections to academic performance depending on the academic beliefs of the student. These academic beliefs include interest in the topic, motivation, and self-efficacy.

When compiling new revisionist research with long standing data about goal orientations there are competing theories into which type of goals produce the strongest connections to

academic performance (Harackiewicz et al., 2002a; Senko & Harackiewicz, 2001). However what is common in all of these studies is that there is no strong evidence that shows how the connection between goals and academic performance is created. Did the strong academic performance lend students to adopt mastery goals or did having mastery goals lead to strong academic performance? The same argument can be made for the different type of performance goals. The mediating factors between goals and academic performance need to be examined to determine how a student determines her/his goal orientation. In order to investigate the connections between goals and academic performance we must look at the internal and external factors that contribute to goal orientation.

Internal beliefs. Internal beliefs encompass multiple facets of how a student views her/his academic ability. These beliefs include self-efficacy, motivation, previous experiences, and interest just to name a few. Because the link between goal orientation and academic performance has not been previously defined, many researchers are looking into how or if these internal beliefs become mediating factors between what type of goals are valued and the academic performance associated with them. When students are interested in a topic, they are more apt to adopt a mastery goal. They want to learn about the topic because it interests them not simply because of the grade they will receive (Urdan et al., 1998). In this situation a student could perform poorly yet still have a mastery goal mediated by the internal belief of interest in the subject. In another instance of internal beliefs mediating goal orientation, a student could be motivated by the desire to not demonstrate failure in the classroom. This student would adopt an ability-avoidance goal and would work hard just to make sure she/he passed the next test. In this case the student performed well yet was oriented to an ability-avoidance goal. Internal beliefs are mediating factors in goal orientation but are difficult to research due to their intrinsic nature.

19

While researchers acknowledge their influence in goal orientation, they focus more on external factors that can be controlled and altered.

      Social beliefs. Social climate and culture are external factors in goal orientation and are more widely researched in goal orientation theories than internal beliefs. Students tend to adopt the goal structure that is promoted by the culture they identify with, be it their peer group, their parents, or their school (Høigaard, Kovač, Øverby, & Haugen, 2015; Maehr & Anderman, 1993; Wentzel & Wigfield, 1998). However many of these cultures support competing orientations which can lead to fluctuating ideas of the importance of goals in the student. In a 2010 study, Friedel et al. examined the change in goal orientation of middle school students. This study is important because it takes place during a transition period for many students. During middle school, teachers and parents begin to shift more importance towards grades and academic performance due to the oncoming transition into high school. Because most students model the beliefs modeled by their parents and teachers, they began to adopt more performance goals at the expense of mastery goals. By the end of middle school, students demonstrated a significant decrease in mastery goal orientation and an increase in performance goal orientation.

      How a school advocates goals is of vital importance in the goal orientation of the student. Multiple studies have found that students tend to adopt a similar goal structure to the one promoted at their school (Maehr & Anderman, 1993; Midgley et al., 1998; Urdan et al., 1998). Schools and classrooms that promoted personal improvement and intrinsic motivation tended to have more students adopt mastery goals whereas schools promoting competition and comparison led students to adopt performance-approach and performance-avoidance goals (Høigaard et al., 2015). The school culture that students find themselves in do not directly dictate the goals that they choose but they do combine with internal beliefs to influence their orientation and this goal

orientation has lasting impacts in their academic career. The goal orientation that a student

adopts can have multiple effects not only on academic performance but also behaviors and

perseverance.

Impacts of Goal Setting

Many surveys have been conducted to determine a student's goal orientation, but the

goals themselves do not inherently cause academic performance to increase or decrease. Instead

the goals intersect with many mediating internal and external factors that impact a student's

academic progress in both negative and positive ways. These factors can manifest through

external behaviors and through intrinsic motivation.

Behaviors and perseverance. Both positive and maladaptive academic behaviors are

consistently linked with goal orientations. Students who adopt performance-avoidance goals

tend to exhibit handicapping behaviors. (Midgley & Urdan, 2001; Urdan et al. 1998) These

students tend to avoid asking for assistance in the classroom, put off studying, or hang out with

friends to have a reason to explain poor performance should it occur. These handicapping

behaviors are extremely maladaptive because they preclude a student's chance to perform to

their ability. A student who is capable of academic success limits their performance by not

achieving at the level they are capable of. If a student performs at a level lower than they

expected, their self-handicapping behaviors are justified and a cycle of maladaptive behavior

continues.

In looking at behaviors associated with goals it is important to delineate between

performance-approach and performance-avoidance goals. While both performance goals are

linked to extrinsic motivations (proving superior ability over peers or desire to avoid showing

deficiency) they differ in the behaviors that are exhibited by the students who adopt them. While

many students who are performance-avoidance oriented adopt maladaptive academic behaviors like self-handicapping, students who adopt performance-approach tend to show positive academic behaviors like increased motivation. This increased motivation is due to the desire to out-perform their peers which leads these students to continue to work through challenges, persevere, and spend increased time on the topic at hand (Schunk, 1985; 1990). Motivation and perseverance are also behaviors demonstrated by students who adopt mastery goals however the reasoning behind these behaviors is slightly different. Students who adopt mastery goals tend to have high interest in the topic which increases their intrinsic motivation for learning. They persevere through challenges because they are curious and interested into mastering the topic rather than demonstrating academic ability. Regardless of the performance-approach or the mastery goal, these students exhibit positive academic behaviors. The ability to persevere through challenges allows students to reach their academic potential as opposed to limiting it through self-handicapping and maladaptive behaviors. Thus the goal-orientation that a student adopts is connected to the type of behaviors they exhibit. These factors are all connected in increasing academic performance.

Academic Performance. The behaviors exhibited by students are valued or devalued in their connection to academic performance. Behaviors that lead to better performance are positive and behaviors that limit academic performance are maladaptive. Academic performance is defined in many different ways such as through course grades, unit tests, and GPAs. Researchers have sought to attribute specific goals to increased academic performance. Multiple studies show connections between mastery goals and academic performance but there are competing results when it comes to performance goals (Bong, 2001; Harackiewicz et al., 2002b). This is due to the fact that some researchers do not separate performance-approach and

22

performance-ability goals. When they are linked together performance goals rarely correlate with academic performance yet when separated there are mixed results that show limited or even positive connections between performance-approach and academic performance (Bong, 2001; Harackiewicz et al. 2002b). Underlying the competing data between which goal orientations produce the highest academic performance is the question of which variable is actually influencing the other. Does the academic performance inspire the goal orientation or does the goal orientation increase academic performance? Goals and academic performance are connected but it is difficult to examine which way the connection flows. So while the end goal of most research is to examine the connection between goals and academic performance, the mediating factors of beliefs and behaviors could have more impact than the goals themselves.

Connecting Self-Efficacy and Goal Orientation

Research has demonstrated that goals are an important variable in academic performance. However, students internalize their own goal orientations much like their beliefs about their self-efficacy. Because self-efficacy and goal orientation are internal constructs, it is important to determine ways for external agents, like teachers, to influence positive efficacy and goal beliefs.

Changing Internal Beliefs about Self-Efficacy and Goal Orientation

Countless studies have shown the connection between positive self-efficacy beliefs and academic performance as well as mastery and performance-ability goal orientations and academic performance. However not all students enter high school with these types of goals or positive opinions of their self-efficacy. How can we increase self-efficacy in high school students? By combining previous research about goal orientation and self-efficacy, links can be studied to determine possible ways to positively change student's internal beliefs about their ability.

While mastery goals have shown the most consistent connection to positive academic performance, they also are harder to instill in students from an outside agent, especially once they have entered high school (Friedel et al. 2010; Harackiewicz et al. 2002b). This is due to years of previous experiences and attitudes as well as increased pressure to perform on high-stakes tests. Research on performance-approach goals shows more promise in allowing external agents, like teachers, to influence student's goal orientation. The lack of dedicated research specifically on performance-approach goals also demonstrates a need to investigate this area of goal orientation on academic performance.

A possible way for teachers to encourage performance-approach goal orientation in the classroom is by promoting interim goals. Interim goals represent a short term subgoal that students can judge themselves on as they work to a larger goal that takes a longer time to achieve (Bandura & Schunk, 1981). According to Bandura and Schunk, interim subgoals "provide immediate incentives and guides for performance, whereas distal goals are too far removed in time to direct what one does in the here and now" (1981, p. 587). Many students with low self-efficacy have difficulty in seeing long term success and thus adopt performance-avoidance goals leading to poor academic performance. Promoting interim subgoals allows students to have immediate insight to gauge their capabilities. By mastering a small concept, students feel more efficacious and become more motivated and willing to persevere through challenges (Schunk, 1985). The mediating behaviors and beliefs associated with positive self-efficacy could be increased through interim goal setting (Schunk, 1990).

Summary

School and classroom culture has a significant effect on the type of goals adopted by students in the classroom. Teacher interaction is also a vital component of how students view

24

their ability and judge their self-efficacy. The impact of the role of the teacher in both of these areas cannot be understated. The more self-efficacious a student feels, the more positive academic behaviors they exhibit leading to higher academic performance. Research needs to examine how teachers, as external agents, can foster increased self-efficacy in their students. While a teacher cannot simply tell a student to feel more efficacious, they can advocate for a positive goal structure in the classroom through promotion of interim goals. The lack of research between interim goal setting as a mediator to increased efficacy and performance-goal setting in high schoolers makes examination of the connection of these variables extremely important in both goal and self-efficacy theory.

Chapter 3: Methodology

Introduction

After determining the need for research into interim goal setting and self-efficacy, I needed to decide the most appropriate way to investigate the connection. Goal theory and self-efficacy have been examined in both quantitative and qualitative frameworks depending on the viewpoint of the researcher. Below I explain and justify reasoning for conducting a quantitative study through a postpositivist lens. I then describe my empirical pre- and post-test design to examine change in efficacy levels after a treatment of goal promotion is administered to students in mathematics classrooms.

Background of the researcher

Postpositivism

To study how self-efficacy can increase in high school students I wanted to examine how different factors, in this case interim goals, affect changes in self-efficacy perception. The study of how self-efficacy can increase in high school students needs to be carried out by identifying and isolating other factors that affect the perception of their self-efficacy. Identifying and isolating these factors allows the researcher to determine the influence of interim goal setting on self-efficacy. Like all postpositivist research, this study is based on theories, in this case social cognitive theory and goal achievement theory. Positivist and postpositivist researchers believe in the value of the scientific method, which is the idea that a truth is determined after all other possible explanations have been explained through trials and observations. However, the greatest distinction between positivism and postpositivism is that for the positivist researcher once a truth has been discovered it is unchanging, whereas the postpositivist researcher believes and accepts the idea that truths can change based on the acceptance of the theories they are based on. Thus if

the theory that the truth is based in changes, then the truth itself must be reevaluated. Postpositivism emerged from positivism through the writings of Kuhn (1962/2012). Kuhn argued for the idea of paradigm shifts, which is the idea that objective truths are not infinite and unchanging but rather are given their power as truth based on the consensus of the scientific community and the theories in which the truths are based in. In other words, what this means for a postpositivist is that objective truths are attainable but only stay truths based on the acceptance of the community and theories in which they are defined.

Due to the nature of community acceptance, methodology in a postpositivist framework must account for every possible alternative that might discredit the findings of the study. In the research process itself, positivist and postpositivist researchers agree on scientific methods. This shared mindset on empirical scientific methods almost always leads to quantitative research because it allows the researcher to explain any other alternatives with objective values as opposed to interpreting qualitative narrative sources, which can be analyzed in a variety of ways leading to different conclusions (Phillips & Burbules, 2000). A quantitative experimental researcher is looking for a cause and effect relationship (Cross & Belli, 2004).

The truth, found at the end of a cause and effect study gains strength based on the methods. The stronger the methods, meaning how well the researcher accounted for any other variables effecting the direct relationship of the original variables being studied, the stronger the argument can be made for the cause and effect nature of the findings. Through thorough investigation of the variables, positivist and postpositivist researchers arrive at a truth having explained away any other alternatives. However, the difference between the positivist and postpositivist researcher comes after the research concludes. I accept Kuhn's (2012) theory of paradigm shifts, meaning that the findings of this research are only as valid as the theories they

27

are based on. If later researchers put more value in new theories that undermine the current ones I am working in, then new research would need to be conducted based in the boundaries of those newly accepted theories. Thus, truths could be redefined and framed by the new paradigm in which they are studied in. However, since this study is grounded in the currently accepted theories of social cognition (Bandura, 1977, 1997, 2002) and goal achievement (Bong, 2001; Maehr & Anderman, 1993), my research seeks to determine value and truth within the boundaries of these theories. Future studies do not detract from truth that can be explained now. Through scientific methods, I can determine truths in the current research paradigm.

Importance of Experimental Research in Education

While experimental research is used as a basis for many educational policies, it is outnumbered by the amount of qualitative educational research being published (Biesta, 2007; Cross & Belli, 2004; Hushman & Marley, 2015; Luke & Woods, 2009). In their meta-analysis of self-efficacy research, Honicke and Broadbent (2016) analyzed 59 studies from 2003 to 2015 and found that only 8% were experimental or quasi-experimental designs. Both experimental and non-experimental research is important in education, but the current review of research indicates a lack of publications of experimental and quasi-experimental research. Using quasi-experimental methods helps provide new data in self-efficacy research using data-analysis techniques to search for cause and effect relationships. Though, in the social sciences it may be more accurate to use the term functional relationship as opposed to cause and effect relationship (Sealander, 2004). A functional relationship is a causal relationship where it is difficult to quantify the full effect of the independent variable. Due to many extraneous variables found in educational research, even the most well designed experiment cannot account for every possible variable. However, experimental educational research can provide data for foundational

relationships between independent and dependent variables. This quasi-experimental design will provide important foundational relationship data on self-efficacy and goal research where there is currently a lack of published material.

Sample Design

This study is based on a pre- and post-test quasi-experimental design where one group will receive the implementation of a teacher-promoted goal script and the other group will not receive the goal promotion intervention. I discuss details of the methods, data collection, data analysis, and considerations of extraneous variables below.

Research question

The research question that drove this study is the following. What is the effect of teacher promoted interim goals on the mathematics self-efficacy of high school students? This question was further broken down into three subquestions

1) Is there a difference between reported mathematics self-efficacy for students who receive interim goals from their teachers and those who do not?

2) Is there a difference in reported mathematics self-efficacy between the four subgroups of mathematics self-efficacy for students who received interim goals from their teacher and those who did not?

3) What is the effect size of reported mathematics self-efficacy for students who receive interim goals from their teachers

Instrumentation

I measured the student's self-efficacy using an 11statement survey which is modified from the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich, Smith, Garcia, and McKeachie (1991). Pintrich et al. developed the questionnaire over a five year

period and was subjected to numerous variations to determine internal reliability and validity. In creation of each section, Pintrich et al. used duplicate question statements to create internal reliability. Meaning they phrased sentences in multiple ways that all asked about the same construct, for example self-efficacy. Then those similar questions were paired together to see if a subject answered the same way for each question to make sure the wording of the questions was uniform into what was being asked. Validity was determined using Cronbach's alpha which was high with results ranging from .52 to .93 based on each sub category. Since 1991, the MSLQ has been the most widely used measure to determine student self-efficacy (Honicke & Broadbent, 2016). The MSLQ consists of 81 total statements that students answer on a 7 point Likert-scale. Each of the 81 questions is separated into six categories and each category can be individually administered without lessening the reliability and validity of the score (Pintrich et al., 1991) Students rate themselves on each statement where the lowest value of one refers to "Not true of me at all" up to seven which represents "Very true of me."

For this survey, the self-efficacy questions were selected from the entire pool of the MSLQ and modified to contain wording applicable to high school mathematics students. For example, language about "keeping up with class readings" was changed to "keeping up with homework" to more appropriately mirror high school mathematics classrooms. An eleven question survey was used to measure self-efficacy at the start and end of the study (see Figure 1). Students responded to the eleven statements on a seven-point Likert scale where seven represent very true of me and one represented not true of me at all. These eleven questions can further be broken down into four main areas of self-efficacy. Questions seven and eleven were classified as efficacy beliefs about homework completion. Questions two, three, and nine were classified as efficacy beliefs about mathematics assessments. Questions one, six, and ten were classified as

efficacy beliefs about in-class engagement. Questions four, five, and eight were classified as internal or personal efficacy beliefs about mathematics ability.

I also coded the survey to allow for a more thorough analysis when comparing efficacy changes in relation to the goal script intervention. Students will receive an overall self-efficacy score based on the average of each question. Then the overall average was broken down into four codes representing four areas of self-efficacy. The four codes for each of the statements were: personal self-efficacy beliefs, homework completion beliefs, upcoming assessment beliefs, and in-class engagement beliefs. The last three categories allowed me to disaggregate the data based on specific goal treatments given during the intervention.

Figure 1
Self-Efficacy Survey Questions

1. I feel confident enough to ask questions in my mathematics class

2. I believe that I have good mathematics studying practices

3. I believe I can do well on a mathematics test

4. I believe that I will get a good grade in this mathematics class

5. I believe that I am a person who is good at mathematics

6. I believe that I can complete all the classwork assignments for this class

7. I believe that I can complete all the homework assignments for this class

8. I believe I can understand the content in this mathematics course

9. I feel confident when taking a mathematics test

10. I stay focused when working on mathematics in class

11. I believe I can complete mathematics homework assignments on my own

Population

The population for this study are students at a suburban high school in the southeastern United States. The school has a population of about 1,900 students made up of 42% white

students, 31% Black students, 16% Hispanic students, 7% Asian students, and the remaining reporting as multi-racial. Additionally, 43% of the population classifies as economically disadvantaged along with 6% being classified as Limited English Proficient, and 13% of the population classified as remedial. Students receiving special education service account for 13% of the population (GOSA, 2014). I selected this school because of its diversity and location.

Time frame

This study will measure the change in student's self-efficacy over a four-week period. The length of time was based on the time it would take to typically cover more than one unit of study. That way if there is a change in self-efficacy it cannot solely be attributed to performance on a single unit but rather over the length of multiple and differing mathematical concepts and units of study. An ideal study would last over the entire course but time restraints limit the study to a one-month period. This will allow students and teachers the month of August to adjust to the new school year before immediately participating in the study. Also the month of September is free from any high-stakes testing which could be an influencing factor on student mathematics self-efficacy.

Participant Selection

Nine teachers were recruited to take part in the study. These teachers ranged from ninth through twelfth grade as well taught multiple courses including Foundations of Algebra all the way up to Pre-Calculus. Each teacher had two classes of the same subject. The two classes were comparable, meaning that a teacher who teaches Algebra 1 first block and honors Algebra 1 third block would not be eligible for participation. Having the same teacher with the same course at the same level helps account for confounding variables of teacher preference and level of mathematics course. I recruited nine mathematics teachers who fit these criteria and were

willing to participate in the study. This number of teachers allows for replication of the data

procedure to allow for more robust data for analysis. This produced an n = 377. One class was

randomly assigned to be the control class and the other class was the intervention class.

Sample Characteristics

This study was conducted in a southeastern suburban high school in the United States.

Nine mathematics teachers were recruited to administer the treatment of the goal script to their

students over a four-week period. The classes were already formed so a true randomized

experiment was not possible. However, each teacher had a control and an intervention class both

of which were classes in the same subject. For example, an equal number of Algebra 1 control

classes were compared to an equal number of Algebra 1 intervention classes. Students and

parents were given a description of the study prior to data collection and informed consent forms

were collected from students, parents, and teachers. Due to some students electing to not

participate in the study and pre-made class rosters, 189 students received goal treatment and 188

served in the control classes for a total of 377 participants.

Implementation of Treatment

For each teacher selected for the study, one class was the control group (with no

prescribed interim goal promotion by the teacher) and the other class was the intervention group

which received interim goal promotion rhetoric delivered from a daily script read by the teacher.

To isolate the variable of interim goal setting, the script focused on short term markers that are

non-content specific so results can be generalized across the various mathematics classrooms. In

the intervention class, teachers were given goal scripts that covered three different topics:

Homework completion, preparations for an upcoming assessment, and in-class engagement. As

illustrated in Figure 2, the scripts were no longer than three sentences, defined the interim-term

goal, and had repeated usage of the word goal. Each day teachers would mark which goal they said and if they said it at the beginning, middle, or end of class. They were also instructed to write down if there were any major differences between the control and intervention class that affected the daily instruction, for example a fire drill, class assembly, or other class disruption.

The three topics each represent a short term interim goal that can lead to performance-approach goals. For example, homework completion is a short term interim goal that is a piece of a larger performance-goal (like an increased understanding on a topic or a higher grade on a test). Each script was no longer than three sentences and teachers delivered them either at the beginning, middle, or end of class. The length of the script was kept short so that it did not take away instructional time from the class and was easy to deliver every day. The teachers recorded which of the three scripts she/he read each day over the four week period.

Figure 2
Teacher goal scripts

☐ **Homework Completion**
"Remember that our goal is focusing on completing all of the homework tonight. It is important to try every problem. Use your notes and practice problems to help if you get stuck but remember to attempt every problem. This is the goal"

☐ **Preparation for upcoming assessment**
"Remember that our goal is to be preparing for our next assessment (say the date). Preparing means you work through problems, go to tutoring, and review vocabulary. Our goal is to be reviewing each night to prepare for the assessment"

☐ **In-class engagement**
"Remember that our goal is to focus on staying on task all period. That means we are trying every problem, asking and answering questions, and avoiding off-task behaviors. Our goal is to maximize our in-class engagement"

Data Collection Procedures

At the beginning of the study, students took the modified mathematics MSLQ to establish a baseline of their self-efficacy and goal-orientation. The researcher administered the survey to every student in the study. Student anonymity was kept by allowing students to take the survey with only the identification of their student number, removing their name from the results. After student participants answered the modified mathematics MSLQ the teachers implemented the interim goal treatment script mentioned earlier over four weeks to one of her/his randomly selected classes while the other class will not receive the teacher goal script.

Data was collected over a four-week period one month into the semester. This time period was selected because it was still early enough in the semester that there would not be a major change in efficacy from the start of the school year but also long enough into the semester that students are beginning to learn new material and not simply working on review material from the first few weeks of school. The four-week time frame for data collection was used because it represents the typical amount of time needed to cover more than one unit in a high school mathematics classroom. This way, data would be collected as students learned more than one topic. If a change in efficacy occurred, it is unlikely to be attributed to simply performance on one single topic but rather multiple mathematics concepts, or in other words, the mathematics course as a whole.

Each teacher was encouraged by the researcher to teach each class similarly with the only main difference being the goal script for the prescribed class. I understand that the teacher cannot teach each class identically. A data collection form was given to each teacher. At the end of each day the teacher identifies which of the three scripts she/he read from and if there were any major differences in the teaching structure between the classes that day. This could include,

but was not limited to, losing time due to a fire drill or assembly, the teacher being absent, an observation from an administrator, or any other similar type of classroom disruption. It also included a daily attendance sheet to account for students who were absent. Since education is a fluid structure, the daily collection form allowed me as the researcher to identify and hopefully isolate confounding variables.

At the end of the four weeks, I returned to the classroom and re-administer the modified mathematics MSLQ. Again, students took the survey using their student numbers to ensure anonymity.

Data Analysis

A repeated measures ANOVA was conducted by the researcher to determine if there was any significant change in reported self-efficacy from the beginning of the study to the conclusion of the study. The between factor will be with the control and non-control classes and the within-subjects factor will be the four-week time frame. These factors will allow for comparison between control and non-control classrooms to determine if there is a significant change in reported self-efficacy in the classrooms that received the goal treatment.

Due to the structure of the modified mathematics MSLQ, I was also able to look for any significant change in self-efficacy specifically related to the three different goal scripts.

Limitations

Due to the fluid nature of teaching, there are multiple variables that cannot be fully controlled for in a classroom setting. I mentioned above how many of the variables were accounted for. For example, teachers marked on daily log sheets if any major differences occurred between the two classes. Each teacher will have a goal and non-goal class to isolate the variable of the teacher. For example, some students might have a rise in self-efficacy because

they enjoy the teacher, not because of the goal promotion. Also, teachers will be compared using two of the same class subject to isolate the variable of higher vs. lower level of mathematics class. Interim goal promotion in an advanced placement class could produce different results than interim goal promotion in a remedial algebra class. The variable of the different mathematics class will be examined as a covariate during data analysis. Data collection procedures were designed by the researcher to account for the anticipated confounding variables. Through extensive data collection techniques, the data was analyzed by isolating these extraneous factors to focus on the possible significance of the treatment of interim goal setting on student's self-efficacy.

Summary

This chapter discussed the methodology for this study. The study was designed from a postpositivist framework with scientific methodologies. Data was collected over a four week period using a pre- and post-test mathematics efficacy survey. Students were separated into groups that received daily goal promotion or no daily goal promotion. I minimalized external variables to allow for direct examination of goal promotion and self-efficacy change. The limitations that were present have been acknowledged and factored into commentary in the analysis of the data which will be discussed in the next chapter.

The table has Pre-test and Post-test spanning columns, each with N, M, SD.

Chapter 4: Findings

Introduction

After conducting data collection, I analyzed the data to look for trends in descriptive statistics as well as finding significance in a repeated measures ANOVA test. These tests were run to answer the research question: What is the effect of teacher promoted interim goals on the mathematics self-efficacy of high school students?

Effects of Interim Goal-Setting on Mathematics Self-Efficacy

A repeated measures ANOVA was conducted with all students to see if significant gains in efficacy occurred in classes that received goal intervention compared to classes that did not. The data was then further broken down into subgroups of specific goals and specific teachers.

Table 1
Descriptive Statistics from Self-Efficacy Survey

	Pre-test			Post-test		
	N	M	SD	N	M	SD
Control	188	5.242	1.091	188	5.276	1.158
Goal Intention	189	5.039	1.147	189	5.253	1.113

The repeated measures ANOVA was conducted with time as a within-subjects factor. The main interaction effect of time*group was found to be significant ($F(1,375) = 4.649$, $p = .032$, partial $\eta^2 = .012$) (Table 2). This indicates that students in the intervention class showed a significant increase in self-efficacy over four weeks in comparison to students who did not receive goal intervention. The significant interaction effect means that we can reject the null hypothesis of the first research question that there is no difference between reported mathematics self-efficacy for students who received interim goals from their teachers and those who did not.

Table 2
Analysis of Variance Summary

Source	Sum of Squares	DF	Mean Square	F
Within	1.549	1	1.549	4.649*
Error	124.946	375	.333	

p < .05

Due to the quasi-experimental nature of the study, there was a difference in pre-test scores between the intervention and the control groups. As can be seen in Figure 3, the intervention group made significant increases in reported self-efficacy compared to the control group. This indicates that teacher goal dialogue can significantly increase mathematics self-efficacy.

Figure 3
Change in Self-Efficacy from Pre to Post test
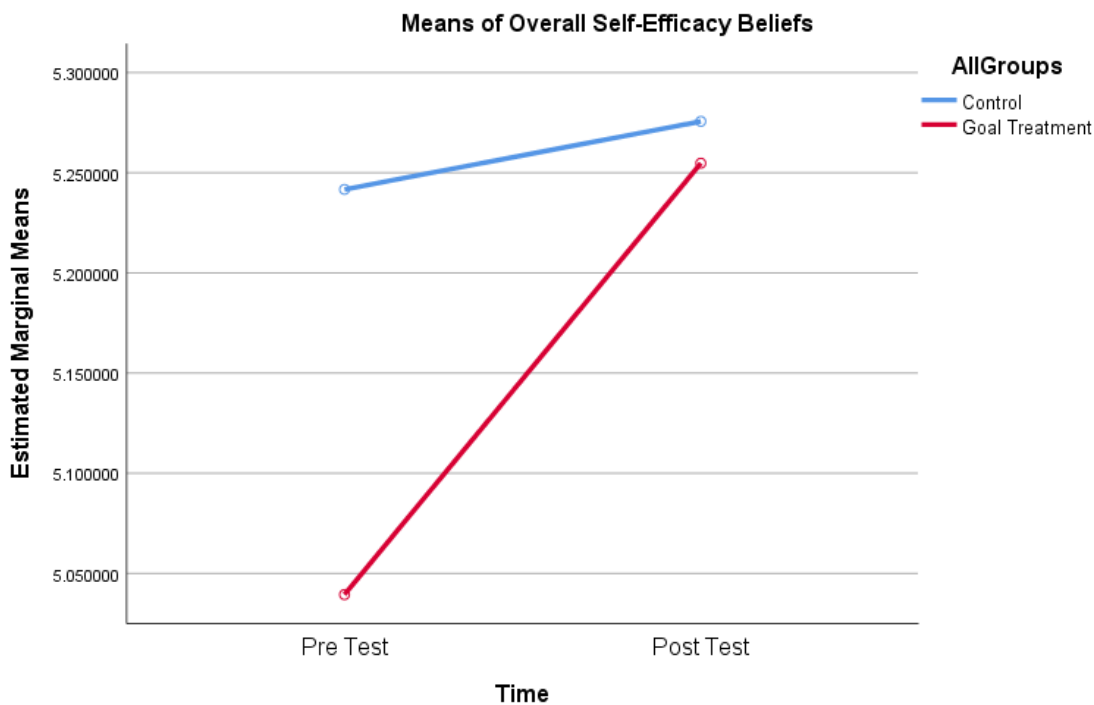
After running a repeated measure ANOVA, I also ran two univariate repeated measure ANOVAs to look for significance in each group itself. The simple main effect of the control

group showed no significance ($F(1,187) = .347$, $p = .557$) whereas the simple main effect of the treatment group did show significance ($F(1,188) = 12.402$, $p = .001$). This data demonstrates that the treatment of interim goals shows a significant increase on self-efficacy when pretest and posttest are compared. The pretest and posttest difference was not significant for the control group.

Changes in Specific Self-Efficacy Beliefs

In addition to looking for significance in change of the overall self-efficacy score, a repeated measures ANOVA was also conducted on each sub category of self-efficacy. These were beliefs about homework completion, mathematics assessments, in-class engagement, and personal mathematics beliefs (see Table 3).

Table 3
Descriptive Statistics for Sub Categories of Self-Efficacy Study

	Pre-test			Post-test		
	N	M	SD	N	M	SD
Homework Completion						
Control	188	5.096	1.307	188	5.138	1.356
Goal Intervention	189	4.901	1.303	189	5.092	1.295
Mathematics Assessments						
Control	188	5.531	1.157	188	5.410	1.275
Goal Intervention	189	5.286	1.244	189	5.437	1.255
In-Class Engagement						
Control	188	5.482	1.208	188	5.488	1.214
Goal Intervention	189	5.236	1.262	189	5.464	1.204
Personal Mathematics Beliefs						
Control	188	5.115	1.285	188	5.216	1.291
Goal Intervention	189	4.821	1.380	189	5.091	1.266

No significance in interaction was found in homework completion ($F(1,375) = 2.124$, p =.146, partial $\eta^2 = .006$) or personal mathematical beliefs ($F(1,375) = 2.893$, p =.09, partial $\eta^2 = .008$). However, a significant increase was found in the interaction effect of time*group in beliefs about mathematics assessment ($F(1,375) = 6.680$, p =.01, partial $\eta^2 = .018$) and in-class engagement ($F(1,375) = 4.540$, p =.034, partial $\eta^2 = .012$) (Table 4).

Table 4
*Analysis of Variance Summary for Self-Efficacy Sub Categories*

	Sum of Squares	*DF*	Mean Square	*F*	Sig.
Homework Completion	1.031	1	1.031	2.124	.146
Error	182.068	375	.486		
Mathematics Assessments	3.515	1	3.515	6.680	.01*
Error	197.342	375	.526		
In-Class Engagement	2.327	1	2.327	4.540	.034*
Error	192.189	375	.513		
Personal Mathematics Beliefs	1.187	1	1.187	2.893	.09
Error	151.835	375	.410		

*$p < .05$

When comparing the means and looking at the graphs of change over time, the efficacy beliefs about assessment actually dropped for the control group. This was the only sub category that had a drop in efficacy beliefs. While many factors could have led to this drop, it is possible that without teacher promoted goal structure about assessments, students internalized negative vicarious experiences about assessment data during this time frame leading to a drop in efficacy in this category (See Figure 4).

Figure 4
Change in Self-Efficacy in Assessment Beliefs
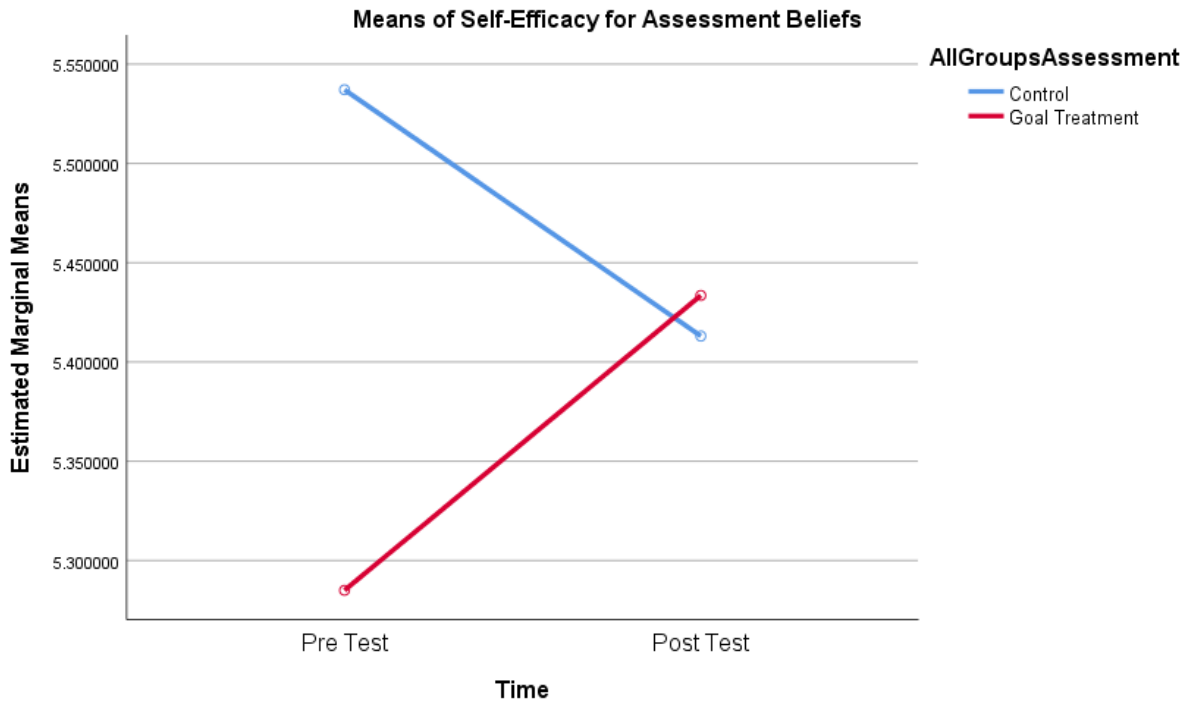
The other subcategory that had a significant change between the control and the intervention

group was in-class engagement. There was little change in the reported efficacy of the control

group but a significant change for the intervention group. A repeated measures test showed that

students in the goal intervention class showed a significant improvement in efficacy about in-

class engagement ($F(1,189) = 8.373$, $p <.004$, partial $\eta^2 = .043$), where there was no significance

found in students in the control class ($F(1,188) = .006$, $p =.938$ partial $\eta^2 = 0$). The effect size

for the goal treatment showed a medium effect whereas there was little to no effect in the control

class. This particular efficacy belief can be impacted greatly by the use of social persuasions,

which in this case are the teacher promoted goals (see Figure 5).

Figure 5
Change in Self-Efficacy in for In-Class Engagement
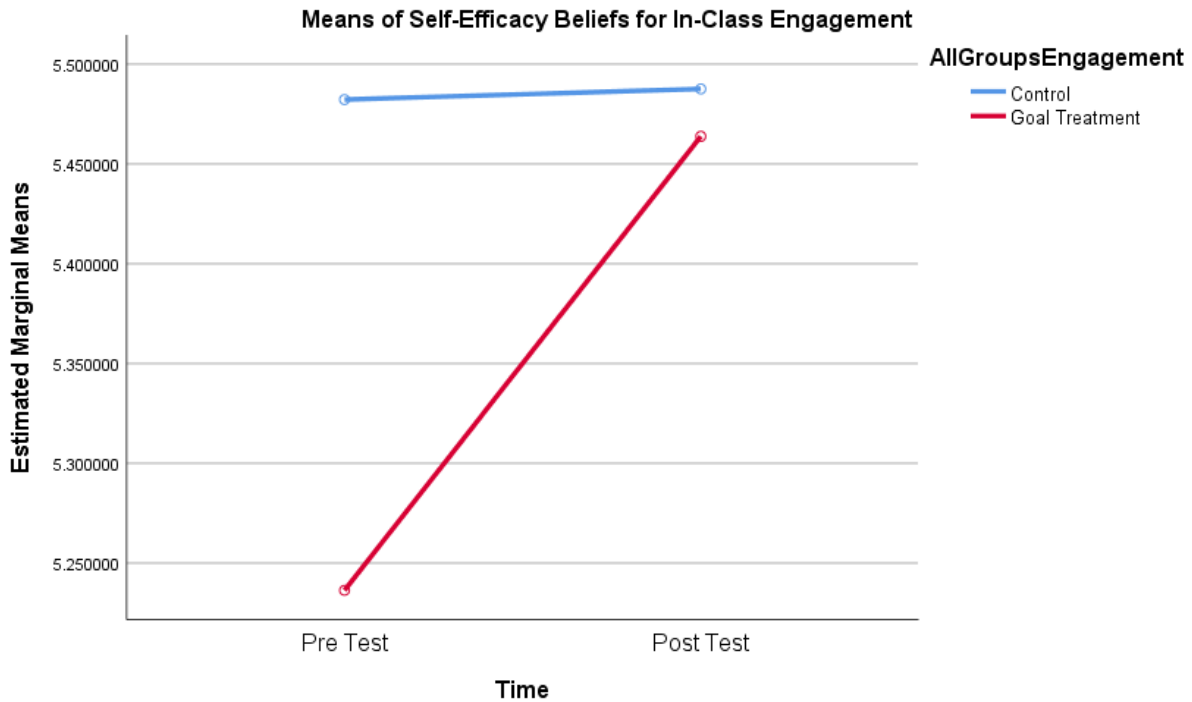
For each sub category (except assessment beliefs) the intervention group did not surpass the mean of the control group. However, this study is not meant to have one group report higher self-efficacy than the other, but rather demonstrate that the treatment of goals has a significant effect on change in self-efficacy. Increases in overall efficacy as well as in two of the four subcategories demonstrates that the students who received goal interventions from their teachers significantly increased their mathematics efficacy as compared to their peers who did not receive directed goal dialogue. So in relation to my second research question and hypothesis we can reject the null hypothesis that there is no difference in reported mathematics self-efficacy between beliefs about assessments and in-class engagement however we cannot reject the null hypothesis for the other two efficacy subgroups of homework completion and personal mathematics beliefs.

Frequency and Effects of Specific Goals

Further investigation was conducted on the frequency and use of the different goal scripts used by the teachers. Teachers were allowed to choose which of the three goal scripts they said each day based on whatever was most appropriate for their students. This was to increase the applicability of the study to both the teachers and the students. For example, goals about homework completion would not be useful if there was no homework assigned that day. The teachers could also choose to give the script at the beginning, middle, or end of class and some even gave the goal dialogue multiple times per class. The most commonly used goal script was about upcoming assessments which was given 36% of the time. This is interesting because the sub category of assessment beliefs had the highest increase in self-efficacy among students in the intervention group. However, it would be faulty to assume there is a direct correlation as the other two goal scripts had similar percentages (Homework completion 33% and In-Class engagement 31%) of use amongst the intervention classes without a direct connection to significant efficacy change. What is important to note is that all three of the goal scripts were given at similar frequencies over the four week period and the overall efficacy of the intervention classes increased. This indicates that it is not necessarily a specific goal script that is needed to increase efficacy but rather any applicable short term goal.

A second factor to consider with the goal treatment was the frequency in which it was given, for example once a class period or multiple times per class period. When analyzing data on efficacy changes by specific teacher, only one teacher showed significance in such a small sample space. This teacher showed a significant increase the interaction between time*group in personal beliefs ($F(1,41) = 5.939$, $p = .019$, partial $\eta^2 = .127$) and in-class engagement beliefs ($F(1,41) = 4.327$, $p = .044$, partial $\eta^2 = .095$). In looking at the simple main effect for personal

beliefs ($F(1,22) = 11.002$, $p =.003$, partial $\eta^2 = .344$) and in-class engagement ($F(1,22) = 5.811$,

$p =.025$, partial $\eta^2 = .217$) both treatment classes had a large effect size compared to a little to no

effect size in the control classes ($\eta^2 <.01$) . This teacher also gave the goal dialogue more

frequently than any other teacher other the four week period with 41 recorded uses of the script

compared to the next highest teacher with 26 recorded uses. The more repetitions of the goal

script could indicate that more frequent uses of short term goal dialogue could create significant

efficacy changes even in small settings like a single classroom.

The Effects of Treatment Based on Self-Efficacy Pre-Test Scores

While most of the previous data analysis has focused on the interaction between the

treatment and control group, I found it important to look at the changes with the treatment group

itself. Specifically, were there significant changes in efficacy based on the initial pre-test scores?

In other words, did students who scored a low pre-test score show a higher increase in efficacy

than students who scored in the medium or high range on their original efficacy.

I categorized the students into three groups based on their original efficacy score. The

three groups were categorized as Low Efficacy (average scores less than or equal to 4), Average

Efficacy (average scores greater than 4 but less than 6), and High Efficacy (scores greater than or

equal to 6 and up to the maximum level of 7). These levels were based on splitting up the 7-

point Likert scale used in the survey. Due to the nature of a 7-point survey, the three levels

could not be evenly split up between the seven integers so I broke the levels into groups that

most closely linked the value of the integer with the student's responses.

Out of the 189 students in the treatment group, 41 students were classified as low

efficacy, 107 were average efficacy, and 41 were high efficacy. A repeated measures test

showed that only the low efficacy students showed significant improvement in efficacy ($F(1,40)$

= 25.557, $p < .001$, partial η^2 = .371), where no significance was found in the average ($F(1,106)$

= 2.378, $p = .126$, partial η^2 = .022) and high efficacy groups ($F(1,40)$ = .248, $p = .621$, partial η^2

= .006) (see Table 5). The effect size for the low efficiency students is large, while the other two

groups had low effect size.

Table 5
Descriptive Statistics and Analysis of Variance for the Effect of Treatment on Low, Average, and High Efficacious Students

	Pre-Test Mean	Post-Test Mean	N	F	Sig.
Low Efficacy	3.36	4.10	41	25.557	.000*
Average Efficacy	5.14	5.26	107	2.378	.126
High Efficacy	6.45	6.40	41	.248	.621

*$p < .05$

Further descriptive statistics show that of the 41 low efficacy students 100% showed

improvement in their efficacy scores whereas only 89% of the average efficacy showed

improvement along with 85% of the high efficacy group. Also important to note is that students

who classified as highly efficacious actually decreased in the mean efficacy score during the

treatment period. The breakdown of the effect of the treatment is very important to the

implications of this research which will be discussed in the following chapter

Summary of the findings

The driving research question of this study is, What is the effect of teacher promoted

interim goals on the mathematics self-efficacy of high school students? A repeated measures

ANOVA indicated that there is a significant increase in mathematics self-efficacy for students

who received an intervention of daily goal dialogue from their teacher. This argument was

strengthened by finding significance in a repeated measures ANOVA on the treatment group and

not finding significance in the control group. Additionally, sub categories of efficacy beliefs

about upcoming assessments and in-class engagement showed a significant increase when compared to students who did not have daily goal dialogue. Goal dialogue frequency also showed a significant increase especially in the context of a single class. In examination of just the treatment group, a greater increase in efficacy was reported in students who originally reported low levels of efficacy compared to their peers who originally reported medium and high level efficacy. In the following chapter, I will lay out the implications of these findings in the context of self-efficacy goal spectrum.

Chapter 5: Discussion

Introduction

This study was designed to see the effects of interim goal setting on the mathematics self-efficacy of high school mathematics students. The findings shown in the previous chapter demonstrate there is a significance in increases in self-efficacy with students who received interim goal treatment than their peers who did not. Furthermore, effect sizes in the treatment group demonstrate there are varying levels of impact of interim goals based on preliminary self-efficacy reports. A theory about the effectiveness of interim goals on self-efficacy will be defined and discussed in the implications of this study which I will define as the Self-Efficacy Goal Spectrum. Through careful analysis of the data, I drew conclusions and determined implications for action and recommendations for further research.

Summary of the Study

This study was created to address the problem of low mathematics self-efficacy in high school students. From this problem, I sought to research if mathematics self-efficacy could increase in high school students and if so, how. Through examination of the literature, positive self-efficacy was commonly linked with students who set high goals for themselves (Midgley et al., 1998; Wentzel & Wigfield, 1998). While the literature showed that there was a common link between the two, there was no research into if the goals themselves affected self-efficacy. Could the goals themselves be a key in making positive changes in mathematics self-efficacy? Schunk (1985) researched short-term (interim) goals in elementary students and the data demonstrated a significant increase in self-efficacy for these young students however, how would interim goals affect self-efficacy in students who already had eight years of previous experiences that shaped their opinions about their mathematics ability? By framing teachers as agents of positive

48

influence through the lens of goal achievement theory I arrived at my research question, What is the effect of teacher promoted interim goals on the mathematics self-efficacy of high school students?

Summary of Data Analysis

A repeated measures ANOVA was conducted on the significant change in reported mathematics self-efficacy between students who received goal promotion dialogue from their teachers and those who did not. The ANOVA test showed that there was a significant increase in reported mathematics self-efficacy over four weeks compared to students who did not receive goal treatment. In looking at the four self-efficacy subgroups (homework completion, upcoming assessments, in-class engagement, and personal mathematics ability) beliefs about in-class engagement and mathematics assessments showed a significant change in the treatment classes compared to the control classes.

The data shows that the group that received daily teacher goal scripts had significant increases in mathematics self-efficacy. This connects to the idea that teachers are positive outside agents on their students and can have a positive influence on student self-efficacy. The concept of teachers as outside agents is central to the theoretical framework of this study based in social cognitive theory. While teachers are unable to control the previous experiences that students have before coming into their classroom, they can affect the culture of the classroom through the values they promote (Bandura, 1997, 2002). In this study, teachers promoted interim goals through daily goal dialogue. This daily goal promotion demonstrated to students that teachers valued these short term goals. In the goal treatment classes, students internalized the daily goal affirmations as a positive and as such the goal treatment classes showed a significant change in efficacy over four weeks than the control classes.

49

When the data was broken down into the four efficacy subgroups, beliefs about mathematics assessments and in-class engagement showed a significant increase between groups. These findings can be attributed to the connection between self-handicapping behaviors and performance-avoidance goals. Students who report low levels of self-efficacy typically demonstrate self-handicapping behaviors, like not studying for tests or acting out in class so if they do not perform well academically they blame it on the behaviors rather than ability. "I didn't pass the test because I goofed off and talked in class, if I paid attention I would have done better." In this way, students view poor academic performance based on actions not ability. These performance-avoidance goals (goals in which students do the bare minimum to get by) are commonly linked to low levels of self-efficacy. However this study showed that efficacy levels of assessment beliefs and in-class engagement rose in classes where teachers promoted short term interim goals. The positive promotion of short term goals encouraged students to shift from performance-avoidance goals to performance-approach goals which had a positive effect on their efficacy. This could be due to the fact that in the goal classrooms, students were reminded to judge their progress on easily monitored daily goals. If a teacher says that the daily goal is to complete all the classwork assignments and the student consistently meets that goal every day for a week then they are less likely to avoid handicapping behaviors because now they have the experience and knowledge that that they can in fact meet those goals. These positive experiences, along with the positive promotion of goals by outside teacher agents, affect two of the three components that influence self-efficacy (social persuasions and previous experiences).

Research has consistently shown the connection between mastery goals and high self-efficacy but in order to increase self-efficacy students must have positive mathematical experiences. Positive mathematical experiences can come from many factors but many of them

are out of control of the teacher. One way to increase the opportunity for students to experience positive mathematical success is by meeting and setting interim goals.

Implications for Action

The Self-Efficacy Goal Spectrum

My overall hypothesis was that interim goals will help students increase their self-efficacy because as students set a short term goal (i.e. completing a daily homework assignment) and they meet that goal, they will now have a positive experience in mathematics. A student would see it like this, "I set a goal to do my homework and I did my homework. I completed a math goal!" This positive experience increases their mathematics efficacy and the more positive mathematical experiences a student has, the stronger those efficacious beliefs become. However, the question arises, do short term goals provide the same impact on students who report low self-efficacy as compared to their peers who are already at average or high efficacy?

This question led to the creation of what I call the Self-Efficacy Goal Spectrum (SEGS) (see Figure 6).

Figure 6
The Self-Efficacy Goal Spectrum (SEGS)
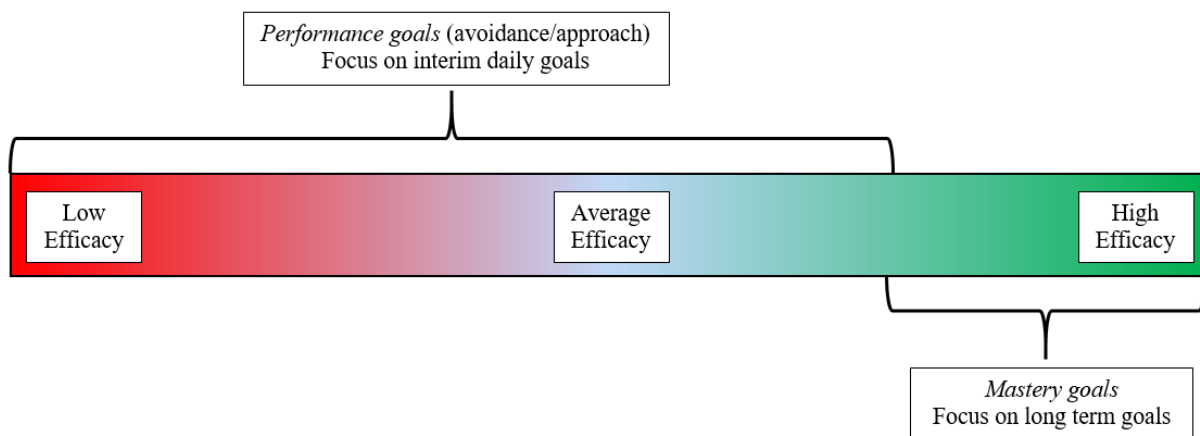
The data showed that students who receive short term goal promotion in the classroom show significant gains in their efficacy, but what if we go deeper into those goals? While the short term goals can help overall, do they help some students more than others? As mentioned in the data analysis, I split the 189 students in the treatment group into three efficacy levels (low, average, and high) based on their pre-test scores. While all the groups showed improvement, only the low students showed significant improvement. I believe this is due to the link between goals and efficacy. Students respond better to goals that match their current efficacy level. The three levels of efficacy that I am describing match up with the three goal levels in goal achievement theory; performance avoidance, performance approach, and mastery goals. Students at the low efficacy level need short term performance goals because they need to experience success in math (Bandura, 1997; Schunk 1985, Zimmerman & Cleary, 2006). These students typically have low self-efficacy because of years of negative experiences in math so quick, realistically attainable goals help those students have positive math experiences which result in increased levels of efficacy.

What happens when the low efficacious students move up the spectrum to average efficacious students? They now have experienced success in math, and are beginning to shed some self-handicapping habits and are moving towards positive educational behaviors like perseverance. Goals that may have had strong impacts at the low level (for example completing daily homework) now seem trite. A student at the average level may go, "of course I do my homework that is not a goal it is something I already do." So while the short term goal is not hindering the student it also is not providing the same impact that it once did at the low level. These average efficacy students need different goals. For example, while it would benefit a low efficacy student to have a goal of *completing* daily homework, an average efficacy student would

benefit from *accurately* completing the homework. At first glance it may not seem like a difference but the difference is in how the student approaches the subject itself. Low efficacy students demonstrate behaviors where they do not even begin mathematical problem solving for fear of negative performance so simply the act of completing homework is a step in the right direction. However once they are in the habit of consistently completing homework, the next step is getting them to be performance *approach* learners. Meaning, not just doing math but, consistently working to determine a correct solution.   Also notice that it is still a short term goal, completing daily homework. But, it is modified to meet the efficacy level of the student.

Performance goals, both avoidance and approach can be targeted by using interim goals. While we can call them short term or daily goals there is importance in why I choose to call them interim goals in the research question and the title of the dissertation itself. Interim means that these goals are temporary on the way towards something greater. For lack of better phrasing, the goal is for students to move out of performance goals altogether and reach mastery goals. The daily interim goals are meant to help students move up the efficacy spectrum until they develop enough efficacious beliefs that they set and work towards mathematical mastery goals. While I can promote broad mastery goals in my mathematics classroom, low and average efficacy students will not see significant changes in personal beliefs because they are currently not at level to see the value in mastery goals.

What the SEGS shows is that for maximum effectiveness in increasing self-efficacy, the goals teachers promote in the classroom must meet the students at their current efficacy level. Then as students move up the spectrum, teachers alter their goal promotion as students move towards mastery level efficacious beliefs. The SEGS serves as a template to help teachers promote the most effective types of goals to best serve the efficacy needs of their students.

Using the SEGS to See Quick Results

The data gives credence to the SEGS theory especially in the context of a short time frame. Many high schools now operate on a semester schedule similar to colleges which means that students go through high school courses faster than under the traditional year-long model. How can teachers help increase student efficacy in a quick effective method? This research was designed in a way to account for the shortened time of a semester schedule. The data was conducted over a four-week time frame close to the beginning of the school semester. This was for a few main reasons, first- change in efficacy would be more closely linked to the goal (or non-goal) treatment than to factors such as being in the classroom all year. Second, four weeks in a semester-long class would cover at least one unit of study or more. This way efficacy change could be linked to the time frame and not simply the topic of study. For example if the study only took place over just one unit of study, say graphing linear functions, and the student already has positive experiences with the topic then the goal treatment may have no noticeable effect on efficacy. However, by having the study last over multiple units, it is more likely that the change in mathematical self-efficacy is linked to mathematics itself and not simply one mathematical topic. This significance means that efficacy changes can be seen early in the semester thus laying the groundwork for continued positive improvements as students go through the rest of the course. If interim goals are promoted at the start of the semester students could have moved up the SEGS by midterms creating positive mathematical experiences and increasing student performance approach goals which are research shows is consistently linked with improved academic performance (Bong, 2001).

Using the SEGS across Subject Levels

The student participants in this study ranged from ninth to twelfth grade over a variety of mathematical classrooms including, Foundations of Algebra, Algebra 1, Geometry, Algebra 2, and Pre-Calculus. These classes also covered a variety of learning levels including support, co-taught, on-level, honors, and accelerated. This is important because the data shows significance across all grades, subjects, and levels in mathematics, which continues to support the SEGS theory. Students who receive the interim goal treatment based on their efficacy level show improvement in efficacious beliefs. Course level is not a dictator of what goals are effective but rather the efficacy level of the student. A student in pre-calculus and a student in foundations of algebra can all benefit from the right type of interim goals tailored to the efficacy level. Understanding the SEGS can help teachers who may have incorrect assumptions about the self-efficacy of their students simply because they are in a senior level math class. Some teachers of seniors incorrectly assume that their students would all benefit from mastery level goals, for example "where are you going to college, what do you plan to study, and what do you want to do for a career?" While these are important discussions, many seniors still report low to average level mathematics efficacy meaning these mastery goals are not promoting an increase in self-efficacy. With the ongoing need of students pursuing mathematical degrees in college, it is very important that senior mathematics students leave high school at high levels of mathematical efficacy. Increasing mathematics self-efficacy should not be delegated to one mathematical content area but should be an ongoing focus throughout the career of high school students. The SEGS provides an ongoing spectrum that helps teachers promote the most effective goals as students move through high school and up the efficacy spectrum.

Practical Implementation for Teachers

This study was also designed in a way to make the goal implementation as easy as possible for teachers to implement in their daily classrooms without having to make major changes to their teaching style or daily routines. The dialogue was short and easily adaptable to whatever the current classroom agenda was for the day for example if it was to focus on in-class engagement, homework completion, or preparing for an upcoming assessment. Teachers were able to talk about the short term goal in under a minute and could be fit into any part of the classroom routine, for example during a warm-up or passing out papers. The teacher participants said that by the end of the study, talking about goals became second nature and some students would even ask "what is our goal for today?" In only four weeks, the classroom environment became one where students and teachers consistently and positively advocated interim term goals.

I designed the study so when significance was found, the treatment protocol is something that any teacher would be capable of implementing in her/his classroom. Teachers were not asked to attend professional development sessions and they were not asked to take time out of their normal lessons. They were simply asked to add in a few sentences into their daily routine. Even though the treatment showed significant improvement in efficacy, the effects will never be seen in students if teachers are unable to implement it in their classrooms. The practical implementation of this treatment means that this can be implemented across other schools and classrooms for continued use not simply relegated to a four-week period.

<center>**Recommendations for Further Research**</center>

This study is the start to a broad field of goal setting and mathematics self-efficacy research. Through my data I have laid the groundwork for the theory of the Self-Efficacy Goal Spectrum and further research must be conducted to strengthen and examine this theory.

Research of the SEGS

This research is the first step in examination of the SEGS and there are many areas that must be researched including replicating similar results as well as expanding the data pool. The first thing I would suggest is that students in other high schools experience the same treatment. It is important to determine that the spectrum itself (performance approach/avoidance towards mastery goals) is most closely linked to the initial efficacy levels of the student and not confounding demographic variables. In addition to expanding to other schools, it would be important to increase the sample pools as well in order to see if the spectrum continues to show significant effect changes when the correct goals are linked to the efficacy level of the student.

An addition to this study is to return to the participants to see if the increase in self-efficacy lasted when the goal treatment was removed. In other words, how long must interim goals be promoted before they become permanently internalized in students? Similarly, if the goal treatment is removed, will the students lose any gains in self-efficacy they made over the time period? This is a vital area of research because we as teachers are trying to promote lasting efficacy changes not simply a quick boost in mathematics efficacy to get students through midterms. A possibility could be that when students move into the high level of efficacy/ mastery goal level that they no longer need daily affirmation of goals. There is something to this hypothesis because students who reported as highly efficacious at the start of the study showed no significant increase in efficacy and actually had their mean efficacy score decrease.

<center>57</center>

Understanding the minutia of the spectrum is important so teachers are promoting the most effective goals for their students. Right now the spectrum is a blend with no true delineation between when interim goals should switch to mastery goals and further research needs to investigate where that change might show the greatest effect in increasing efficacy.

The SEGS also shows promise for expanding past the sphere of mathematics. Interim goals can be promoted in a wide variety of subjects outside of mathematics. The more research that is conducted in the SEGS framework opens the possibilities for increasing efficacy for every facet of the high school learner.

Further Research into High School Mathematics Self-Efficacy

While the SEGS is something that could have broad educational impacts I still want to promote the need for more research in high school mathematics self-efficacy. The purpose of this study is to bring attention to the importance of students experiencing success in high school mathematics classrooms. Students who experience failure in the freshmen year of mathematics are more likely to drop out before graduation (Balfanz & Legters, 2004). Local schools and school boards are constantly trying to find the best way to increase mathematical performance in students but many of these strategies do not focus on one of the main factors that affect performance, and that is self-efficacy. Rather than trying to change the pedagogy of mathematics teachers, what if we found ways to support and increase student self-efficacy through pragmatic and practical approaches that teachers across the country can implement in their classrooms? This research showed that mathematics self-efficacy can increase through the treatment of interim goal promotion in the classroom. The treatment was practically implemented and demonstrated significant increase in mathematics self-efficacy. If this study was expanded to a larger sample outside of just a single high school and results were replicated,

the data would strengthen the SEGS theory. It would give teachers, administrators, and educational policy creators a new avenue to increasing mathematical performance which is not through changing curriculum or increased testing but rather through increasing mathematical self-efficacy through a realistic treatment method of daily interim goal promotion.

Conclusion

This study is the start of looking at how goal theory can effectively increase mathematical self-efficacy in high school students as framed through my definition of the Self-Efficacy Goal Spectrum. A quasi-experimental study was conducted to answer the research question "What is the effect of teacher promoted interim goals on the mathematical self-efficacy of high school students?" Nine teachers and 377 student participants were part of a four week study. The students took a pre- and post-test survey about mathematics self-efficacy. Student participants were randomly assigned by class to receive a daily goal script from their teachers, which promoted short term daily goals, or to be part of a control classroom where no goal dialogue was administered. A repeated measures ANOVA was conducted which found a significant change in efficacy over the four-week period for students who were part of the goal treatment group. Additionally students in the treatment group showed that the interim goals had a stronger effect on students in the low self-efficacy group as compared students in the average and high efficacy groups. These results were explained through the Self-Efficacy Goal Spectrum which shows a continuum of how different interim goals show maximum effect at different stages of student self-efficacy.

This study demonstrates how interim goals can increase mathematical self-efficacy over a wide range of high school mathematics students. The implications of these results are that teachers can have a practical way to increase self-efficacy without changing their daily routines.

In other words, daily goal dialogue can create significant increases in student self-efficacy with little change in classroom practices. This study also can serve as the groundwork for further research into the SEGS, the longevity of mathematics self-efficacy after treatment has been removed, and how the SEGS can provide a new educational discussion platform for high school efficacy inside and outside the mathematics classroom. The significance found in this research demonstrates that when teachers promote interim goals in their classrooms, students report an increase in mathematics self-efficacy. The significance found in this study shows that this research is the start of a new branch of self-efficacy and goal research which can have far reaching implications in high-school mathematics.

References

Balfanz, R., & Legters, N. (2004). *Locating the dropout crisis. Which high schools produce the nation's dropouts? Where are they located? Who attends them?* (Research Report No. 70). Retrieved from Center for Research on the Education of Students Placed at Risk website: http://files.eric.ed.gov/fulltext/ED484525.pdf

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist, 28*(2), 117-148.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W.H. Freeman and Company.

Bandura, A. (2002). Social cognitive theory in cultural context. *Applied Psychology: An International Review, 51*(2), 269-290.

Bandura, A., & Schunk, D. (1981). Cultivating competence, self-efficacy, and intrinsic interest through interim self-motivation. *Journal of Personality and Social Psychology, 41*(3), 586-598.

Biesta, G. (2007). Why "what works" won't work: Evidence-based practice and the democratic deficit in educational research. *Educational Theory, 57*(1), 1-22.

Bong, M. (2001). Between- and within-domain relations of academic motivation among middle and high school students: Self-efficacy, task-value, and achievement goals. *Journal of Educational Psychology,* 93(1), 23-34. doi:10.1037//0022-0663.93.1.23

Bouffard-Bouchard, T., Parent, S., & Larivée, S. (1991). Influence of self-efficacy on self-regulation and performance among junior and senior high-school age students. *International Journal of Behavioral Development, 14*(2), 153-164.

Coutinho, S. A., & Newman, G. (2008). A model of metacognition, achievement goal orientation, learning style and self-efficacy. *Learning Environments Research, 11,* 131-151. doi:10.1007/s10984-008-9042-7

Crippen, K. J., Biesinger, K. D., Muis, K. R., & Orgill, M. (2009). The role of goal orientation and self-efficacy in learning from web-based worked examples. *Journal of Interactive Learning Research, 20*(4), 385-403.

Cross, L. H., & Belli, G. M. (2004). Experimental research to inform educational policy. In K. deMarrais, & S. D. Lapan (Eds.), *Foundations for research: Methods of inquiry in education and the social sciences* (pp. 329-351). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychology Review, 95*(2), 256-273.

Friedel, J. M., Cortina, K. S., Turner, J. C., & Midgley, C. (2010). Changes in efficacy beliefs in mathematics across the transition to middle school: Examining the effects of perceived teacher and parent goal emphases. *Journal of Educational Psychology, 102*(1), 102-114. doi:10.1037/a0017590

Gebka. B. (2014). Psychological determinants of university students' academic performance: An empirical study. *Journal of Further and Higher Education*, *38*(6), 813-837. doi:10.1080/0309877X.2013.765945

Governor's Office of Student Achievement (GOSA) (2014). *Interactive school report cards.*

    Retrieved from https://gaawards.gosa.ga.gov/analytics/saw.dll?dashboard

Harackiewicz, J. M., Barron, K. E., Pintrich, P.R., Elliot, A.J., & Thrash, T. M. (2002a).

    Revision of achievement goal theory: Necessary and Illuminating. *Journal of*

    Educational Psychology, 94(3), 638-645.

Harackiewicz, J. M., Barron, K. E., Tauer, J. M., & Elliot, A. J. (2002b). Predicting success in

    college: A longitudinal study of achievement goals and ability measures as predictors of

    interest and performance from freshmen year through graduation. *Journal of Educational*

    Psychology, 94(3), 562-575.

Høigaard, R., Kovač, V. B., Øverby, C., & Haugen, T. (2015). Academic self-efficacy mediates

    the effects of school psychological climate on academic achievement. *School Psychology*

    Quarterly, 30(1), 64-74. doi:10.1037/spq0000056

Honicke, T., & Boradbent, J. (2016). The influence of academic self-efficacy on academic

    performance: A systematic review. *Educational Research Review, 17,* 63-84.

    doi:10/1016/j.edurev.2015.11.002

Hushman, C. J., & Marley, S. C. (2015). Guided instruction improves elementary student

    learning and self-efficacy in science. *The Journal of Educational Research, 108*, 371-

    381. doi: 10/1080/00220671.2014.899958

Kuhn, T. S. (2012). *The structure of scientific revolutions* (50th anniversary ed.). Chicago, IL:

    The University of Chicago Press.

Luke, A., & Woods, A. (2009). Policy and adolescent literacy. In L. Christenbury, R. Bomer, &

    P. Smagorinsky (Eds.), *Handbook of adolescent literacy research* (pp. 197-219). New

    York, NY: Guildford Press.

Maehr, M. L., & Anderman, E. M. (1993). Reinventing schools for early adolescents:

Emphasizing task goals. *The Elementary School Journal, 93*(5), 593-610.

Midgley, A., Kaplan, A., Middleton, M., Maehr, M. L., Urdan, T., Anderman, L. H., Anderman,

E., & Roeser, R. (1998). The development and validation of scales assessing students'

achievement goal orientations. *Contemporary Educational Psychology, 23,* 113-131.

Midgley, A. & Urdan, T. (2001). Academic self-handicapping and achievement goals: A further

examination. *Contemporary Educational Psychology, 26*, 61-75.

doi:10.1006/ceps.2000.1041

Multon, K. D., Brown, S. D., & Lent, R. L. (1991) Relation of self-efficacy beliefs to academic

outcomes: A meta-analytic investigation. *Journal of Counseling Psychology, 38*(1), 30-

38.

Pajares, F., & Miller, D. M. (1994). Role of self-efficacy and self-concept beliefs in

mathematical problem solving: A path analysis. *Journal of Educational Psychology,

86*(2), 193-203.

Phan, H. P. (2010). Students' academic performance and various cognitive processes of learning:

An interactive framework and empirical analysis. *Educational Psychology, 30,* 297-322.

doi:10.1080/01443410903573297

Phillips, D. C., & Burbules, N. C. (2000). *Postpositivism and educational research*. Lanham,

MD: Rowman & Littlefield Publishers, INC.

Pintrich, P. R., & DeGroot, E. V. (1990). Motivational and self-regulated learning components of

classroom academic performance. *Journal of Educational Psychology, 82,* 33-40.

doi:10.1037/0022-0663.82.1.33

Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1991). *A manual for the use of the motivated strategies for learning questionnaire (MSLQ).* Ann Arbor: National Center for Research to Improve Postsecondary teaching and Learning, University of Michigan.

Schunk, D. H. (1985). Participation in goal setting: Effects on self-efficacy and skills of learning-disabled children. *The Journal of Special Education, 19*(3), 307-317.

Schunk, D. H. (1990). Goal setting and self-efficacy during self-regulated learning. *Educational Psychologist, 25*(1), 71-86.

Schunk, D. H., & Meece, J. L. (2006) Self-efficacy development in adolescence. In F. Pajares & T. Urdan (Eds.), *Self-efficacy beliefs of adolescents* (pp. 71-96). Greenwitch, CT: Information Age Publishing.

Sealander, K. A. (2004). Single-subject experimental research: An overview for practioners. In K. deMarrais, & S. D. Lapan (Eds.), *Foundations for research: Methods of inquiry in education and the social sciences* (pp. 303-327). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Senko, C., & Harackiewicz, J. M. (2001). Performance goals: The moderating roles of context and achievement orientation. *Journal of Experimental Social Psychology, 38,* 603-610.

Smith, L., Sinclair, K.E., & Chapman, E. S. (2002). Students' goals, self-efficacy, self-handicapping, and negative affective responses: An Australian senior school student study. *Contemporary Educational Psychology, 27*, 471-485. doi:10.1006/ceps.2001.1105

Urdan, T., Midgley, C., & Anderman, E. M. (1998). The role of classroom goal structure in students' use of self-handicapping strategies. *American Educational Research Journal, 35*(1), 101-122.

Usher, E. L., & Pajares, F. (2009). Sources of self-efficacy in mathematics. A validation study. *Contemporary Educational Psychology, 34,* 89-101. doi:10.1016/j.cedpsych.2008.09.002

Wentzel, K. R., & Wigfield, A. (1998). Academic and social motivational influences on students' academic performance. *Educational Psychology Review, 10*(2), 155-175.

Zimmerman, B. J., & Cleary, T. J. (2006) Adolescents' development of personal agency: The role of self-efficacy beliefs and self-regulatory skill. In F. Pajares & T. Urdan (Eds.), *Self-efficacy beliefs of adolescents* (pp. 45-69). Greenwitch, CT: Information Age Publishing