Helping College Mathematics Students Improve Their Mathematics Self-Efficacy and Self-Regulation Using MyMathLab

Allan C. Pangburn

Follow this and additional works at: https://scholarcommons.sc.edu/etd

Part of the Curriculum and Instruction Commons

Recommended Citation

This Open Access Dissertation is brought to you by Scholar Commons. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of Scholar Commons. For more information, please contact dillarda@mailbox.sc.edu.
HELPING COLLEGE MATHEMATICS STUDENTS IMPROVE THEIR MATHEMATICS SELF-EFFICACY AND SELF-REGULATION USING MYMATHLAB

by

Allan C Pangburn

Bachelor of Science
Mount Olive College, 2009

Master of Science
University of North Carolina Wilmington, 2011

Submitted in Partial Fulfillment of the Requirements
For the Degree of Doctor of Education in
Curriculum and Instruction
College of Education
University of South Carolina

2020

Accepted by:

Ismahan Arslan-Ari, Major Professor

Fatih Ari, Committee Member

Hengtao Tang, Committee Member

Anna C. Clifford, Committee Member

Cheryl L. Addy, Vice Provost and Dean of the Graduate School
DEDICATION

This dissertation is dedicated to my family, friends, and wife who have supported and been with me from day one.

To my Pangburn, and Texter families. You all have supported me through this process in many ways. Also, you always provided encouraging words, never let me give up on myself, and pushed me to always better myself. This accomplishment is a thank you for all that you have done for me and I hope to keep making you proud of me.

To my White and Baucom families. You are a new addition to my family with engagement with Shih-Yu-Kuo. You also supported me through this process in many ways. Your encouraging words and many great meals helped pushed me to finish this accomplishment. This accomplishment is a thank you for your help.

To all my friends, where a good number of you are family as well. You also supported me through this entire process by not letting me quit on myself, provided great words of encouragement, and hours of either assisting me or listening to me rant and rave. This accomplishment is a thank you for your help.

To my future wife Shih-yu-Kuo “Shih” Pangburn. You went through many stressful, tearful, late nights, many hours of hard work, and exciting moments of this process. Through all these moments you still chose to ask to marry me. This accomplishment is as much yours as it is mine.
ACKNOWLEDGEMENTS

I would not have accomplished this journey I started over three years ago unless there were key people to help me in this journey. Nicole Ritter and Lynn Goodson are valuable friends who are not just student colleagues and writing group members. They provided essential and prompt feedback, a positive attitude, and encouraging words helped me in achieving my goal. Thank you, Brandi Brenwald, Meghan Howard, Dr. Deborah Cureton, and Professor Chris Judge who donated several hours of their time to, help perfect the writing quality of my dissertation. I also would like to thank my dissertation committee members, Dr. Faith Ari, Dr. Hengtao Tang, and Dr. Anna Clifford, for their support, feedback, and encouragement over the past three and a half years as I moved this study from inception to completion. I would like to thank my students from Fall 2019 for their collaboration, positive attitudes, and honesty made this study a success.

Finally, I thank Dr. Ismahan Arslan-Ari, my advisor and dissertation committee chairperson. Without her guidance, patience, and real-world practicality, I would not have been able to finish my journey. I am very grateful for her professional wisdom, many forms of encouragement, and countless hours editing, revision suggestions, sharing numerous sources, helping with the use of SPSS, and the many conversations to help refine my analysis and overall dissertation. I have grown as an educator, researcher, and student through my collaboration with Dr. Arslan-Ari and there are not enough words or actions I can accurately express to say thank you to her for all that she has done.
ABSTRACT

A confident self-regulated learner knows how to effectively monitor their time management, motivation, help-seeking, self-efficacy, self-reflection, and strategic planning skills. These skills are components of a student’s self-regulation skills. The purpose of this action research was to evaluate the impact of using self-regulated learning strategies embedded in the online homework platform, MyMathLab, on the students’ self-regulated learning and mathematics self-efficacy skills while taking College Algebra at a 2-year Regional College Campus in the southeastern United States. This study looked to answer (1) how, and to what extent, does the online homework platform, MyMathLab, impacts the students’ self-regulated learning skills and mathematics self-efficacy? and (2) what are the students’ perceptions of how the online homework platform, MymathLab, impacted their self-regulated learning skills?

This action research used a convergent parallel mixed-methods design. This study used daily homework, structured journals to reflect on what self-regulated learning skills the students are using, and homework helping tools and pre-created resources on MyMathLab to help improve the students’ self-regulated learning skills and mathematics self-efficacy. Thirteen college students participated in this action research. Data was collected using Sources of Mathematics Self-Efficacy Scale, Online Self-Regulated Learning Questionnaire, structured journals, and focus group interviews. Data was analyzed using descriptive statistics, the Wilcoxon Signed-Ranks Test, and inductive
analysis. This study found that although there was no significant effect of the intervention, the participants’ social persuasion, goal setting, task strategy, environment structure, time management, and self-evaluation skills positively improved after the intervention. Also, the participants had mainly positive perceptions of how MyMathLab impacted their self-regulated learning skills while mentioning what MyMathLab and non-MyMathLab resources negatively impacted their self-regulated learning and mathematics self-efficacy skills. This study showed that when an instructor chooses to use an online homework platform, they need to choose a platform that will most positively impact their students’ self-regulated learning skills. This study had a limited number of participants in only one section College Algebra, the intervention lasted only five weeks, and the data was self-reported.
# TABLE OF CONTENTS

Dedication.................................................................................................................................................. iii

Acknowledgements....................................................................................................................................... iv

Abstract........................................................................................................................................................ v

List of Tables .............................................................................................................................................. viii

List of Figures ............................................................................................................................................ xi

Chapter 1: Introduction ............................................................................................................................. 1

National Context........................................................................................................................................ 1

Local Context.......................................................................................................................................... 3

Chapter 2: Literature Review..................................................................................................................... 10

Chapter 3: Method ....................................................................................................................................... 37

Research Design.................................................................................................................................... 37

Settings and Participants...................................................................................................................... 39

Intervention............................................................................................................................................ 40
LIST OF TABLES

Table 3.1 Focus Group Participants ...................................................................................41
Table 3.2 Summary of the MyMathLab Tools Promoting SRL Skills ..............................43
Table 3.3 How Structured Journals Impact SRL Skills .....................................................49
Table 3.4 Research Questions and Data Sources Alignment .............................................50
Table 3.5 Research Questions and Focus Group Questions Alignment ............................53
Table 3.6 Research Questions, Data Sources, and Analysis Method Alignment ..............54
Table 3.7 Timeline of the Intervention, Data Collection, and Data Analysis ....................57
Table 4.1 Cronbach’s Alpha for the Post-Survey of Sources of Mathematics Self-Efficacy Scale ...........................................................................................................64
Table 4.2 Descriptive Statistics for Survey of Mathematics Self-Efficacy Scale ................ ............................................................64
Table 4.3 Results of Wilcoxon Signed-Ranks Test for Mathematics Self-Efficacy Scale ...........................................................................................................65
Table 4.4 Cronbach’s Alpha for the Post-Survey of Sources of OSRLQ .........................67
Table 4.5 Descriptive Statistics for OSRLQ ......................................................................68
Table 4.6 Results of Wilcoxon Signed-Ranks Test for OSRLQ .......................................69
Table 4.7 Summary of Qualitative Data ............................................................................70
Table 4.8 Ways to Impact a Student’s Learning Strategy Theme with Emerging Categories and Codes .................................................................78
Table 4.9 Ways to Improve MyMathLab Theme with Emerging Categories and Codes .................................................................................................79
Table 4.10 Ways MyMathLab Impacts Mathematics Self-Efficacy Subtheme with Emerging Categories and Codes .........................................................85
Table 4.11 Ways Non-MyMathLab Impacts Mathematics Self-Efficacy Subtheme with Emerging Categories and Codes ................................................................. 90

Table 4.12 Types of Goals Students Set Subtheme with Emerging Categories and Codes .................................................................................................. 94

Table 4.13 Ways to Impact Goals Subtheme with Emerging Categories and Codes ...................................................................................................... 98

Table 4.14 Types of Self-Evaluation Students Do Subtheme with Emerging Categories and Codes .................................................................................. 100

Table 4.15 MyMathLab Impacts Task Completion Subtheme with Emerging Categories and Codes ...................................................................................... 104

Table 4.16 Ways to Impact a Student’s Class Success with Emerging Categories and Codes ......................................................................................... 106

Table 4.17 Ways to Impact a Student’s Concept Understanding Subtheme with Emerging Categories and Codes ........................................................................ 109

Table 4.18 Mixed Perceptions of MyMathLab Theme with Emerging Categories and Codes ................................................................................................ 114
LIST OF FIGURES

Figure 2.1 Zimmerman and Moylan’s 2009 Model ............................................................ 17
Figure 3.1 Example Question from a Daily Homework Assignment ............................... 44
Figure 3.2 Help Me Solve This Function ........................................................................ 45
Figure 3.3 MyMathLab Feedback for Incorrect Answers on Homework ......................... 46
Figure 3.4 Student’s MyMathLab Homepage ................................................................. 47
Figure 3.5 Student View of Assigned Assignments ....................................................... 47
Figure 3.6 The Gradebook Feature of MyMathLab ......................................................... 48
Figure 4.1 Researcher’s Qualitative Analysis Journal .................................................... 72
Figure 4.2 Codes recorded in www.delvetool.com .......................................................... 73
Figure 4.3 First Round of Sorting Codes ....................................................................... 73
Figure 4.4 Screenshot of Second Round Coding in Microsoft Excel ............................... 75
Figure 4.5 Screenshot of Round 3 Coding in Microsoft Excel ........................................ 76
CHAPTER 1
INTRODUCTION

National Context

Blended and online learning environments have become more popular and attractive for many students and teachers. Recent studies have shown that blended learning increases students’ motivation and test grades (Boda & Weiser, 2018), increases students’ self-efficacy and class engagement (Chyr, Shen, Chiang, Lin, & Tsai, 2017), and some curriculum is better situated in a blended learning environment (Napier, Dekhane, & Smith, 2011). Previous research also demonstrates that there is an increased rate of student withdrawal from school as well as failing courses in blended learning environments than the traditional classroom (Alkis & Temizel, 2018; Dray, Lowenthal, Miszkiewicz, & Marczynski, 2011; Elkins, 2015). To help lessen the withdrawal and failure rates, schools and textbook companies have studied the use of online homework platforms and created their own versions of online homework (Paiva, Ferreira, Mendes, & Eusebio, 2015). These studies show that online homework positively affects student test performance (Lazarova, 2015) and improves student engagement and retention rates (Callahan, 2016). Also, having an online homework platform that provides instant and interactive feedback is more beneficial to student learning (Peng, 2009). Students can access online homework platform learning aids at any time or location (Ratniyom, Boonphadung, & Unnanantn, 2016). The results of the studies demonstrate to policymakers, school administrators, and teachers that the use of online platforms can
help student dropout and failure rates decrease, and students can learn in blended learning environments.

Blended learning environments require students to use the following skills: motivation, setting goals, evaluating their self-efficacy and satisfaction, and effective use of help-seeking aids (Alkis & Temizel, 2018; Broadbent & Fuller-Tyszkiewicz, 2018; Chyr et al., 2017; Kintu, Zhu, & Kagambe, 2017; Shea & Bidjerano, 2010). These are some of the skills that a self-regulated learner (SRL) uses to be “a master of their own learning processes” (Zimmerman, 2008, p. 166). The skills of a SRL have been correlated to their homework behavior (Ramdass & Zimmerman, 2011). Ramdass and Zimmerman’s (2011) found that homework helps students develop better self-regulation skills and measuring a student’s completion rate instead of time spent better impacts a student’s self-regulation. Another study recommends that combining a certain type of homework with self-regulated learning strategies can have a positive impact on the students’ self-regulation skills (Lee, 2016). However, to my knowledge no researcher has determined what method of assigning homework most effectively impacts a student’s SRL skills

One of the components of a SRL is when the student monitors their self-efficacy (Labuhn, Zimmerman, & Hasselhorn, 2010). A student’s self-efficacy has been shown to be affected by their goal orientation (Ramdass & Zimmerman, 2011). This means a student’s belief in learning a concept is based on the goals they set. Another way to impact a student’s self-efficacy is when the student uses homework support services (Kitsantas, Cheema, & Ware, 2011). This implies that online homework platforms (OHWP) can positively impact a student’s self-efficacy. Also, students receiving clear
and detailed feedback are able to evaluate their self-efficacy of the assignment they completed (Abrami, Bernard, Bures, Borokhovski, & Tamim, 2012). In conclusion, these results show that OHWPs and blended learning environments can have a positive impact on a student’s SRL skills and self-efficacy.

**Local Context**

From the Fall 2018 self-reported admissions applications, excluding dual enrollment students, there were 301 students out of 871, about 35%, total students that are first-generation college students (Office of Institutional Effectiveness and Research, 2020). By definition this means they are the first in their immediate family to earn a college degree. Also, for the same semester there were 432 students out of 1,532, including dual enrollment students, about 28%, the total student population were first-generation college students at the same Regional College Campus. This is important to know, because according to Marquez’s (2014) study almost 35% of the new incoming students at the Regional College Campus may not have effective time management, motivation, self-efficacy, or self-regulation skills. I have observed through advising, students enrolled in my classes, and talking with colleagues that the Regional College Campus also has almost a 10% nontraditional student population, students that are at least 25 years old and enrolled in college more than one year after graduating high school (Groce, 2015; Phillips, 2013; Shillingford & Karlin, 2013). I have noticed in my classes that the nontraditional students have mixed feelings about using OWHP instead of a traditional paper method. These mixed feelings cause them to have low motivation to do online homework. While advising students on which collegiate mathematics courses to take, my colleagues and I have observed that most students earn a score anywhere
between 4 and 7 out of a possible 26 on a mathematics placement test, which equates to getting between 15% and 26% correct. Also, we have noticed that a lot of the students have either low SAT and ACT scores or do not take either test.

Over the last two years, the Regional College Campus has had a rise in dual credit students, students who are taking and receiving college credit courses while still in high school. Most of the dual credit students are familiar with using either Google Documents or Khan Academy, but they are not familiar with using an OHWP like MyMathlab or WebAssign. This lack of experience of using an OWHP can hinder the students’ self-efficacy and self-regulation skills, because they will not have a strong belief in themselves to study, manage their time, or emotions, to effectively learn the mathematical concepts being taught.

I have been a mathematics instructor at the Regional College Campus for almost nine years. During this time, I have used the following homework methods: traditional paper and pencil and online homework through either MyMathLab or WebAssign, both examples of OHWP. I switched from traditional paper and pencil to an OHWP for many reasons. The main reason is to help improve my students’ critical thinking and problem-solving skills, which can be done by having them attempt their homework multiple times before the assignment being an in-class assessment. Also, using an OHWP provides feedback instantly to students, instead of instructor feedback taking days. I switched from WebAssign to MyMathLab because my students were frequently complaining that WebAssign was not user-friendly. Also, I did not like how WebAssign organized the resources I uploaded. For the past three years, I have used MyMathLab because most of my students use either MyMathLab or another Pearson based product in the mathematics
or statistics course that follows my course. The characteristics of MyMathLab that I enjoy are the multiple ways it allows me to assign homework. MyMathLab allows me to upload and organize my documents however I choose and provides better data analysis on students’ grades and accessing different tools of MyMathLab.

While using both MyMathLab and WebAssign I have noticed students do not properly manage their time, lack the motivation to effectively use an OHWP, and have weak self-efficacy and self-regulation skills when faced with a task that they first perceive too difficult for them. Through course evaluations to both me and colleagues, students have expressed they do not diligently work on assignments and do not have positive perceptions towards learning new and harder mathematics concepts. The students also expressed they do not organize or manage their class notes and personal time effectively to learn the material being taught.

**Statement of Problem**

During my teaching career at the Regional College Campus, I have noticed that students taking freshman-level mathematics courses have low mathematics self-efficacy and self-regulation skills while learning mathematical concepts that they perceive as being too difficult.

**Purpose Statement**

The purpose of this action research was to evaluate the impact of using SRL strategies embedded in the online homework platform, MyMathLab, has on the students’ SRL and mathematics self-efficacy skills while taking College Algebra at the Regional College Campus.
Research Questions

This study explored the following research questions:

1. How, and to what extent does, the online homework platform, MyMathLab, impact the students’ self-regulated learning skills?

2. How, and to what extent does, the online homework platform, MyMathLab, impact the students’ mathematics self-efficacy?

3. What are the students’ perceptions of how the online homework platform, MyMathLab, impacted their self-regulated learning skills?

Researcher Subjectivities and Positionality

The ways in which I have used technology in my career as an instructor is in research, assigning and submitting assignments, using different educational tools to help reinforce concepts, and to check mathematical calculations. I have noticed from attending different mathematical and educational conferences, that if technology is used properly, technology tools can enhance a student’s educational experience. I am pursuing an Education Doctorate Degree in Curriculum and Instruction: Educational Technology Concentrate for two reasons. The first, and main, reason is that I want to gain more knowledge on how to improve my teaching while using technology both in and out of the classroom to improve my students’ educational career and to effectively use technology. The second reason is to earn tenure at the Regional College Campus where I can continue to effectively educate students to be prepared for both their collegiate and workforce careers.

My background and history have shaped my position as an instructor to a postpositivist paradigm, which means I think and make decisions based on proven
rational data (Creswell, 2014). However, what I have experienced in the last five years is that decisions can be made from both proven rational data and opinionated data, which follows the pragmatist paradigm (Creswell, 2014). For example, when I look to make a change in my teaching style, I spend hours collecting information based on what has worked for my colleagues, been proven and verified by researchers, and examining my current teaching methods, to determine what is the best method to teach the new topic. This example shows that I believe facts are based on what can be tested and measured, even if there is no presence of a test, which is called an objective ontology (O’Gorman & MacIntosh, 2015, p. 55). During my research I believe in the development of a hypothesis, gathering of data based on the test(s) I conducted, measured, and analyzed the data to see if the analysis either fit or does not fit in a statistical interval which showed if the hypothesis was accepted or rejected (Mertler, 2017). My methodology was asking questions and gathering data based on both quantitative and qualitative methods. As I conducted my research and gathered data, the ethical behavior I observed throughout the research is one that made a positive change in the students’ educational career. This means the research that was conducted will not harm the student or interfere with their learning.

My positionality was both an educator and researcher who is an insider collaborating with other insiders (Herr & Anderson, 2005). This positionality fits pragmatism because the other researchers and I would be researching to influence a “personal, professional, and institutional transformation” (Herr & Anderson, 2005, p. 36-37) that will have a positive effect on the student’s educational career.
As an educator and researcher, I must ensure my biases do not skew the results of my research results or harm students’ educational career. To help ensure the results are not skewed, I will need to validate the results by interviewing the participants in the study and conduct the research again with new participants.

**Definition of Terms**

**Daily homework** is a homework assignment that will have five problems that are like the material covered in that day’s class. The homework was assigned at the end of each day’s class and is due within 24 hours. The students will have three attempts to earn a perfect score.

**Goal setting** is when a student sets a requirement or standard to be completed at the end of a task that will help them achieve their overall educational goals (Kizilcec et al., 2017; Stoeger & Ziegler, 2008).

**Help-seeking** is when a student asks for help from a peer, teacher, tutor, or uses different resources to understand a concept (Kizilcec, Perez-Sanagustin, & Maldonado, 2017).

**Mathematics self-efficacy** is how a person perceives their ability to learn and perform mathematical tasks (May, 2009).

**MyMathLab** is an online homework platform created by the company Pearson. MyMathLab offers the following to students: e-textbook for the course, assignments, course documents, videos, and tutorials (Products and services for teaching, 1996). MyMathLab offers the following to the professor: upload course materials and videos, create a variety of assignments, and access to a variety of data analysis for each student in their class (Data, analytics, and adaptive learning, 1996).
**Self-efficacy** is how a person perceives their ability to learn and perform tasks effectively (Dull, Schleifer, & McMillan, 2015; Ramdass & Zimmerman, 2011).

**Self-reflection** is when a student evaluates their knowledge, understanding, and satisfaction of the concept being taught, and then adjust their strategic planning and goals to better understand the concept (Zimmerman & Campillo, 2003).

**Self-regulated learning skills** are the skills students use to monitor and improve their organization, self-evaluation, self-efficacy, learning environments, task and planning strategies, and motivation (Martinez-Pons & Zimmerman, 1988; Zimmerman, 2008).

**Self-regulation** is where a student constantly organizes and manages their thought process, emotion, behavior, and environment so that they can achieve their academic goals (Ramdass & Zimmerman, 2011).

**Time management skills** are when a student effectively manages and prioritizes their time when doing multiple tasks (Collier & Morgan, 2008). These tasks include, but are not limited to, doing homework, working, or community obligations.
CHAPTER 2
LITERATURE REVIEW

The purpose of this action research was to evaluate the impact of SRL strategies embedded in the online homework platform, MyMathLab, has on the students’ SRL and mathematics self-efficacy skills while taking College Algebra at the Regional College Campus. This study explored the following research questions: (1) How, and to what extent does, the online homework platform, MyMathLab, impact the students’ self-regulated learning skills? (2) How, and to what extent does, the online homework platform, MyMathLab, impact the students’ mathematics self-efficacy? (3) What are the students’ perceptions of how the online homework platform, MyMathLab, impacted their self-regulated learning skills?

In analyzing the research questions, three main variables emerged: (1) online homework platforms, (2) self-efficacy skills, and (3) self-regulated learning skills. From these variables, the following keywords were generated: homework, online homework, online homework platforms, motivation, mathematics self-efficacy, self-regulation, self-efficacy, and MyMathLab. Some of the searches that were conducted used the following combinations of keywords: homework and self-efficacy or self-regulation or self-regulated learning; online homework and self-efficacy or self-regulation or self-regulated; MyMathLab and self-efficacy or self-regulation or self-regulated learning; mathematics self-efficacy. I also searched for articles by either: Zimmerman, Usher,
Pajares, or Barnard, because their research focuses on either self-efficacy or self-regulated learning. I searched for peer-reviewed articles in the following databases: *Education Source, ERIC, Computer Science, Education Full Text, PsycINFO, ProQuest*, and *PsycTESTS*. The different searches initially looked for articles no more than ten years old.

This chapter analyzes the research done on self-efficacy, mathematics self-efficacy, self-regulated learning skills, how to improve student’s mathematics self-efficacy and self-regulated learning skills, measuring students’ mathematics self-efficacy and self-regulated learning skills, OHWPs, features of OHWPs, and how OHWPs improve mathematics self-efficacy and self-regulated learning skills.

**Self-Regulated Learning Skills**

This section starts by defining what SRL skills are. Followed by Zimmerman and Campillo’s phases of self-regulation and methods of improving a student’s SRL skills. Also, how SRL impacts mathematics education. This section will end with how to measure a student’s SRL skills.

**Definition of Self-Regulated Learning**

Self-regulation is where a learner constantly organizes and manages their thought process, emotion, behavior, motivation, and environment so that they can achieve their academic goals (Jacobson & Harris, 2003; Ramdass & Zimmerman, 2011; Yukselturk & Top, 2013). SRL is a component of self-regulation. SRL is when a learner uses and evaluates their own abilities, motivation, and beliefs to perform the needed tasks to learn a concept (Barnard-Brak, Lan, & Paton, 2010; Cho & Heron, 2015; Hoops, Yu, Wang, & Hollyer, 2016; Zimmerman, 2008). SRL differs from self-regulation since self-
regulation is when a learner is controlling themselves to achieve a goal, whereas SRL is when a learner “transforms their mental abilities … into an academic performance skill” (Zimmerman, 2008, p. 166). A learner must use a variety of skills to be a successful SRL, and these skills are known as SRL skills. Some of the skills students’ use are environment structuring (Barnard, Lan, To, Paton, & Lai, 2009; Barnard-Brak et al., 2010; McClain, 2015), goal setting or being goal-oriented (Jacobson & Harris, 2003; Zhu & Mox, 2018), time management (Barnard et al., 2009; Barnard-Brak et al., 2010), help-seeking (Lai & Hwang, 2016), self-efficacy (Panadero & Alonso-Tapia, 2014; Puustinen & Pulkkinen, 2001), self-reflection (Ramdass & Zimmerman, 2011; Zhu & Mok, 2018), and task strategies (Cakiroglu & Ozturk, 2017; Kizilcec et al., 2017, Taylor, 2014).

**Environment Structuring.** Environment structuring is defined as when a student evaluates, chooses, and manipulates their immediate surroundings based on either their own individual preferences and/or talking with peers and teachers (Shi, Frederiksen, Muis, 2013) that best enhances their learning experience and complete their tasks (McClain, 2015; Shi et al., 2013; Zimmerman & Martinex-Pons, 1988). Surroundings include in and out of classrooms environments and electronic environments, including smart phones, tablets, and computers (Yen, Tu, Sujo-Montes, & Sealander, 2016). Cakiroglu & Ozturk (2017) found that students evaluated, chose, and manipulated their home environment learning more than the traditional classroom because “the noisy environments decrease my motivation to watch the videos: (p. 343). This is corroborated by Yen et al. (2016) where students discussed they chose locations that allowed them to complete their online tasks in environments that had the least amount of distractions, comfortable, and efficient. McClain (2015) found that when students enrolled in an
online course who complete self-monitoring forms their environmental structuring will positively affects their final course grades. This means that when students are recording their reasonings for choosing a surrounding, they will help improve their course grades. Li (2019) mentioned that a student’s socioeconomic and job status, and family may affect their environmental structuring because Latin American students reported using their environmental structuring skills more than any other culture.

**Goal setting.** Goal setting is when a student sets a requirement or standard to be completed at the end of a task that will help them achieve their overall educational goals (Kizilcec et al., 2017; Stoeger & Ziegler, 2008). Kizilcec et al.’s (2017) found that goal setting is positively correlated with strategic planning. This means that setting goals gives students a plan of how to gauge their progress in accomplishing a task (Jacobson & Harris, 2003). Also, setting goals has a positive correlation to increasing a student’s motivation (Littlejohn, Hood, Milligan, & Mustain, 2016; Miligan & Littlejohn, 2000) and this motivation impacts the student’s strategic planning and monitoring (Moos & Marroqui, 2010). A student’s goal orientation is correlated to their self-evaluation (Lai & Hwang, 2016). This means that a student’s goal affects how they evaluate their learning and how they achieve their goals. Zhu and Mok (2018) found that improving a student’s personal best goal orientation improves their SRL. Lastly, goal-oriented students are more likely to revisit, redo, and spend more time on different forms of assessments (Kizilcec et al., 2017).

**Time management.** Time management is when a student effectively manages and prioritizes their time when doing multiple tasks (Collier & Morgan, 2008). These tasks include, but are not limited to, doing homework, working, or community
obligations. Koukounas’ (2016) found that students who do not effectively use their time were not actively involved with their learning. So, students need to effectively manage their time to be more actively involved with their learning. When an educator uses an SRL model, the students’ time management improves and they are less likely to procrastinate (Lai & Hwang, 2016; Zimmerman, 2008). Time management has been found to have a positive effect on students’ success while in online learning environments (Broadbent & Poon, 2015). Students whose goal is to complete all assignments in a massive open online course are more likely to be more disciplined in managing their time and how they learn the material (Littlejohn et al., 2016). Also, for students in a massive open online course to effectively manage their time, they need to have a clear understanding of what the task requires them to do (Handoko, Gronseth, McNeil, Bonk, & Robin, 2019).

**Help-seeking.** Help-seeking is when a student asks for help from a peer, teacher or tutor, or uses different resources to understand a concept (Kizilcec et al., 2017). Hoops et al.’s (2016) study stated that students who are strong SRLs are more likely to engage in seeking help to attain their academic goals. Hoops et al.’s (2016) study also found that if the instructor demonstrated or stated different ways to seek help, the more likely students would be to seek help. Students can seek help by emailing their instructors, talking to peers, and using different resources provided by either the instructor or online platform (Broadbent & Poon, 2015; Hoops et al., 2016; Kizilcec et al., 2017). Shea & Bidjerano’s (2012) study stated that students who are taking blended learning or online courses need to be offered more opportunities to seek help, considering that students are more likely to seek help in these types of courses due to their online
platform. Help-seeking has been shown in multiple studies to be a negative predictor for a student’s final examination grade (Kizilcec et al., 2017; Koukounas, 2016).

**Self-reflection.** Self-reflection is when a student evaluates their knowledge, understanding, and satisfaction of the concept being taught, and then adjusts their strategic planning and goals to better understand the concept (Zimmerman & Campillo, 2003). One of the essential skills of SRL is self-reflection because the students are reflecting on every component of what they have learned and how they learned the concept (Clary & Kitsantas, 2017; Efklides, 2011; Puustinen & Pulkkinen, 2001). Studies have found that there is a positive correlation between a student’s self-reflection, motivation, and goal setting (Littlejohn et al., 2016; Zimmerman, 2008). This means when students set a specific goal, they are able to evaluate their learning easier and improve their motivation to learn and complete tasks (Littlejohn et al., 2016; Zimmerman, 2008). Zimmerman’s (2008) study also found that during the performance phase of an SRL Model the strategic process is impacted by the student’s self-reflection of their recorded outcomes and goals. This implies that SRL Models increase a student’s self-reflection process. Most SRL surveys do not have the proper items to measure a student’s self-reflection abilities (Roth, Ogrin, & Schmitz 2016), but many studies use some form of student journals or diaries where the students write about their reflection process (Broadbent & Poon, 2015; Lai & Hwang, 2016; Panadero, Klug, & Järvelä, 2016; Roth, Ogrin, & Schmitz, 2016; Zimmerman, 2008).

**Task Strategy.** Task strategy is defined as when a student organizes, plans, and modifies their time to complete tasks related to their learning process, and the process and the instructional material and tools to complete these tasks (Kizilcec et al. 2017).
One task strategy used by students is revisiting lecture videos and assessments even after completing a task (Cakiroglu & Ozturk, 2017; Kizilcec et al., 2017). Yen et al.’s (2016) found students in an online class used the following task strategies: taking detailed notes, read aloud the notes, preparing detailed questions before attending online discussions, building a network of resources and people to study and learn the concepts, and practicing more problems. The students further mentioned they do these strategies more often than traditional class environment because “notes are more important for learning online that in a regular class” and “to master the course content” (Yen et al., 2016, p. 36). Taylor’s (2014) study corroborated using repetitious practicing and outlining notes. Taylor’s (2014) study also mentioned the using flashcards and advanced organizers as two more types of task strategies students use to learn the material. Lawanto, Santoso, Lawanto, & Goodridg’s (2014) found that students who were rated low performers in a web-based course had better task strategies skills than high performers, but they did not access the course materials as often as the high performers. This suggests that the low performers’ task strategy is to mainly focus on organizing, planning, and modifying their time to complete tasks related to their learning process. While accessing the course material and resources the rest of the time.

**Zimmerman’s Model of Self-Regulation**

An effective SRL model can help students develop enough confidence to design their own SRL model that is more suited to their needs (Thomas, Bennettm & Lockyer, 2016). This means an instructor needs to choose an SRL model that positively affects the students' SRL skills. One model that has been used and modified over the years to best help a student’s SRL is Zimmerman’s Model of Self-Regulation that is based on
Bandura’s social cognitive theory (Puustinen & Pulkkinen, 2001; Zimmerman, 1989; Zimmerman & Capillo, 2003). This model has been updated to include the newest findings. The newest model is referred to as Zimmerman and Moylan’s 2009 Model (Panadero & Alonso-Tapia, 2014). This new model provides more detail to each phase of Zimmerman’s Model and how each phase interacts with the others (Panadero & Alonso-Tapia, 2014). Figure 2.1 depicts Zimmerman and Moylan’s 2009 Model. Zimmerman’s Model is cyclical and divided into the following three phases: forethought, performance, and self-reflection.


**Forethought phase.** This phase has two main components, analyzing their task and their self-motivation beliefs (Panadero & Alonso-Tapia, 2014; Puustinen &
These two components are intertwined because prior experiences with a certain task will affect how students analyze the task (Panadero & Alonso-Tapia, 2014). During the task analysis component, students will set goals that are attainable based on how well they want to perform on the task and how the task will be assessed (Panadero & Alonso-Tapia, 2014; Puustinen & Pulkkinen, 2001; Zimmerman & Capillo, 2003). Goal-oriented students are more likely to have better SRL skills (Jacobson & Harris, 2003). Students will also design a plan and determine what learning strategies and tools they need to use to attain the goals that they set.

During the self-motivation beliefs component, students will further analyze the task by examining their self-efficacy and determining if the task is valuable to their personal goals and interests them. (Panadero & Alonso-Tapia, 2014; Puustinen & Pulkkinen, 2001; Zimmerman & Capillo, 2003). This means students are determining what their belief is to complete and learn the task successfully, and if the task is important to their overall goals for a course or in their daily life. Students need to have a high expectancy to succeed in order to increase their self-regulation (Jaegar & Adair, 2018). This means students need to feel very confident to succeed to improve their self-regulation.

**Performance phase.** During this phase, a student is being self-observant when they are notating how and why they are completing a task and the outcomes that were created from completing the task (Panadero & Alonso-Tapia, 2014; Puustinen & Pulkkinen, 2001; Zimmerman & Capillo, 2003). An example of this is when a student records what steps they use and why they use those steps to solve a certain problem, and how those steps are applied to other problems. A key factor that improves a student’s
self-observation is feedback. When a student receives metacognitive feedback, the
students are more likely to be better SRLs (Labuhn et al., 2010; Lee, Lim, & Grabowski,
2010; Panadero & Alonso-Tapia, 2014). This means that students need to receive
feedback that makes them analyze their thought process. Lai and Hwang (2016) found
that students who can monitor and diagnose their task strategies, time management, and
help-seeking were better SRLs. These are just three components of the self-control
component of the performance phase. The other two components are when students
manage their environmental settings and managing their motivational strategies
(Panadero & Alonso-Tapia, 2014; Puustinen & Pulkkinen, 2001; Zimmerman & Capillo,
2003). A student can manage their motivational strategies by giving themselves
reminders of what needs to be completed and giving themselves rewards when they
complete certain tasks.

**Self-reflection phase.** During this phase, students are evaluating their self-
judgments and self-reactions to the tasks they completed to learn a concept (Zimmerman,
2008; Zimmerman & Capillo, 2003). A student’s self-judgment relies on the goals they
set, how they currently performed and mastered a concept based on previous
performances and mastery, and how the student compares to other students in the class
(Kizilcec et al., 2017; Littlejohn et al., 2016; Puustinen & Pulkkinen, 2001; Zimmerman,
2008; Zimmerman & Capillo, 2003). This means, that students need to have attainable
and measurable goals when completing tasks and learning concepts (Kizilcec et al., 2017).
A student’s self-reactions relies on their levels of satisfaction and how they adapt their
performance to attain their goals and learn the concepts being taught (Zimmerman, 2008;
Zimmerman & Capillo, 2003). So, if a student feels satisfied in completing a task, then
their self-efficacy will improve and the student will be more motivated to learn a concept based on the completed task (Kitsantas et al., 2011; Ramdass & Zimmerman, 2011).

**Zimmerman’s model.** In Zimmerman’s Model of Self-Regulation, a student will begin by setting attainable goals to complete a task, analyze their perceptions of attaining these goals and completing the task, and design a strategic plan to attain their goals and complete the task. Next, the student will use and execute their strategic plan, document how and why they are completing their steps, and creating a learning environment to complete the task. Also, the student will seek feedback from their teacher and give themselves rewards when they attain a goal or complete a segment of the task. Next, the student will analyze and evaluate how well they have completed the task, what they have learned, and their belief of how they will use the concept in the future. This analysis and evaluation are given to the student from a teacher or peer. Finally, a student will start this process over when completing similar and future tasks.

**Improving SRL in Mathematics Classrooms**

Students who take advanced-level math courses are more likely to have higher levels of SRL skills and strategies than students in non-advanced math courses (Cleary & Chen, 2009). One way to improve a student’s self-evaluation skills the teacher needs to use collective discourse teaching style in their classroom (Marshman & Brown, 2015). Collective discourse helps because the students must evaluate and justify their answers and the process through which they formulated it (Marshman & Brown, 2015). If the course is offered online than teachers need to use a social media platform to create this collective discourse (Chen & Heron, 2015). Chen and Heron’s (2015) also found that teachers need to provide planning and learning (both required and non-required)
resources, and practice quizzes can positively impact a student’s SRL skills. Self-monitoring forms have been shown to improve academic achievement, course grades, and SRL because the self-monitoring forms are giving the students a chance to evaluate their progress towards their goals (McClain, 2015). Cleary and Kitsantas’ (2017) found a student’s interest in a task and prior achievement in mathematics classes will impact their SRL skills, because the students are analyzing their self-efficacy and determining if the task is valuable to their personal goals and interests (Panadero & Alonso-Tapia, 2014; Puustinen & Pulkkinen, 2001; Zimmerman & Capillo, 2003). Cleary & Chen’s (2009) study also found that interest in a mathematical task affected how they implemented SRL skills. Teachers also need to help show their students how to effectively manage and regulate their self-explanation skills to improve their class performance and learning process (Baars, Leopold, & Paas, 2018). Also, teachers need to remind students to use supplemental resources and materials to aid them in their learning process (Volis, Childs-Kean, & Thomas, 2019). This implies that students need to use the supplemental resources and materials, even if the teacher does not remind or recommend it. Lastly, while students are using these resources, tools, and materials they need to use it to the full extent, not just for meeting course requirements (Butzler, 2016). This means spending time reflecting on what learning strategies were taught while using the tool, resource, or material (Butzler, 2016).

Measuring SRL

**Motivated strategies for learning questionnaire.** Motivated Strategies for Learning Questionnaire (MSLQ) was designed by Pintrich in 1991 to measure a student’s motivation and learning strategies (Alkis & Temizel, 2018; Taylor, 2014). MSLQ
specifically measures a student’s intrinsic and extrinsic goal orientation, task value, control of learning beliefs, self-efficacy, test anxiety, rehearsal strategies, elaboration strategies, organization strategies, critical thinking strategies, metacognitive self-regulation, time management skills, effort regulation, peer learning, and help-seeking skills (Taylor, 2014). This study will not use MSLQ, because it does not measure a student’s SRL in an online or blended learning environment.

**Online self-regulated learning questionnaire.** This study will use the Online Self-Regulated Learning Questionnaire (OSRLQ) created by Barnard, et al. (2009). The OSRLQ was created to help fill a need for measuring students’ SRL in online and blended learning classes (Barnard et al., 2009; Barnard-Brak et al., 2010; Shea & Bidjerano, 2012). OSRLQ focuses on six factors of SRL skills: environment structure, goal setting, time management, help-seeking, task strategies, and self-evaluation (Barnard et al., 2009; Barnard-Brak et al., 2010; Lai & Hwang, 2016; Shea & Bidjerano, 2012).

**Structured journals.** Many studies have required participants to use some form of logging their experiences during an intervention. One of those forms is a structured journal, log, or diary, where students record their experiences or reflections based on given prompts (Roth et al., 2016; Panadero, Klug, & Jarvela, 2016; Zimmerman, 2008). Zimmerman’s (2008) found that using structured diaries improved the participants' self-efficacy, satisfaction, time management, and planning. These skills were improved because the diary makes the participant more aware of their own skills than a survey does (Zimmerman, 2008). Finally, these structured journals are used to provide qualitative data to research questions that cannot be answered by quantitative data. (Broadbent & Poon, 2015; Lai & Hwang, 2016; Panadero et al., 2016; Roth et al., 2016; Zimmerman,
That means for this study, the structured journals will give the participants a chance to explain their responses to the OSRLQ.

**Self-Efficacy**

This section will define self-efficacy and mathematics self-efficacy, how to improve students’ mathematics self-efficacy, and how mathematics self-efficacy has been measured in previous research.

**Defining Self-Efficacy and Mathematics Self-Efficacy**

One way to improve a student’s motivation to learn a concept is by improving the student’s self-efficacy (Dull et al., 2015, p. 156). There are multiple definitions of self-efficacy in the literature. Self-efficacy is defined as how a learner believes or what is their confidence to effectively perform a task (Dull et al., 2015; Kitsantas et al., 2011; Ramdass & Zimmerman, 2011; Yukselturk & Top, 2013). Self-efficacy is affected by past successes and failures (Koukounas, 2016). Additionally, if a student had failed a previous task, then their self-efficacy will be lower (Dull et al., 2015). So, this implies that “self-efficacy may be moderated by emotional experiences” (Kim, Park, & Cozart, 2014, p. 180). The lower a student’s self-efficacy is, the more likely that students will avoid perceived difficult tasks (Valtonen, Kukkonen, Dillon, & Väisänen, et al., 2009). Whereas, the higher a student’s self-efficacy is, the higher the likelihood that the student will seek help (Ramdass & Zimmerman, 2011) and complete their homework (Kitsantas et al., 2011). This higher homework completion improves a student’s self-efficacy (Planchard, Daniel, Maroo, Mishra, & McLean, 2015).
Mathematics Self-Efficacy

Mathematics self-efficacy is defined as a student’s belief in their abilities to perform mathematical tasks (Gates, 2014; May, 2009). Students who have high mathematics self-efficacy are more successful or have higher test scores in a mathematics classroom (Kitsantas et al., 2011; May, 2009; Peters, 2013). If a student does not have a high mathematics self-efficacy from lower-level mathematics courses, that student will not perform well in higher-level mathematics courses (Gates, 2014). Also, students with higher mathematics self-efficacy are more likely to apply what they are learning to other concepts (Gates, 2014). For example, having students apply simple and compound interest concepts to their checking or saving accounts, loans, or investments (Hodges & Kim, 2013). This means students with higher levels of mathematics self-efficacy can be more prepared for mathematical concepts in the real world.

Improving Mathematics Self-Efficacy

There are many ways an instructor can improve a student’s mathematics self-efficacy. One way is for an instructor to provide clear steps to complete a task. Clear steps provide the student with a starting point and a way to break a complex task into smaller pieces to complete (Margolis & McCabe, 2006). Also, the instructor needs to assign tasks, such as homework, or problems slightly above their level of understanding. This allows the student to be able to self-reflect on why they were able to succeed, repeat their success, and be able to master the concepts being taught (Gates, 2014; Margolis & McCabe, 2006; Ramdass & Zimmerman, 2011). While assigning problems the instructor needs to select problems that are based on the real-world, relevant concepts, and
engaging to the students daily. Both their self-efficacy and mathematics self-efficacy can be improved, because the problems are more interesting to the students and the students get to see how concepts taught in-class are connected to everyday life (Margolis & McCabe, 2006; May, 2009; Ramdass & Zimmerman, 2011). Once the students have completed these assignments, the instructor needs to provide feedback that recognizes the quality of their work (Koukounas, 2016; Lau, Kitsantas, Miller, Drogin Rodgers, 2018). This means that the instructor is telling them more than just if the answer is right or wrong. Teachers need to be providing the students with feedback that enhances their ability to “strategize and develop appropriate actions for future performances” (Koukounas, 2016, p. 24). Finally, Koukounas (2016) found that students who are assigned online homework will positively improve their self-efficacy (p. 85).

There are also many ways a student can improve their mathematics self-efficacy. One way is for the students to spend time and complete their homework (Kitsantas et al., 2011; Ramdass & Zimmerman, 2011). Completing homework has been shown to improve the students’ satisfaction (Labhun et al., 2010; Stoeger & Ziegler, 2008), which will improve their self-efficacy (Liu & Haque, 2017).

**Measuring Mathematics Self-Efficacy**

There are many questionnaires that have been developed to measure a student’s mathematics self-efficacy. This study used Usher and Pajares’ version of the Sources of Mathematics Self-Efficacy Scale created in 2009. This scale was created based on Lent, Lopez, and Bieschke’s Sources of Mathematics Self-Efficacy Scale that was created in 1991 (Usher & Pajares, 2009). Sources of Mathematics Self-Efficacy Scale was originally created to measure college students’ mathematics self-efficacy but has been
adapted for almost every level of mathematics education (Lau et al., & Drogin, 2018; Usher & Pajares, 2008, 2009; Zientek, Fong, & Phelps, 2019). Sources of Mathematics Self-Efficacy Scale focuses on four factors of Bandura’s definition of self-efficacy: mastery experience, vicarious experience, social persuasion, and physiological states (Lau et al., 2018; Usher & Pajares, 2008).

Mastery experience is defined as the student evaluating how well they understand the completion of a task to be successful (Kontas, & Ozcan, 2017; Lau et al., 2018; Usher & Pajares, 2008, 2009). Vicarious experience is defined as how much or how often a student is exposed to peers or non-peers “who demonstrate competence in the subject of interest” (Usher & Pajares, 2009, p. 90). Social persuasions are defined similarly to vicarious experiences but focus on students receiving encouraging messages to boost their confidence in completing a task (Kontas, & Ozcan, 2017; Lau et al., 2018; Usher & Pajares, 2008, 2009). Physiological states are defined as when a student bases their experiences of learning a task based on their anxiety, stress, fatigue, and mood (Kontas, & Ozcan, 2017; Lau et al., 2018; Usher & Pajares, 2008, 2009).

**Online Homework**

This section will start by defining what blended learning, online homework, and OHWPs are. Followed by showing what features and tools teachers and students find as advantages and disadvantages. Next, show which features and tools of OHWPs have been shown to impact a student’s SRL skills. Followed by a discussion of how often homework, mainly online homework, should be assigned. This section will end by showing how OHWPs improve a student’s self-efficacy and self-regulation.
Defining Blended Learning

Blended learning is where an educator uses both a form of digital technology and traditional face-to-face instruction while in a classroom environment (Boda & Weiser, 2018; Delgado, Wardlow, McKnight, & O’Malley, 2015; Gecer & Dag, 2012; Kintu, Zhu, & Kagambe, 2017; Koukounas, 2016; O’Byrne & Pytash, 2015). This means an instructor can use either online homework platforms, tablets, laptops, or computers with their traditional classroom instructional methods to teach concepts and evaluate the students’ knowledge. Many researchers interchange blended and hybrid learning (Boda & Weiser, 2018; Delgado et al., 2015; Gecer & Dag, 2012; Kintu et al., 2017; Koukounas, 2016; O’Byrne & Pytash, 2015), but according to O’Byrne and Pytash’s (2015) study there does not exist a perfect mixture of digital technology and traditional teaching to define blended learning. Chyr et al.’s (2017) study uses the definition that 30% to 37% of the course is traditional face-to-face. While Watson et al.’s (2011) report shows that blended learning can range from as low as 1% using digital instruction to 90% digital instruction used.

Students have enjoyed the anytime and anywhere access to course documents and tools that helped their learning of the material (Lin, 2009). This means students felt that the online components of blended learning were just as well as in-class instruction and being able to learn in any location. Students have also said that computer assignments made “learning more permanent” (Gecer & Dag, 2012, p. 441). This means that students feel that online assignments make the concepts being taught stay with the students longer. Lastly, blended learning has been shown to help improve a student’s self-efficacy and self-directed learning (Chyr et al., 2017).
Defining Online Homework and OHWP

Homework has been studied over the years and has been found to help students perform better in class. With the use of technology in and out of class, there has been an increased use of online homework. Online homework is defined as completing and submitting all homework online (Albelbisi & Yusop, 2018). When students are completing and submitting their homework online, they are using an online homework system, better known as OHWP. Lunsford and Pendergrass (2016) defined an OHWP as a computer system that gives the students assigned homework and provides immediate feedback to their responses. Also, OHWP is offered through either: textbook publishers (Callahan, 2016; Lunsford & Pendergrass, 2016), shareware (Balta, Perrea-Rodriguez, & Hervas-Gomez, 2018), or open-source (Heenehan & Khorami, 2016).

Advantages of the Features of OHWPs

There are many advantages to using OHWPs. One of the biggest advantages is the OHWPs provide immediate feedback to students as they complete assignments (Balta et al., 2018; Callahan, 2016; Heenehan & Khorami, 2016; Locklear, 2012; Lunsford & Pendergrass, 2016; Perdian, 2013; Shanahan, 2017). This feedback is either in the form of a grade (Duzhin & Gustafsson, 2018; Labuhn et al., 2010; Lunsford & Pendergrass, 2016), providing hints or steps of how to solve the problem correctly (Duzin & Gustafsson, 2018; Labuhn et al., 2010; Lee et al., 2010; Lunsford & Pendergrass, 2016), or if the problem is just right or wrong (Hegeman, 2015; Hodges, Anderson, Carpenter, Cui, Gierasch, Leupen, Nanes, & Wagner, 2015). The teachers also receive feedback from the OHWP in the form of grades, time spent on assignments, students access and
complete assignments, and what concepts students are either comprehending or not comprehending (Balta et al., 2018; Lunsford & Pendergrass, 2016; Perdian, 2013).

OWHP also allows students to access the platform to complete assignments anywhere at any time (Albelbisi & Yusop, 2018; Doorn, Janssen, & Brien, 2010). This is helpful for students in a hybrid or blended learning class because students complete assignments or learn the material, not just in a traditional face-to-face classroom (Watson et al., 2011). Also, most OHWPs are either compatible with or use the full textbook that the instructor is using (Lunsford & Pendergrass, 2016). This is helpful for students because they would spend less money on using both a physical and eTextbook for the same class (Lunsford & Pendergrass). Many OHWPs offer many different pre-made resources and tools that allow teachers to upload notes, materials, or other helpful resources that are designed to enhance the students’ learning (Hegeman, 2015; Locklear, 2012; Lunsford & Pendergrass, 2016).

OHWPs also offer advantages for teachers. One advantage is allowing teachers to assign and create problems from a problem bank and then assign new problems based on equivalency (Heenehan & Khorami, 2016; Lunsford & Pendergrass, 2016). Also, many OHWPs allow teachers to create their own unique problems inside the assignment functions (Balta et al., 2018; Callahan, 2016; Lunsford & Pendergrass, 2016). Teachers can also create any form of formative assessment in an OHWP, such as tests and quizzes (Albelbisi & Yusop, 2018; Balta et al., 2018). An OHWP also helps lessen the amount of grading a teacher does by grading assignments assigned via the OWHP (Locklear, 2012). Teachers also enjoy that online homework assigned via an OHWP scaffolds students’ learning (Johnson, 2001; Moos & Marroquinn, 2010; Ramdass, 2012; Thompson,
Pastorino, Lee, & Lipton, 2016). Finally, teachers like that OHWPs allows students to collaborate on assignments (Callahan, 2016).

**Disadvantages of Using an OHWP**

There are also disadvantages to using an OHWP. The two biggest disadvantages are students can become dependent on OHWP tools to learn and not use their own knowledge to learn (Hodges et al., 2015; Locklear, 2012) and students focus on just answering the question and not the process to solve problems (Locklear, 2012; Peng, 2009). Students struggle and focus on putting answers in the correct format that the OHWP wants the answers in (Heenehan & Khorami, 2016; Holt, Holt, & Lumadue, 2012; Prescott, 2017). This struggle and focus can take away from what the students are supposed to be learning from the online assignment. Finally, OHWP can be viewed as the content provider and not the instructor (Hegeman, 2015). This is a concern because the OHWP may not be able to provide specific enough feedback needed for each student to understand why they are not comprehending a concept (Hegeman, 2015).

Some OHWP have different restrictions that could hinder a student’s learning or confidence. One restriction is not every OHWP provides students with immediate feedback with no explanation as to why the solution is right or wrong (Locklear, 2012). This does not help the students focus on the steps or concepts of what they are not performing correctly. Another restriction is when an OHWP does not have a clear or too strict of a format for answering questions (Heenehan & Khorami, 2016). This means OHWPs do not always have the students answer the problems in the same format or require them to format their answers differently than in-class discussions and tasks. Both restrictions lead to students and teachers to have negative perceptions of OHWPs.
Even with these disadvantages, OHWPs have been shown to improve students’ academic performance (Albelbisi & Yusop, 2018; Balta, et al., 2018; Locklear, 2012, Ramdass & Zimmerman, 2011) and the students have the same performance level with online homework as traditional homework (Balta et al., 2018; Callahan, 2016; Heenehan & Khorami, 2016; Locklear, 2012; Zerr, 2007).

The literature shows that OHWPs has many advantages for enhancing a student’s learning, like giving teachers access to a question bank that contains thousands of problems created by math teachers (Hauk, Powers, & Segalla, 2015; Engelke, Karakok, & Wangberg, 2016) and allowing the teacher to create their questions (Heenehan & Khorami, 2016). Online homework increases the student’s perceptions of the mathematical concepts and mathematics courses (Locklear, 2012; Zerr, 2007), and increases student involvement with in-class discussions (Locklear, 2012). OHWPs allow students to attempt an assignment multiple times, which allows the student to practice more and to learn the concepts being taught in the assignment (Engelke et al., 2016; Locklear, 2012) and receive immediate and detailed feedback after every homework attempt (Engelke et al., 2016; Paiva et al., 2015). Some OHWPs provide the following helping tools to help the student complete their assignments: pre-made tutorial videos, examples, email the instructor, and animations (Hegeman, 2015; Locklear, 2012; Lunsford & Pendergrass, 2016). One of these tools allows the students to email their instructor while working on the problem, without leaving the homework assignment (Locklear, 2012). Finally, students enjoy using the online eTextbook and believe it is useful to their learning (Paiva et al., 2015).
Effects of OHWP Perceptions

Studies have shown that students find OHWPs can have a positive impact on the learners’ motivation, performance, making mathematical concepts seem useful, and mathematical course enjoyment (Locklear, 2012; Paiva et al., 2015; Zerr, 2007). However, one study showed that online homework did not improve or reverse the students’ grades as the semester progressed (Locklear, 2012). The reason for the reverse effect has been attributed to students not completely understanding and being able to apply the concepts taught online to in-class topics or other assessments (Hauk et al., 2015; Locklear, 2012). Further, studies have shown differing opinions on how OHWP affects student learning and course perceptions (Hauk et al., 2015; Heenehah & Khorami, 2016). One reason for the mixed perceptions is students feel that the OHWP can make real-world examples too complex and will distract the students from learning the key concepts (Borman & Sleigh, 2011). Finally, to have the most beneficial impact on student’s perception of using an OHWP, they need to feel that the platform is useful, easy to use, and beneficial to their educational needs (Zogheib, Rabaa’I, Zogheib, & Elsaheli, 2015). To effectively do this, an instructor must be willing to put in the effort and time to integrate an OHWP into their teaching environment, then the OHWP is beneficial to both the students and teacher (Lunsford & Pendergrass, 2016).

How Tools of OHWP Impact a Student’s SRL Skills

This section will show how OHWP can positively impact a student’s SRL skills. Most students enjoy how the tutorial program via WebAssign (Lunsford & Pendergrass, 2016), Help Me Solve This and View an Example via MyMathLab (Holt, et al., 2012; Raines, 2016), and videos via MyMathLab (Holt et al., 2012) provide detailed step-by-
step instructions on how to solve the problems. The OHWP WebWork has been shown to help students manage their time outside of the physical classroom effectively (Zerr, 2007). Also, MyMathLab’s Help Me Solve This and View an example has also been shown to help students manage their time because they can work on the problems at their own pace and are provided clear due dates and times (Raines, 2016). The Ask My Instructor Tool via MyMathLab has been shown to help students in their efforts to understand the concepts and why they are getting problems wrong (Li, 2008). WebWork allows students to discuss with each other why they get problems incorrect and share their methods of solving problems, which students enjoyed using (Engelke et al., 2016). Shanahan’s (2017) found that the teachers enjoyed that the OHWP “held the students responsible for accuracy and deadlines” (p. 62). This means the students have to properly manage their time to complete the tasks in a timely manner. Lastly, if the students are taught how to effectively use all of MyMathLab’s resources (Steltenpohl, 2012), then MyMathLab can encourage students to use just the MyMathLab resources and not need any other outside help (Law, Ng, Goh, Tay, & Sek, 2012).

**Assigning Homework**

Researchers do not have a definitive answer about how often to assign homework for both traditional and online homework. Zerr (2007) assigned homework two or three times a week for the semester and found that students enjoyed the amount of homework and it positively impacted their learning of the material being taught. Tas, Vural, & Oztekin’s (2014) found that teachers assign homework frequently and found that students did not regularly complete the assignments. The definition of frequently was not clearly defined. The definition was either once a week or at the end of every class (Tas et al.,

33
Stoeger and Ziegler’s (2008) assigned homework for Monday through Thursday and found that students’ performance and completion rates increased throughout the semester. This means that students were able to complete more of the assignments and their grades improved during the semester. The rest of the research stated that they assigned homework but did not mention the frequency to which it was assigned.

Also, one part of Lee’s (2016) study focused on which method of assigning homework students statistically preferred. Students were asked if they preferred a homework assignment that was either: skills practice, preview of future concepts, preparation for next class, skill application, product production, communication, or study skills development (Lee, 2016). The study found that overall that students preferred homework that had them practice skills that were learned in-class over the other methods because they are already familiar with the concept and could help improve their confidence with the concept that was taught (Lee, 2016). Female students preferred to have homework that was either skills practice, product production, and study skills, because doing an unfamiliar assignment may hinder their success and not know what strategies to use to work more independently (Lee, 2016). Male students preferred to have skills practice and skills application homework because they felt if they worked and communicated together or sought help then their confidence would weaken (Lee, 2016).

**Online Homework and Mathematics Self-Efficacy**

Kitsantas and Zimmerman (2009) found that there is a “significant indirect” correlation between homework and a student’s self-efficacy (p. 104-106). This means that online homework has a secondary effect on a student’s self-efficacy. Ozerbas and Erdogan (2016) found that using digital-based activities increase a student’s motivation.
So, using online homework would improve a student’s self-efficacy, since online homework is an example of a digital-based activity. Peng’s (2009) found that students with low intrinsic motivation and computer efficacy used OHWP more frequently if the OHWP seem beneficial to their learning. This was also shown in Albelbisi and Yosup’s (2018) study. Therefore, instructors need to state at the beginning and throughout the semester the importance of using the OHWP, because it will affect the students’ self-efficacy. When students are continuously held to a standard of high accountability to do online homework, their self-efficacy can be positively influenced (Koukounas, 2016). Gates’ (2014) study also found that online homework and an OHWP helped improved all factors of self-efficacy.

**Online Homework and SRL**

Many studies show traditional paper and pencil homework improve a student’s self-regulation (Kitsantas & Zimmerman, 2009; Lee, 2016; Ramdass & Zimmerman, 2011), but there are mixed reviews on if online homework improves a student’s self-regulation. Koukounas’ (2016) found that “continuous high accountability for online homework and formative assessment with students may positively influence their self-efficacy, effort regulation, and achievement in developmental algebra I” (p. 102).

Similarly, there is a positive correlation between students completing their homework and their self-regulation (Kitsantas & Zimmerman, 2009; Lee, 2016; Ramdass & Zimmermann, 2011). This means as students complete their homework, they are also improving their self-regulation, which means they are improving their SRL skills. Koukounas (2016) found that “developmental algebra I students most likely perceived high accountability for online homework as a learning task imposed upon them, rather
than a learning strategy they could use to actively participate in their own learning” (p. 105). This means the participants did not take control of the learning strategy presented to improve their knowledge, which means the online homework did not help the students’ self-regulation. Finally, Koukounas (2016) also found that improve a student’s self-regulation while using online homework, the teachers need to hold students accountable and use formative assessments.

Conclusion

This literature review provides a definition and how to improve a student’s mathematics self-efficacy and SRL, and what is online homework and OHWP. Self-efficacy focuses on the beliefs a student must accomplish a task. Whereas SRL focuses on how students use self-motivation, goals, planning strategies and helping tools, and self-evaluation to learn and complete a task. Also, self-efficacy is a component of SRL, but SRL is not a component of self-efficacy. An instructor should always be trying to improve a student’s self-efficacy and self-regulation because students will avoid perceived difficult tasks (Valtonen et al., 2009) because students will not always be able to receive one-on-one help from an instructor (Hoops et al., 2018). This means that students are less prepared to handle real-world problems if their self-efficacy and self-regulation are not improved. Finally, OHWPs have been shown to improve both mathematics self-efficacy and SRL. However, there is not an agreement on which platform best enhances a student’s mathematics self-efficacy and SRL.
CHAPTER 3

METHOD

The purpose of this action research was to evaluate the impact of using SRL strategies embedded in the online homework platform, MyMathLab, has on the students’ SRL and mathematics self-efficacy skills while taking College Algebra at the Regional College Campus. This study explored the following research questions: (1) How, and to what extent, does the online homework platform, MyMathLab, impact the students’ self-regulated learning skills? (2) How, and to what extent does, the online homework platform, MyMathLab, impact the students’ mathematics self-efficacy? (3) What are the students’ perceptions of how the online homework platform, MyMathLab, impacted their self-regulated learning skills?

This chapter discusses the design of this research, settings, participants, the intervention for this research, data collection methods, data analysis, rigor and trustworthiness of the data to be collected, and ways to share the findings.

Research Design

Action research is defined as a systematic inquiry process conducted by educators and school administrators to gather information about how the educators teach, administrators lead the school, and how students learn (Mertler, 2017). The results of action research will specifically help the school(s) involved in the research and how to effectively address and fix a particular problem at that school. While other methods of research take the results and generalize it for every school in the world, this is not always
possible because not every school is designed the same nor has the same student populations (Conwill, 2003; Hammond & Cooper, 2016; O’Grady, 2011).

Another way action research is different from other forms of research is the absence of clearly defined starting and ending point (Mertler, 2017), which means action research is a cyclical process. Also, in most research environments or studies, the researcher is not actively involved in the data gathering process, which can lead to data not being gathered based on the researcher’s experience in the field of study (Hammond & Cooper, 2016). Additionally, most other research analyzes solely either qualitative or quantitative data, while most action research uses a mixed-methods design to interpret the data collected. The mixed-methods design allows the researcher to gather, interpret, and analyze both the quantitative and qualitative data at the same time, instead of just either quantitative or qualitative data. This is beneficial to both educators and administrators because we want to know how and why our teaching methods are impacting the students learning.

Action research fits the purpose of my research because I am both the teacher and researcher seeking to improve my students’ mathematics self-efficacy and SRL skills while using OHWPs, both in my classroom and future courses at the Regional College Campus. At the end of my action research, I have a better insight into the mathematics self-efficacy and SRL skills of the students at the Regional College Campus taking mathematics courses that use OHWPs. This insight will not be able to be generalized for other college campuses, because the Regional College Campus has a significant first-generation student population, unlike other colleges in the world. So, the results cannot be generalized for other colleges.
Quantitative data was gathered from pre- and post-surveys. While qualitative data was gathered from focus group interviews and structured journals, I gathered the quantitative and qualitative data separately, but at the same time. I then analyzed, compared, related, and interpreted the findings of the quantitative and qualitative data simultaneously. This shows that I used a convergent parallel mixed-method design because I collected and analyzed both the quantitative and qualitative data separately, and then compared and interpreted the results together (Bozkurt, Erim, & Celik-Demiray, 2018; Creswell, 2014; Duran & Akbas, 2017). This method was chosen because the quantitative and qualitative data were compared side-by-side, instead of one data type being used to either “design an instrument” for the other type of data used (Creswell, 2014, p.226) or lead the researcher to the types of instruments that need to be used to collect data for other types of data used (Creswell, 2014).

**Settings and Participants**

This action research took place in the Department of Mathematics at the Regional College Campus. The students involved with this action research were registered for one of the Math111i Intensive College Algebra courses that I teach. This course was chosen because students who are taking this course typically have some of the lowest SRL skills and mathematics self-efficacy skills. There were 17 students registered for the class, but only 13 of them chose to participate in this action research. The students came from a variety of majors, where this course is a prerequisite to advanced mathematics courses. The students had the following majors: seven were business or marketing, two nursing, three undecided, and one of either computer science, associates of science, environmental science, education, and biological science. There were 13 college freshmen, two college
sophomores, and two dual credit students. There was almost an equal number of students who are male and female, with eight male and nine female students. There were 15 Caucasian and two African-American students. The students’ ages ranged from 16 to 22 years old, with the mean age of 18.29. Table 3.1 gives further information about the students you participated in the focus group interviews. College Algebra is a freshmen collegiate level algebra course that covers topics from high school Algebra I and II as well as non-Trigonometry parts of Pre-Calculus. This course is a prerequisite for many upper-level mathematics and statistics courses. This course is designed for students who are majoring in business, social sciences, education, and nursing. The class meets four days a week for a maximum of 75 minutes each time.

During class meetings, I used a Microsoft Surface Pro to write and record lecture notes that were later posted to MyMathLab. The notes are projected through a projector that is connected to the Surface Pro. The students were able to access MyMathLab either using a computer at one of Regional College Campus’ computer labs or a personal laptop or desktop. The only other technological devices that were used in the classroom during the daily lecture were calculators, and I utilized the classroom desktop. Students completed and submitted pre-created daily homework that would reinforce that day’s lecture before the next class. Students were also able to access the course textbook and many pre-created helping tools to enhance their learning of the concepts taught each day.

**Intervention**

In this study, I used MyMathLab to examine its effect on students’ the following SRL skills in a college-level blended mathematics course: goal setting, time management, help-seeking, mathematics self-efficacy, and self-reflection. These skills were chosen
because I can easily monitor and implement these skills into MyMathLab. Appendix A is the approval letter from the University of South Carolina’s Institutional Review Board (IRB) to conduct this research. Also, Appendix B is the approval letter from Pearson to use MyMathLab for this research. During the 5-week intervention, students were to attend in-class lectures, and complete daily homework and structured journals via MyMathLab. In-class lectures were approximately 75 minutes four times per week. Daily homework was assigned an hour before class every day and was due by the next class, within 24 hours. There was a total of 20 daily homework assignments and five structured journals during the intervention.

Table 3.1 *Focus Group Participants*

<table>
<thead>
<tr>
<th>Pseudonyms</th>
<th>Age</th>
<th>Ethnicity</th>
<th>Gender</th>
<th>Grade</th>
<th>Major</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alex</td>
<td>18</td>
<td>Caucasian</td>
<td>Male</td>
<td>Freshmen</td>
<td>Business</td>
</tr>
<tr>
<td>Jake</td>
<td>18</td>
<td>Caucasian</td>
<td>Male</td>
<td>Freshmen</td>
<td>Computer Science</td>
</tr>
<tr>
<td>Jill</td>
<td>19</td>
<td>African-American</td>
<td>Female</td>
<td>Sophomore</td>
<td>Elementary Education</td>
</tr>
<tr>
<td>Rose</td>
<td>18</td>
<td>Caucasian</td>
<td>Female</td>
<td>Freshmen</td>
<td>Bachelors Nursing</td>
</tr>
<tr>
<td>Shanna</td>
<td>22</td>
<td>Caucasian</td>
<td>Female</td>
<td>Sophomore</td>
<td>Bachelors Biological Science</td>
</tr>
<tr>
<td>Jasmine</td>
<td>18</td>
<td>Caucasian</td>
<td>Male</td>
<td>Freshmen</td>
<td>Nursing</td>
</tr>
<tr>
<td>Joseph</td>
<td>18</td>
<td>Caucasian</td>
<td>Male</td>
<td>Freshmen</td>
<td>Business Administration</td>
</tr>
<tr>
<td>Jane</td>
<td>16</td>
<td>Caucasian</td>
<td>Female</td>
<td>Dual Credit</td>
<td>Bachelors</td>
</tr>
<tr>
<td>Jessica</td>
<td>18</td>
<td>African-American</td>
<td>Female</td>
<td>Freshmen</td>
<td>Associate Science</td>
</tr>
</tbody>
</table>
MyMathLab was chosen for this study because it allowed the students to contact the professor for help (Locklear, 2012), offered students access to pre-made resources (Hegeman, 2015; Lunsford & Pendergrass, 2016), and an assignment question bank created by mathematics educators (Hauk et al., 2015; Engelke et al., 2016). MyMathLab offers different features for a student to use to master key concepts and improve their homework grades (Pearson, 2020). This study focused on the following features of MyMathLab: daily homework, homework helping tools and feedback, course homepage, course gradebook, and course calendar features. Table 3.2 summarizes the MyMathLab features which were used to promote SRL skills.

**Daily Homework**

Daily homework was a homework assignment that contained five problems that were similar to the material covered in that day’s class. The homework was assigned one hour before the class started every day and was due by the start of the next class, within 24 hours. The students had three attempts to earn a perfect score. Homework has been shown to help students develop their motivational skills, self-reflection process, help-seeking skills, and managing their time because the students are working on the homework by themselves with limited supervision by the teacher (Ramdass & Zimmerman, 2011). Lunsford and Pendergrass (2016) found that daily homework was a great way to give students reinforcement of the material covered in class. This reinforcement positively impacts a student’s motivation to complete their homework (Planchard et al., 2015) and improves their grade (Lunsford & Pendergrass, 2016). So, having higher motivation to do their homework and higher grades positively impacts a
student’s mathematics self-efficacy (Dull et al., 2015; Koukounas, 2016; Yukselturk & Top, 2013).

Table 3.2. Summary of the MyMathLab Tools Promoting SRL Skills

<table>
<thead>
<tr>
<th>SRL Skills</th>
<th>MyMathLab Tools and Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal Setting</td>
<td>• Students would set goals to complete the assignment before using all three attempts.</td>
</tr>
<tr>
<td></td>
<td>• Students would set goals to complete the homework before the next class.</td>
</tr>
<tr>
<td></td>
<td>• Students would set goals to earn the highest grade possible in the three attempts.</td>
</tr>
<tr>
<td></td>
<td>• Structured journals were assigned weekly and allowed the students to set and evaluate their goals.</td>
</tr>
<tr>
<td>Time Management</td>
<td>• Daily homework was assigned daily and due before the next class starts.</td>
</tr>
<tr>
<td></td>
<td>• The homepage and assignment calendar showed the students when and which assignments are due.</td>
</tr>
<tr>
<td>Help-Seeking</td>
<td>• Students had access to different homework helping tools (View an Example, Animation, Video, Contact the Professor, and eTextbook) while completing their homework.</td>
</tr>
<tr>
<td>Mathematics Self-Efficacy</td>
<td>• Gradebook showed the students their current class grade and assignment grades.</td>
</tr>
<tr>
<td></td>
<td>• Daily homework offered different homework helping tools to complete the assignment.</td>
</tr>
<tr>
<td></td>
<td>• Students were able to rework the problems they get incorrect (Locklear, 2012).</td>
</tr>
<tr>
<td></td>
<td>• Students received positive instant informative feedback when they answered a question both incorrectly and correctly.</td>
</tr>
<tr>
<td>Self-Reflection</td>
<td>• Students would evaluate and judge their stance in the class based on class and assignment grades.</td>
</tr>
<tr>
<td></td>
<td>• Structured journals were assigned weekly and allowed the students to evaluate their weekly learning process and accomplishment.</td>
</tr>
</tbody>
</table>
The daily homework was created using MyMathLab’s quiz function because this feature required the students to respond to short answer questions, as seen in Figure 3.1. Also, this function required students to answer and submit the entire assignment before allowing them to redo it. The daily homework had five problems and students were limited to three attempts to earn the highest grade possible in the assigned time. While completing the daily homework assignments, students had access to the following homework helping tools: View an Example, Video, Animation, Textbook, Ask My Instructor, and Instructor Tip.

![Quiz: Daily HW Creating Linear Equations](image)

Figure 3.1. Example Question from a Daily Homework Assignment.

The students did not have access to the helping tool “Help Me Solve This,” because this feature will take the given problem and show the students exactly how the problem should be solved, as shown in Figure 3.2. The main purpose of helping tools is to aid the students in completing their daily homework successfully by either showing the students how to work a similar problem, receive a helpful hint to starting the problem, or seeking help from me, the professor.
As seen in Table 3.2, the use of daily homework might impact the students’ SRL skills in a variety of ways. First, daily homework was assigned and due at the same time every day. This might help the students prioritize, manage their time, and plan their schedule to ensure that they complete their homework within the allotted time. Being able to rework a problem can improve a student’s mathematics self-efficacy (Locklear, 2012). As previously mentioned, the daily homework reinforces concepts that were taught in-class, which would help increase their mathematics self-efficacy (Planchard et al., 2015). While the students completed their daily homework they received either feedback that tells them if the answer is correct or “informative feedback” if the answer is incorrect (Landers & Reinholz, 2015, p. 22) that can help them to correctly answer the problem, as shown in Figure 3.3. This informative feedback impacts a student’s strategy planning and self-reflection on their learning of the concepts being taught (Clark & Zimmerman, 1990; Puustinen & Pulkkinen, 2001). The provided feedback is generated
by MyMathLab. This means I, the researcher and instructor, did not create any of the daily homework feedback.

![MyMathLab Feedback for Incorrect Answers on Homework](image)

**Figure 3.3.** MyMathLab Feedback for Incorrect Answers on Homework.

**Homepage**

The MyMathLab homepage had a horizontal calendar, showing “What to Work on Next,” the student’s grade for the course, and links to their daily homework, eTextbook, gradebook, and different pre-created resources, as seen in Figure 3.4. When students click on the “Daily Homework” link they were able to see what assignments were due, how many attempts were left, and what their current grade for that assignment was, as seen in Figure 3.5. Knowing the due dates and number of attempts left will help the students to set their daily and weekly goals of completing the assigned assignments, achieving the highest grade possible, and learn the material being taught (Stoeger & Ziegler, 2008). Also, knowing this same information would help the students prioritize and manage their time better.
The gradebook showed the students their current class grade, the grade for each assignment, and how their grade was broken down, as seen in Figure 3.6. Students could set their goals to earn the highest grade possible on all assignments and to make a passing grade for the course, which is at least 70. The gradebook could also positively impact a student’s extrinsic motivation because the students would want to see they have earned passing grades on assignments (Trevino & Defreitas, 2014). So, positively affecting a student’s extrinsic motivation, positively impacts their mathematics self-efficacy (Trevino & DeFreitas, 2014). Lastly, the gradebook could help the students self-reflect on how well they understand the material being taught in the class and on the homework.
Structured Journals

The structured journals in this intervention are based on Zimmerman and Martinez-Pons’ (1988) used structured interviews to determine how the Strategy Model impacted the students’ SRL skills. The structured journals were assigned once a week every Friday at noon and due the following Sunday by 5 pm. The structured journals were created in MyMathLab’s test function. I had to pre-create each question before the intervention started and then upload them into the test function. The structured journals can impact a student’s self-reflection on the goals they set for the week, their confidence of applying the current concepts to future concepts, how often and why they used the different homework help tools or MyMathLab created resources, and what their goals were for the following week. Table 3.3 shows the guided questions the students will answer for their weekly structured journals.
Table 3.3 *How Structured Journals Impact SRL Skills*

<table>
<thead>
<tr>
<th>SRL Skills</th>
<th>Guided Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal setting</td>
<td>1) What were your goals for the previous week? Explain why?</td>
</tr>
<tr>
<td></td>
<td>2) What are your goals for this week? Explain why?</td>
</tr>
<tr>
<td></td>
<td>3) Did you accomplish the goals you set for this week? Explain why or why not?</td>
</tr>
<tr>
<td>Self-reflection and self-</td>
<td>1) Did you accomplish the goals you set for this week? Explain why or why not?</td>
</tr>
<tr>
<td>reaction</td>
<td>2) Which and how often did you use the homework help tools? Why did you use that</td>
</tr>
<tr>
<td></td>
<td>3) What are your goals for this week? Explain why?</td>
</tr>
<tr>
<td>Help-seeking</td>
<td>1) Which and how often did you use the homework help tools? Why did you use that</td>
</tr>
<tr>
<td></td>
<td>specific help tool and not another?</td>
</tr>
</tbody>
</table>

**Data Collection Methods**

This study collected data from two questionnaires, structured journals, and focus group interviews. Table 3.4 shows how the data sources align with the research questions.

**Sources of Mathematics Self-Efficacy Scale**

The Sources of Middle School Mathematics Self-Efficacy Scale was adapted from the Sources of Mathematics Self-Efficacy Scale created by Lent, Lopez, and Bieschke in 1991 (Usher & Pajares, 2009). This study used the version created by Usher and Pajares in 2009 when the researchers were creating and validating the Mathematics Self-Efficacy Scale for Middle Schoolers, shown in Appendix C (Usher & Pajares, 2009). The Sources of Mathematics Self-Efficacy Scale contains 24 items using a 6-point Likert Scale, where 1 means *definitely false* and 6 is *definitely true* (Usher & Pajares, 2009). The Sources of
Mathematics Self-Efficacy Scale contains four subscales: mastery experience (6 items), vicarious experience (6 items) from either adults, peers, or self, social persuasion (6 items), and physiological state (6 items) (Usher & Pajares, 2009). Questions 3 and 19-24 are reversed (Usher & Pajares, 2009). In Appendix C, each question is labeled as to which subcategory it belongs to and if it is reversed. Reliability scores for the subscales were reported as: .88 mastery experience, .84 for vicarious experience, .88 for social persuasion, and .87 for physiological state (Usher & Pajares, 2009). Also, Usher and Pajares (2009) validated their version of the Sources of Mathematics Self-Efficacy Scale by conducting multiple regression analyses, asked experts in the field of social cognitive theory to analyze the scale, and tested their scale multiple times with different participants. The students took this questionnaire as part of their pre- and post-questionnaire to measure their mathematics self-efficacy.

Table 3.4 Research Questions and Data Sources Alignment

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1: How and to what extent does the online homework platform MyMathLab impact the students’ self-regulated learning skills?</td>
<td>• Questionnaires</td>
</tr>
<tr>
<td></td>
<td>• Structured Journals</td>
</tr>
<tr>
<td></td>
<td>• Focus groups</td>
</tr>
<tr>
<td>RQ2: How and to what extent does the online homework platform MyMathLab impact the students’ mathematics self-efficacy?</td>
<td>• Questionnaires</td>
</tr>
<tr>
<td></td>
<td>• Structured Journals</td>
</tr>
<tr>
<td></td>
<td>• Focus groups</td>
</tr>
<tr>
<td>RQ3: What are the students’ perceptions of how the online homework platform MyMathLab impacted their self-regulated learning skills?</td>
<td>• Focus groups</td>
</tr>
<tr>
<td></td>
<td>• Structured Journals</td>
</tr>
</tbody>
</table>
OSRLQ

The OSRLQ, shown in Appendix D, was created by Barnard et al. (2009) to measure students’ SRL skills in either a blended learning environment or an entire online learning environment. The OSRLQ has 24 items using a 5-point Likert Scale, where 1 means strongly disagree and 5 means strongly agree. The OSRLQ contains six subscales: environment structuring (5 items), goal setting (4 items), time management (3 items), help-seeking (4 items), task strategies (4 items), and self-evaluation (4 items). Also, question 5 is reversed (Barnard et al., 2009; Barnard-Brak et al., 2010). In Appendix D each question is labeled as to which subcategory it belongs to. The researchers determined the validity and reliability of the OSRLQ on college students enrolled in a blended or hybrid learning environment (Barnard et al., 2009; Barnard-Brak et al., 2010). Reliability scores for the subscales were reported as: .90 for environment structuring, .86 for goal setting, .78 for time management, .69 for help-seeking, .67 for task strategies, and .78 for self-evaluation (Barnard et al., 2009; Barnard-Brak et al., 2010). Barnard et al. ensured the construct validity of the OSRLQ for either strictly hybrid or online learning environments. The students took this questionnaire as part of their pre- and post-questionnaire to measure their SRL skills.

Structured Journals

The structured journals were used to gather qualitative data on how different components of MyMathLab affect the students’ SRL skills. The structured journal questions are based on SRL Contexts, where the researchers had the students self-reflect on what methods they used to learn concepts, what strategies they used, how they studied for in-class assignments, and how they motivated themselves (Zimmerman & Martinez-
Structured journals have been used in many other studies and have been called reflection or reflective assignments (Kumar & Refaei, 2013; Shannon, Simmelink-McCleary, Im, Becher, & Crook-Lyon, 2013; Shannonhouse et al., 2015). Students completed one structured journal each week for the intervention. Each student submitted a total of five journals for this study. One of the guided questions for the structured journal was: What were your goals for the previous week? Explain why these were your goals? Appendix E contains the structured journal guided questions.

**Focus Group Interview**

Focus groups are used to gather the participants’ perceptions, attitudes, and opinions about an intervention or program that was used (Krueger, Colletti, Bogner, Barg, & Stineman, 2014). Focus groups contain participants from the study who share a commonality and representation of the entire participant group (Collier & Morgan, 2008). For this study, the focus groups were used to gather the students’ experiences and perceptions of how MyMathLab impacted their mathematics self-efficacy and SRL skills. This study had four focus groups with 2-3 students per group, for a total of nine students. The students were asked to volunteer based on their class average. Each group contained at least one student who was passing the course with at least a C average, 70% or higher, and at least one student who had a grade no more than a D average, less than 70%. This criteria was needed to have equal representation of gender, ethnicity, race, and course grade, which provided a wide range of responses to the interview questions and gave a more accurate representation of the class’ response to how MyMathLab impacted their mathematics self-efficacy and SRL skills.
While conducting the interview I used an audio recorder to record the interview and I took notes during the interview. The interviews lasted approximately one hour.

Table 3.5 shows the alignment of research questions and the questions for the focus groups. Appendix F contains the interview protocol for this study.

**Table 3.5 Research Questions and Focus Group Questions Alignment**

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Focus Group Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1: How and to what extent does the online homework platform MyMathLab impact the students’ self-regulated learning skills?</td>
<td>1. Using examples, both positive and negative, explain how the daily homework affected you in setting your goals to complete the homework?</td>
</tr>
<tr>
<td></td>
<td>2. Can you provide a couple of examples, both positive and negative, of how did daily homework affected your time management skills?</td>
</tr>
<tr>
<td></td>
<td>3. Can you give me an example of how daily homework impacted your learning strategies?</td>
</tr>
<tr>
<td></td>
<td>4. Using examples, both positive and negative, explain how daily homework impacted your self-reflection process?</td>
</tr>
<tr>
<td></td>
<td>5. Can you explain to me how the different components of MyMathLab impacted your task completion? Daily homework? Homepage? Homework help tools?</td>
</tr>
<tr>
<td>RQ2: How and to what extent does the online homework platform MyMathLab impact the students’ mathematics self-efficacy?</td>
<td>1. Can you explain to me how the different components of MyMathLab impacted your mathematics self-efficacy? Daily homework? Homepage? Homework help tools?</td>
</tr>
<tr>
<td>RQ3: What are the students’ perceptions of how the online homework platform MyMathLab impacted their self-regulated learning skills?</td>
<td>1. Using examples, both positive and negative, explain how the daily homework affected you in setting your goals to complete the homework and learn the material?</td>
</tr>
<tr>
<td></td>
<td>2. Can you provide a couple of examples, both positive and negative, of how did daily homework affected your time management skills?</td>
</tr>
<tr>
<td></td>
<td>3. Can you give me an example of how daily homework impacted your learning strategies?</td>
</tr>
<tr>
<td></td>
<td>4. Using examples, both positive and negative, explain how daily homework impacted your self-reflection process?</td>
</tr>
</tbody>
</table>
5. Can you explain to me how the different components of MyMathLab impacted your task completion? Daily homework? Multimedia Library? MyMathLab created resources? Homework help tools?

---

**Data Analysis**

This action research used inductive analysis, Wilcoxon Signed-Ranks Test, and descriptive statistics to analyze the data. Table 3.6 shows an alignment of the research questions, data collection methods, and analysis methods for this action research. The focus group interviews, and structured journals were analyzed by inductive analysis. Wilcoxon Signed-Ranks Test and descriptive statistics were used to analyze the pre- and post-surveys.

Table 3.6 *Research Questions, Data Sources, and Analysis Method Alignment*

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Sources</th>
<th>Analysis Method</th>
</tr>
</thead>
</table>
| RQ1: How and to what extent does the online homework platform MyMathLab impact the students’ self-regulated learning skills? | • Questionnaires  
• Structured Journal  
• Focus Group Interviews | • Inductive analysis.  
• Wilcoxon Signed-Ranks Test and descriptive statistics. |
| RQ2: How and to what extent does the online homework platform MyMathLab impact the students’ mathematics self-efficacy? | • Questionnaires  
• Focus Group Interviews | • Inductive analysis.  
• Wilcoxon Signed-Ranks Test and descriptive statistics. |
| RQ3: What are the students’ perceptions of how the online homework platform MyMathLab impacted their self-regulated learning skills? | • Focus Group Interviews | • Inductive analysis. |
Qualitative Data Analysis

The qualitative data was used to give a deeper understanding of how the students perceive how MyMatLab impacted their SRL and mathematics self-efficacy skills and the impact of these findings. The data collected from the structured journals and focus group interviews were analyzed using inductive analysis. The inductive analysis allows a researcher not to view each source of data as an individual piece of data, but rather data that encompasses the entire research (McCulloh, 2016). I first analyzed the qualitative data by creating different codes based on the analysis of the structured journals and focus group interviews. Based on these codes, I then created separate categories based on further analysis of the structured journals and focus group interviews. Then I used these categories to create themes that will represent the overall findings of the structured journals and focus group interviews. Finally, the themes and categories were discussed in detail as to why they were created and included direct quotes from the qualitative data. Details of inductive analysis were provided in Chapter 4.

Quantitative Data Analysis

The quantitative data was analyzed using SPSS. I used the Wilcoxon Signed-Ranks Test because a Shapiro-Wilk Test showed that the distribution of the difference in the dependent variables were not normally distributed (Bridge & Sawilowsky, 1999; Dorais, Gutierrez, & Gressard, 2020). The Wilcoxon Signed-Ranks Test compared the pre- and post-survey medians of the participants’ responses to the same two surveys (Dorais et al., 2020). The pre- and post-surveys used the Sources of Mathematics Self-Efficacy Scale and OSRLQ, (Buss & Zambo, 2014). Before conducting the Shapiro-Wilk Test and Wilcoxon Signed-Ranks Test, question numbers 3 and 19-24 of the
Sources of Mathematics Self-Efficacy Scale and question number 5 of the OSRLQ, were reversed as the creators of the surveys instruct (Barnard et al., 2009; Usher & Pajares, 2009). An alpha level of .05 was used for all nonparametric tests. Also, descriptive statistics (mean and standard deviation) were used to report the change of the students’ scores after the intervention.

**Procedures and Timeline**

The procedures for this research followed these three steps: (1) Intervention Overview, (2) The Intervention and Data Collection, and (3) Data Analysis. Each step is discussed in detail below and Table 3.7 shows a detailed timeline of the procedures.

**Step 1. Intervention Overview**

This intervention took place during the Fall 2019 semester and participants were taking MATH 111i Intensive College Algebra. For the first week, I explained the format of the course and provided an orientation of the intervention tool MyMathLab. Also, consent forms were distributed to be signed. Appendix G contains the consent form. If the participants are younger than 18, consent and assent forms were signed by the parents and students. The students who did not sign the consent form, which there were four of them, their data was excluded from the research.

**Steps 2. The Intervention and Data Collection**

During the intervention, the students used MyMathLab embedded with the following SRL strategies: daily homework assignments, course calendars, homepage, homework help tools, gradebook, and structured reflection journals. During the first week of class, I, the researcher, emailed the students a Google Forms link that contained a pre-survey to measure their current SRL skills and mathematics self-efficacy and gather
demographic data, as shown in Appendix H. The students completed the survey in-class.

During the intervention, the students attended a blended learning class four times a week for a maximum of 75 minutes each time. Then the students completed daily homework, assigned through MyMathLab, before the next class visit.

Table 3.7. *Timeline of the Intervention, Data Collection, and Data Analysis*

<table>
<thead>
<tr>
<th>Steps</th>
<th>Expectation</th>
<th>Time Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1. Intervention Overview</td>
<td>1. Discuss the course, syllabus, MyMathLab, and intervention.</td>
<td>1 day</td>
</tr>
<tr>
<td></td>
<td>2. Get and review participant consent.</td>
<td>1 day</td>
</tr>
<tr>
<td>Step 2. The Intervention and Data Collection</td>
<td>1. Complete pre-surveys.</td>
<td>1 day</td>
</tr>
<tr>
<td></td>
<td>2. Submit daily homework and structured journals</td>
<td>5 weeks</td>
</tr>
<tr>
<td></td>
<td>3. Complete post-survey.</td>
<td>1 day</td>
</tr>
<tr>
<td></td>
<td>4. Conduct focus group interviews.</td>
<td>1 week</td>
</tr>
<tr>
<td>Step 3. Data Analysis</td>
<td>1. Download surveys from Google Forms to Excel file.</td>
<td>1 day</td>
</tr>
<tr>
<td></td>
<td>2. Conduct the Wilcoxon Signed-Ranks Test.</td>
<td>1 day</td>
</tr>
<tr>
<td></td>
<td>3. Calculate descriptive statistics.</td>
<td>1 day</td>
</tr>
<tr>
<td></td>
<td>4. Interpret quantitative data.</td>
<td>1 week</td>
</tr>
<tr>
<td></td>
<td>5. Transcribe audio recording.</td>
<td>8 weeks</td>
</tr>
<tr>
<td></td>
<td>6. Conduct inductive analysis on audio recording and reflection journals.</td>
<td></td>
</tr>
</tbody>
</table>

While completing the homework the students used homework help tools and the assignment calendar to finish assignments on time. At the end of each week, the students submitted a structured reflection journal through MyMathLab. One day after the intervention ended, which was 5 weeks after the pre-surveys were filled out, I emailed the
students again with a Google Forms link that contained a post-survey to measure their SRL skills and mathematics self-efficacy skills. The students completed the post-survey outside of class. They were given three days to complete the post-survey. Also, within one week after the intervention ended, I conducted four focus group interviews.

**Step 3. Data Analysis**

All data analysis was conducted after all the data was collected. Analyzing and interpreting the quantitative data, pre- and post-surveys took 1 week. Transcribing, analyzing, and interpreting the qualitative data, student reflection journals, and focus group interviews, took eight weeks to analyze the data.

**Rigor and Trustworthiness**

This research used peer debriefing, rich and thick description, member checking, and triangulation method to ensure the rigor and trustworthiness.

**Peer Debriefing**

Peer debriefing is when a researcher has other researchers, not related to the research being conducted, analyze, provide feedback, and ask questions about the research and analysis that was conducted (Haegerle, Zhu, & Davis, 2017). The peer debriefing for this study was made up of my dissertation chair and with two cohort members. I met with my dissertation chair and cohort members at least once a week during the intervention and analysis processes. The dissertation chair provided debriefing while the data was being collected and analyzed. The dissertation chair reviewed, questioned, and provided suggestions for improvements throughout the entire research process. These questions and suggestions are meant to make the findings of the qualitative data clearer to other researchers (Creswell, 2014; Krueger et al., 2014).
Lastly, the questions and suggestions are to make sure that my interpretation of my findings was consistent and accurate (Creswell, 2014; Mertler, 2017; Nguyen, 2015).

**Rich, Thick Description**

Creswell (2014) states to ensure that the data has a rich and thick description, the data needs to “give the discussion of an element of shared experiences” and “offer multiple perspectives about a theme” in order for the data to be more “realistic” and valid (Creswell, 2014, p. 202). I ensured the qualitative data was rich and thick by collecting data from four focus group interviews and 85 journal entries. During the focus group interviews and structured journals, students answered open-ended and in-depth questions, which allowed them to explain their perspective of how the intervention affected them (Reinarman, 2012). If there was any uncertainty in the students' answers during the focus group interviews, I asked follow up questions for clarity and further explanations. Two example questions the students answered were: “Explain how confident you feel applying what you have learned this week to current and future topics? Why do you feel this way?” and “Describe to me your impressions, both positive and negative, of how MyMathLab impacted your mathematics self-efficacy?”

**Member Checking**

Member checking is used by a researcher to make sure there is no researcher bias in the data analysis (Haegele et al., 2017). A researcher conducts member checking by providing the participants of the research a copy of the transcripts to find any errors and provide additional feedback if there is bias or misinterpretations in the findings (Haegele et al., 2017; Liao & Hitchcock, 2018). After the focus group interviews have been transcribed and analyzed, I emailed the participants a copy of the transcripts and asked
them to send revisions. Only one participant provided revisions. There was no discrepancy in the data, so I did not have to conduct more interviews with participants to make sure the findings are accurate (Creswell, 2014). Lastly, I have emailed the students a summary of the findings and have asked them to provide their feedback on the findings. Currently, no one has responded.

**Triangulation Method**

Triangulation method uses multiple data sources to ensure that findings and interpretations are consistent and accurate (Gethers, 2016; Hand & Payne, 2008; McCulloh, 2016; Mertler, 2017). For this study, data was collected from structured journals, focus group interviews, and pre- and post-surveys. These three sources of data helped to ensure that the findings and interpretations are consistent and accurate. Both the focus group interviews and structured journals had open-ended questions to ensure the participants were able to give detailed responses about their perceptions of how MyMathLab impacted their SRL and mathematics self-efficacy skills. Using these multiple sources strengthens the rigor and trustworthiness of the data (Creswell, 2014).

**Plan for Sharing and Communicating Findings**

The participants involved in this research study do not have to worry about their identity being known because I have removed any identifying data that links a specific student to the data collected from the surveys. Identifying data was removed by assigning each participant a random number and having the students input that number at the top of their pre- and post-surveys. Also, I did not mention any students’ identity when presenting the findings. The findings will be shared first and primarily with the math faculty at the Regional College Campus during our department meetings. Next, the
findings will be shared with the rest of the Regional College Campus faculty and administration through different presentations offered at the Regional College Campus. Some of the opportunities are Faculty Colloquium, Research Club, and/or faculty meeting. Presenting here can help my colleagues to analyze the current OHWP they use or help them choose a new OHWP. I submitted a proposal, and it was accepted, to present to the Association for Educational Communications and Technology 2020 conference where I will present the findings of this study. I will also submit proposals to present my findings at other collegiate mathematics departments, Mathematical Association of America, Educational Technology and Society, and South Carolina Council of Teachers of Mathematics conferences.
CHAPTER 4
ANALYSIS AND FINDINGS

The purpose of this action research was to evaluate the impact of using SRL strategies embedded in the online homework platform, MyMathLab, has on the students’ SRL and mathematics self-efficacy skills while taking College Algebra at the Regional College Campus. This study explored the following research questions: (1) How, and to what extent does, the online homework platform, MyMathLab, impact the students’ self-regulated learning skills? (2) How, and to what extent does, the online homework platform, MyMathLab, impact the students’ mathematics self-efficacy? (3) What are the students’ perceptions of how the online homework platform, MyMathLab, impacted their self-regulated learning skills?

This chapter first reports the findings of the quantitative results obtained from student pre- and post-surveys. The chapter ends with reporting the themes that emerged from the students’ structured journals and focus group interviews.

**Quantitative Results**

This section starts by discussing the method of analysis used, followed by presenting the internal consistency, descriptive statistics, and Wilcoxon Signed-Ranks Test findings for the Sources of Mathematics Self-Efficacy Scale. This section ends with presenting the internal consistency, descriptive statistics, and Wilcoxon Signed-Ranks Test findings for the OSRLQ.
Sources of Mathematics Self-Efficacy Scale Consistency and Findings

The Sources of Mathematics Self-Efficacy Scale was created to accurately measure the four sources of Bandura’s theory of self-efficacy across gender, ethnicity, and different levels of mathematics abilities (Usher & Pajares, 2009). The four subscales are mastery of experience, social persuasion, vicarious experience, and physiological state. This scale uses a 6-point Likert-scale, where a score of 1 definitely false and 6 definitely true.

This action research used Microsoft Excel, JASP, and SPSS to analyze the quantitative data gathered from the pre-and post-surveys. Excel was used to organize, prepare the data, and calculate the averages of each subcategory. The data was organized based on the subcategories of the Sources of Mathematics Self-Efficacy Scale. The data was prepared by reversing the data for questions 3 and 19-24 of the Sources of Mathematics Self-Efficacy Scale. Initially, SPSS was used to run the descriptive statistics, reliability coefficients, and Shapiro-Wilk Test. If the significant of the Shapiro-Wilk Test is greater than 0.05, the data is normal. If it is below 0.05, the data significantly deviate from a normal distribution. The results of the Shapiro-Wilk Test indicated the violation of normality test. Thus, the non-parametric Wilcoxon Signed-Ranks Test was conducted using SPSS.

**Internal consistency.** Reliability coefficients, Cronbach’s alpha, was calculated for each subscale to ensure the reliability of this survey since the items in this survey were adapted for this study. Table 4.1 shows the calculated Cronbach’s alphas for the post-survey of the Sources of Mathematics Self-Efficacy Scale for this intervention.
Cronbach’s alphas ranged from .71 and .96, which are acceptable reliability scores (Tavakol & Dennick, 2011).

Table 4.1 Cronbach’s alpha for the Post-Survey of Sources of Mathematics Self-Efficacy Scale

<table>
<thead>
<tr>
<th>Categories</th>
<th>Current Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastery of Experience</td>
<td>.71</td>
</tr>
<tr>
<td>Vicarious</td>
<td>.90</td>
</tr>
<tr>
<td>Social Persuasion</td>
<td>.96</td>
</tr>
<tr>
<td>Physiological State</td>
<td>.92</td>
</tr>
</tbody>
</table>

**Descriptive statistics.** Table 4.2 provides the descriptive statistics for the Sources of Mathematics Self-Efficacy Scale. Pre-survey means ranged from 3.71 to 4.49. Post-survey means ranged from 3.39 to 3.89. Except for one subscale, social persuasion, means for all subscales decreased by the end of the intervention. The subscale with the highest pre-survey mean of 4.49 ($SD = 1.51$) was physiological state. The subscale with the highest post-survey mean of 3.89 ($SD = 1.06$) was social persuasion. The subscale physiological state had the highest decrease in mean calculation with a mean loss of 1.10.

Table 4.2 Descriptive Statistics for Survey of Sources of Mathematics Self-Efficacy Scale ($N=13$)

<table>
<thead>
<tr>
<th>Subscales</th>
<th>Pre-Survey</th>
<th>Post-Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Mastery of Experience</td>
<td>3.71</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>3.36</td>
<td>0.85</td>
</tr>
<tr>
<td>Vicarious</td>
<td>4.12</td>
<td>1.06</td>
</tr>
<tr>
<td></td>
<td>3.65</td>
<td>1.30</td>
</tr>
<tr>
<td>Social Persuasion</td>
<td>3.86</td>
<td>1.51</td>
</tr>
<tr>
<td></td>
<td>3.89</td>
<td>1.06</td>
</tr>
<tr>
<td>Physiological State</td>
<td>4.49</td>
<td>1.06</td>
</tr>
<tr>
<td></td>
<td>3.39</td>
<td>1.39</td>
</tr>
</tbody>
</table>

**Non-parametric tests.** This section presents the medians, Z-scores, and probabilities using the Wilcoxon Signed-Rank Test for the Sources of Mathematics Self-
Efficacy. Table 4.3 provides the medians, Z-scores, and probabilities for the Sources of Mathematics Self-Efficacy Scale. SPSS calculated all Z-scores and probabilities, except for the subscale social persuasion, on the positive ranks. Since there are four subscales for the Sources of Mathematics Self-Efficacy Scale, four separate Wilcoxon Signed-Ranks Tests were run. Bonferroni correction was used to control the Type I error. The Bonferroni correction level was calculated by dividing the desired alpha level of .05 by four. The probability values need to be less than 0.0125 to be considered significant.

Table 4.3 Results of Wilcoxon Signed-Ranks Test for Mathematics Self-Efficacy Scale

\( (N=13) \)

<table>
<thead>
<tr>
<th>Subscales</th>
<th>Pre-Median</th>
<th>Post-Median</th>
<th>Z-score</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastery of Experience</td>
<td>3.67</td>
<td>3.33</td>
<td>-2.138</td>
<td>.033</td>
</tr>
<tr>
<td>Vicarious</td>
<td>4.00</td>
<td>4.00</td>
<td>-0.874</td>
<td>.382</td>
</tr>
<tr>
<td>Social Persuasion</td>
<td>3.67</td>
<td>4.00</td>
<td>-0.079*</td>
<td>.937</td>
</tr>
<tr>
<td>Physiological State</td>
<td>4.33</td>
<td>3.33</td>
<td>-2.275</td>
<td>.023</td>
</tr>
</tbody>
</table>

* on basis of negative ranked tests

A Wilcoxon Signed-Ranks Test for the mastery of experience indicated that using SRL strategies embedded in the online homework platform, MyMathlab, did not elicit a statistically significant change in their scores of mastery of experience, \( Z = -2.14, p = .033 \). The median for the mastery of experience pre-survey was 3.67, whereas the median for the mastery of experience post-survey was 3.33.

A Wilcoxon Signed-Ranks Test for the vicarious indicated that using SRL strategies embedded in the online homework platform, MyMathlab, did not elicit a
statistically significant change in their scores of vicarious, $Z = -0.874, p = .382$. The median for the vicarious pre- and post-survey was 4.0.

A Wilcoxon Signed-Ranks Test for the social persuasion indicated that SRL strategies embedded in the online homework platform, MyMathlab, did not elicit a statistically significant change in their scores of social persuasion, $Z = -0.08, p = .937$. The median for the social persuasion pre-survey was 3.67, whereas the median for the social persuasion post-survey was 4.0.

A Wilcoxon Signed-Ranks Test for the physiological state indicated that using SRL strategies embedded in the online homework platform, MyMathlab, did not elicit a statistically significant change in their scores of physiological state, $Z = -2.28, p = .023$. The median for the physiological state pre-survey was 4.33, whereas the median for the physiological state post-survey was 3.33.

**OSRLQ**

The OSRLQ (Barnard et al., 2009) was used to measure participants’ SRL skills in an online learning environment. The six subscales for this questionnaire are goal setting, time management, help-seeking, environmental structure, task strategy, and self-reflection. This questionnaire uses a 5-point Likert-scale, where 1 *strongly disagree* and 5 *strongly agree*.

As previously mentioned, this action research used Microsoft Excel, JASP, and SPSS to analyze the quantitative data gathered from the pre-and post-surveys. Excel was used to organize, prepare the data, and calculate the averages of each subcategory. The data was organized based on the subcategories of the OSRLQ. The data was prepared by reversing the data for question 5 of the OSRLQ. Initially, SPSS was used to run the
descriptive statistics, reliability coefficients, and Shapiro-Wilk Test. If the significant of the Shapiro-Wilk Test is greater than 0.05, the data is normal. If it is below 0.05, the data significantly deviate from a normal distribution. The results of the Shapiro-Wilk Test indicated the violation of normality test. Thus, the non-parametric Wilcoxon Signed-Ranks Test was conducted using SPSS.

**Internal consistency.** As previously mentioned, this action research will use Cronbach’s alpha to determine the internal consistency and acceptable range is .70 to .95 (Tavakol & Dennick, 2011). Table 4.4 shows the calculated Cronbach’s alphas for the OSRLQ for this intervention. The Cronbach’s alphas ranged from .69 to .89 indicating acceptable reliability scores. During Barnard-Brak et al.’s (2009) study reported acceptable internal consistencies that ranged from .67 to .90. So, the goal setting subscale has an acceptable reliability score.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Current Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal Setting</td>
<td>.69</td>
</tr>
<tr>
<td>Task Strategy</td>
<td>.80</td>
</tr>
<tr>
<td>Environment Structure</td>
<td>.87</td>
</tr>
<tr>
<td>Time Management</td>
<td>.83</td>
</tr>
<tr>
<td>Help Seeking</td>
<td>.88</td>
</tr>
<tr>
<td>Self-Evaluation</td>
<td>.89</td>
</tr>
</tbody>
</table>

**Descriptive statistics.** Table 4.5 provides the descriptive statistics for the OSRLQ. Pre-survey means ranged from 2.75 to 3.62. Post-survey means ranged from 3.06 to 3.71. Except for one subscale, help-seeking, means for all subscales increased by the end of the intervention. The subscale environment structure had the highest pre-survey mean of 3.6 (SD = 0.93) and post-survey mean of 3.71 (SD = 0.86). The subscale self-reflection had the highest increase in mean calculation with a mean gain of 0.56.
Non-parametric tests. This section presents the medians, Z-scores, and probabilities using the Wilcoxon Signed-Rank Test for the OSRLQ. Table 4.6 contains the medians, Z-scores, and probabilities for the OSLRQ. SPSS calculated all Z-scores and probabilities, except for the subscale help-seeking, on the negative ranks. Since there are six subscales for the OSRLQ, six separate Wilcoxon Signed-Ranks Tests were run. Bonferroni correction was used to control the Type I error. The Bonferroni correction level was calculated by dividing the desired alpha level of .05 by six. The probability values need to be less than 0.0083 to be considered significant.

Table 4.5 Descriptive Statistics for OSRLQ (N=13)

<table>
<thead>
<tr>
<th>Subscales</th>
<th>Pre-survey</th>
<th>Post-survey</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Goal Setting</td>
<td>3.25</td>
<td>0.63</td>
</tr>
<tr>
<td>Task Strategy</td>
<td>2.92</td>
<td>0.79</td>
</tr>
<tr>
<td>Environment Structure</td>
<td>3.62</td>
<td>0.93</td>
</tr>
<tr>
<td>Time Management</td>
<td>3.13</td>
<td>0.76</td>
</tr>
<tr>
<td>Help Seeking</td>
<td>3.40</td>
<td>0.70</td>
</tr>
<tr>
<td>Self-Evaluation</td>
<td>2.75</td>
<td>0.69</td>
</tr>
</tbody>
</table>

A Wilcoxon Signed-Ranks Test for the goal-setting indicated that using SRL strategies embedded in the online homework platform, MyMathLab, did not elicit a statistically significant change in their scores of mastery of experience, \( Z = -1.292, p = .196 \). The median for the goal-setting pre-survey was 3.2, whereas the median of the goal-setting post-survey was 3.6.

A Wilcoxon Signed-Ranks Test for the task strategy indicated that using SRL strategies embedded in the online homework platform, MyMathLab, did not elicit a statistically significant change in their scores of task strategy, \( Z = -1.344, p = .179 \). The
median for the task strategy pre-median was 4, whereas the task strategy post-median was 3.25.

Table 4.6 Results of Wilcoxon Signed-Ranks Test for OSRLQ (N=13)

<table>
<thead>
<tr>
<th>Subscales</th>
<th>Pre-Median</th>
<th>Post-Median</th>
<th>Z-score</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal Setting</td>
<td>3.20</td>
<td>3.60</td>
<td>-1.29</td>
<td>.2</td>
</tr>
<tr>
<td>Task Strategy</td>
<td>3.00</td>
<td>3.25</td>
<td>-1.34</td>
<td>.18</td>
</tr>
<tr>
<td>Environment Structure</td>
<td>3.75</td>
<td>3.75</td>
<td>-0.95</td>
<td>.34</td>
</tr>
<tr>
<td>Time Management</td>
<td>3.00</td>
<td>3.33</td>
<td>-0.76</td>
<td>.44</td>
</tr>
<tr>
<td>Help Seeking</td>
<td>3.50</td>
<td>2.75</td>
<td>-1.26*</td>
<td>.21</td>
</tr>
<tr>
<td>Self-Evaluation</td>
<td>3.00</td>
<td>2.75</td>
<td>-1.5</td>
<td>.14</td>
</tr>
</tbody>
</table>

* on basis of negative ranked tests

A Wilcoxon Signed-Ranks Test for the environment structure indicated that using SRL strategies embedded in the online homework platform, MyMathLab, did not elicit a statistically significant change in their scores of environment structure, $Z = -1.292, p = .196$. The median for the environment setting pre- and post-survey was 3.75.

Table 4.6 Medians, Z-scores, and probabilities for OSRLQ (N=13)

A Wilcoxon Signed-Ranks Test for the time management indicated that using SRL strategies embedded in the online homework platform, MyMathLab, did not elicit a statistically significant change in their scores of time management, $Z = -0.768, p = .443$. The median for the time management pre-survey was 3, whereas the median of the time management post-survey was 3.33.

A Wilcoxon Signed-Ranks Test for the help-seeking indicated that using SRL strategies embedded in the online homework platform, MyMathLab, did not elicit a statistically significant change in their scores of environment structure, $Z = -1.26, p = .208$. The median for the time management pre-survey was 3.5, whereas the median of the time management post-survey was 2.75.
A Wilcoxon Signed-Ranks Test for the self-reflection indicated that using SRL strategies embedded in the online homework platform, MyMathLab, did not elicit a statistically significant change in their scores of environment structure, \( Z = -1.495, p = .135 \). The median for the time management pre-survey was 3, whereas the median of the time management post-survey was 2.75.

**Qualitative Results**

This section first discusses the background of the qualitative data, followed by the methods of analysis that were used to analyze the qualitative data gathered from structured journals and focus group interviews, the first round of coding. This section ends with presenting the findings of the qualitative analysis.

**Background of the Qualitative Data**

This intervention gathered qualitative data from four different focus group interviews and five weekly structured journals collected from 17 participants, where nine of 17 participants participated in the focus group interviews. The focus group interviews were used to gather the students’ experiences and perceptions of how MyMathLab impacted their mathematics self-efficacy and SRL skills. The structured journals were used to gather qualitative data on how different components of MyMathLab affect the students’ SRL skills. Table 4.7 shows how many unique codes were generated for all the qualitative data sources for this intervention.

**Table 4.7 Summary of Qualitative Data Sources**

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Number of Participants</th>
<th>Number of Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>85 Structured Journals</td>
<td>8 females and 9 males</td>
<td>1386</td>
</tr>
<tr>
<td>Focus Group Interviews</td>
<td>5 females and 4 males</td>
<td>308</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>1694</td>
</tr>
</tbody>
</table>
Methods of Analysis

Before beginning the analysis process, I first transcribed the four recorded focus group interviews verbatim into four separate Microsoft Word documents. Each member of each focus group received a copy of the transcripts for their interviews and was asked to check the transcriptions for accuracy. They were allowed a week to send corrections. Only one participant provided corrections to their focus group interview. While the transcripts were being corrected, I copied each participant’s structured journal entries for the five-week intervention in a Microsoft Word document.

While transcribing the interviews and copying the structured journals, I paid attention to see if any patterns emerged from the data and recorded these patterns in a journal. A total of four focus group interview transcripts and 85 structured journals Word documents were separately uploaded into Delve, an online qualitative data analysis software. After two weeks, I reread each transcript and structured journal entry to see if any new patterns emerged and recorded them in my journal.

Throughout the entire qualitative analysis process, I conducted inductive analysis over three rounds of coding. During the first round of coding, I went sentence-by-sentence and created codes based on the qualitative data in that sentence. The codes were created by using the in vivo coding and simultaneous coding methods (Saldana, 2016). In vivo coding means to create codes that are almost word-for-word what the participant stated (Saldana, 2016). For example, “My goals for the last week were to have one hundreds on the homework and do well on the quizzes.” was in vivo coded to be goal 100 homework grade. Simultaneous coding was used because many sentences of the data had multiple meanings (Saldana, 2016). For example, “I completed most of my goals by
writing them down and studying,” was simultaneously coded to be accomplishing goals by studying and accomplishing goals by writing them down. This also reflects the use of in vivo coding. While conducting the first round of coding I kept a journal via Google Docs, shown in Figure 4.1, documenting the process I used. My dissertation chair and two cohort members had access to this journal for member checking and peer debriefing. This journal was also used to record my entire process of qualitative analysis. I also consulted with my dissertation chair to make sure that I was coding correctly.

**Figure 4.1. Researcher’s Qualitative Analysis Journal**

After the first round of coding was completed, I took a week to ensure all the codes to properly embedded into my thoughts. At the end of the week, I printed out the codes that were created. Figure 4.2 shows a screenshot of round 1 coding. There were 1694 codes created. I cleaned up the codes by merging the codes that were the same but were either spelled incorrectly or coded differently. For example, low confidence with word problems and low confidence with a word problem. This brought the total number of codes down to 1465. I then cut each code so that I could easily sort the codes between

72
the three research questions for this action research. Figure 4.3 shows the codes being separated by the research questions.

**Figure 4.2.** Codes Recorded in Delve

**Figure 4.3.** First Round of Sorting Codes
I used pattern coding during my second round of coding. Pattern coding means a group of Round 1 codes that have an emerging category of analysis (Saldana, 2016). For example, “the codes examples help learn concepts”, “asking a question affect applying concepts” and “completing homework affects concept understanding” is categorized as affects concept understanding. During the second round of coding, I obtained the input of two of my cohort members on the grouping of the codes to create the categories. Originally the codes were categorized as “ways to manage time”. They suggested that the two codes should be categorized as “time management”. I considered this and changed the categorization of the codes. At this point, I also had a peer debriefing with my dissertation chair who also asked questions related to the reasons for creating the different categories. At the end of the second round of coding, there were 48 categories created that used 1429 codes. Thirty-six codes were removed from the qualitative analysis since they did not fit into the categories and provide any valuable information. I recorded the categories and the corresponding codes in a Microsoft Excel File, as seen in Figure 4.4.

After completing the second round of coding, I took two days to allow the created categories to embed into my thought process. At the end of two days, I reread my categories and then conducted the third round of coding to create themes from the categories. I used the same coding method as I did in the second round of coding. For example, the categories “tools affect confidence”, “tools helped mathematics self-efficacy”, “tools provide steps”, and “tools used to check progress” became the theme MyMathLab impacts mathematics self-efficacy. At the end of Round 3 coding, I conducted peer debriefing with my dissertation chair. My dissertation chair asked me
questions about the relationship of the categories within the same themes and the
differences between the themes. At the end of our discussion, 12 different themes
narrowed down to five themes, with two of the five themes having subcategories. For
example, the subthemes “MyMathLab impacts task completion”, “ways to impact goals”,
“types of goals students set”, “ways to a student’s impacts concept understanding”, “ways
to impact a student’s class success”, and “types of self-evaluation the students do” relate
to the overall theme “ways to impact a student’s self-regulated learning skills”. I
recorded these themes and their associated categories and codes in a Microsoft Excel file.

Figure 4.5 is a screenshot of the Excel file at the end of Round 3 coding.

<table>
<thead>
<tr>
<th>Categories</th>
<th>number of codes</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. affects mathematics self-efficacy</td>
<td>93</td>
<td>Minimal confidence with word problems</td>
</tr>
<tr>
<td>2. more practice</td>
<td>71</td>
<td>Need practice factoring more</td>
</tr>
<tr>
<td>3. affects assessment performance</td>
<td>82</td>
<td>Low self-efficacy affects confidence for assessment performance</td>
</tr>
<tr>
<td>4. affects learning strategies</td>
<td>37</td>
<td>Practicing affects improving learning strategies</td>
</tr>
<tr>
<td>5. self-improvement goal</td>
<td>82</td>
<td>Need improve time management</td>
</tr>
<tr>
<td>6. affects class grade</td>
<td>54</td>
<td>Not accomplishing goal affects grade</td>
</tr>
<tr>
<td>7. affects class success</td>
<td>39</td>
<td>Not focus affects class progress</td>
</tr>
<tr>
<td>8. affects task completion</td>
<td>39</td>
<td>Goal boost task management</td>
</tr>
<tr>
<td>9. affects concept understanding</td>
<td>80</td>
<td>Prior knowledge affects applying concepts</td>
</tr>
<tr>
<td>10. lessen mathematics self-efficacy</td>
<td>21</td>
<td>Low confidence due to test assessment</td>
</tr>
<tr>
<td>11. helped confidence</td>
<td>11</td>
<td>Positive attitude boost confidence</td>
</tr>
<tr>
<td>12. helping tools help recall</td>
<td>21</td>
<td>View example helps recall concepts</td>
</tr>
<tr>
<td>13. tools used to check progress</td>
<td>33</td>
<td>View example helps solution setup</td>
</tr>
<tr>
<td>14. tools affect understanding</td>
<td>29</td>
<td>Task completion affects retaining information</td>
</tr>
<tr>
<td>15. ability to apply concepts</td>
<td>16</td>
<td>Confident apply vertex to new concepts</td>
</tr>
<tr>
<td>16. affects confidence</td>
<td>55</td>
<td>Prior knowledge affects confidence</td>
</tr>
<tr>
<td>17. tools helped mathematics self-efficacy</td>
<td>24</td>
<td>Used homework help tools boost self-efficacy</td>
</tr>
<tr>
<td>18. tools similar to homework</td>
<td>11</td>
<td>Notes similar to homework</td>
</tr>
<tr>
<td>19. tools provide steps</td>
<td>12</td>
<td>Classmates provide steps</td>
</tr>
<tr>
<td>20. tools helped complete homework</td>
<td>38</td>
<td>Examples help complete homework</td>
</tr>
<tr>
<td>21. tools helped learn concepts</td>
<td>28</td>
<td>Study plan help learn concepts</td>
</tr>
<tr>
<td>22. tools helped time management</td>
<td>10</td>
<td>Managing study time</td>
</tr>
<tr>
<td>23. provide learning strategy</td>
<td>14</td>
<td>course tools show method/strategy</td>
</tr>
<tr>
<td>24. tools used to check understanding</td>
<td>13</td>
<td>Feel study plan helps concept learning</td>
</tr>
<tr>
<td>25. frequently used tools</td>
<td>24</td>
<td>Class examples most useful</td>
</tr>
<tr>
<td>26. MyMathLab Pros</td>
<td>50</td>
<td>Improved somewhat time management</td>
</tr>
</tbody>
</table>

Figure 4.4. Screenshot of Second Round Coding in Microsoft Excel

Qualitative Findings

This section presents and discusses the qualitative findings of this action research.

Five themes emerged from the 48 categories that emerged from the inductive analysis.
The five themes that emerged were: (1) ways to impact a student’s learning strategy, (2)
ways to improve MyMathlab, (3) ways to impact a student’s mathematics self-efficacy, (4) ways to impact a student’s self-regulated learning skills, and (5) mixed perceptions of MyMathLab. The ways to impact a student’s mathematics self-efficacy was split into two subthemes: ways MyMathLab impacts mathematics self-efficacy and ways non-MyMathLab impacts mathematics self-efficacy. Also, ways to impact a student’s self-regulated learning skills was split into six subthemes: MyMathLab impacts task completion, ways to impact goals, types of goals students set, ways to impact a student’s concept understanding, ways to impact a student’s class success, and types of self-evaluation the students do. Each of the themes and categories is explained below.

Participants are referred to using pseudonyms to hide their identity. All quotations used are verbatim of what the participants shared in their reflection journals and during the focus group interviews.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Category</th>
<th>Number of Codes</th>
<th>Sample Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed Perceptions of MyMathLab</td>
<td>tools without tools</td>
<td>5</td>
<td>Feel other help tools time consuming</td>
</tr>
<tr>
<td></td>
<td>mixed feeling with online tools</td>
<td>4</td>
<td>homework help tools help sometimes</td>
</tr>
<tr>
<td></td>
<td>MyMathLab Not</td>
<td>19</td>
<td>Not enough real world application</td>
</tr>
<tr>
<td></td>
<td>MyMathLab Pros</td>
<td>50</td>
<td>Improved somewhat time management</td>
</tr>
<tr>
<td></td>
<td>reasons not to use online tools</td>
<td>18</td>
<td>Not using homework tools build confidence</td>
</tr>
<tr>
<td></td>
<td>didn’t help time management</td>
<td>2</td>
<td>MyMathLab didn’t help time management</td>
</tr>
<tr>
<td></td>
<td>tools help with self-reflection</td>
<td>7</td>
<td>Structured prompts help self-reflection</td>
</tr>
<tr>
<td></td>
<td>tools similar to homework</td>
<td>11</td>
<td>Notes similar to homework</td>
</tr>
<tr>
<td></td>
<td>helping tools help recall</td>
<td>2</td>
<td>View example helps recall concepts</td>
</tr>
<tr>
<td></td>
<td>tools help time management</td>
<td>18</td>
<td>Managing study time</td>
</tr>
<tr>
<td>Ways to impact a student’s learning strategy</td>
<td>affects learning strategies</td>
<td>37</td>
<td>Practicing affects improving learning strategies</td>
</tr>
<tr>
<td></td>
<td>tools provide learning strategy</td>
<td>14</td>
<td>Course tools show method strategy</td>
</tr>
<tr>
<td></td>
<td>professor needs to show tools</td>
<td>1</td>
<td>Professor remind homework help tools</td>
</tr>
<tr>
<td></td>
<td>how to improve MyMathLab</td>
<td>25</td>
<td>Have homework once week</td>
</tr>
<tr>
<td>Ways to impact mathematics self-efficacy</td>
<td>tools affect confidence</td>
<td>38</td>
<td>Old tests help confidence</td>
</tr>
<tr>
<td></td>
<td>tools helped mathematics self-efficacy</td>
<td>24</td>
<td>Used homework help tools boost self-efficacy</td>
</tr>
<tr>
<td></td>
<td>tools provide steps</td>
<td>12</td>
<td>Classmates provide steps</td>
</tr>
<tr>
<td></td>
<td>tools used to check progress</td>
<td>13</td>
<td>View example helps solution setup</td>
</tr>
<tr>
<td></td>
<td>ability to apply concepts</td>
<td>16</td>
<td>Confident apply vertex to new concepts</td>
</tr>
<tr>
<td></td>
<td>affects class grade</td>
<td>34</td>
<td>Not accomplishing goal affects grade</td>
</tr>
<tr>
<td></td>
<td>affects confidence</td>
<td>5</td>
<td>Prior knowledge affects confidence</td>
</tr>
<tr>
<td></td>
<td>affects mathematics self-efficacy</td>
<td>9</td>
<td>Minimal confidence with word problems</td>
</tr>
<tr>
<td></td>
<td>affects task completion</td>
<td>25</td>
<td>Goal boost task management</td>
</tr>
</tbody>
</table>

Figure 4.5. Screenshot of Round 3 Coding in Microsoft Excel

Ways to impact a student’s learning strategy. Table 4.8 shows the theme, categories, and two associated codes for the theme ways to impact a student’s learning strategy. The participants of this intervention expressed how MyMathLab resources and
non-MyMathLab resources impacted both negatively and positively their learning strategy, as shown by the two categories that merged to create this theme. MyMathLab resources are defined as any material, textbook, homework, homework helping tools, study plan, and videos provided through MyMathLab. This includes the lecture notes, and quiz and test keys that I uploaded on MyMathLab. Non-MyMathLab resources are defined as the participants’ personal goals, class structure, the participants’ personal learning strategy, peers, tutors, professors, family members, and any videos not provided by MyMathLab.

Affects learning strategies. The participants expressed how either grades in the class or on tasks, non-online helping tools, and practicing affects a student’s learning strategy. Jill said in her journal, “I use the formulas you [instructor and researcher] gave us and also some of tips during class. I write them down and go back to them if I need to…” So, Jill’s learning strategy is to rewrite the formulas and tips I provide while completing a task. Jake said in his journal, “I feel like by missing those two days I put myself behind although I did review the material before coming back to class…” Jake’s learning strategy is to review notes and materials, even when they are not able to make the class. Jasmine mentioned in her journal that she learns better by watching someone do it because “she is able to remember better than reading about it.” In this journal she did not mention who she was watching. However, in previous journal entries she mentioned that she was going to tutoring for help.

Tools provide learning strategy. The participants stated how MyMathLab tools, daily homework, and homework helping tools provided them a learning strategy. There is no clear preferred tool used to aide in their learning strategy. Michael said in his
journal “I only use it [View Example] a few times since it was showing a different way to
do the problems and I didn’t want to get confused.” Jake said in their focus group
“positive as far as it [MyMathLab] provides everything you need to be able to …
understand the content.” Here Jake is stating MyMathLab provides an ample amount of
resources to learn the content. In Locklear’s (2012) study, at least five other participants
expressed this same feeling about MyMathLab. Lastly, Abby mentioned in her journal
on two different entries that the Study Plan helped her the most because it “worked best
for me” and “my style of learning, so I know this will help me learn the material.

Table 4.8 Ways to Impact a Student’s Learning Strategy theme with emerging categories
and codes

<table>
<thead>
<tr>
<th>Theme</th>
<th>Categories</th>
<th>Codes</th>
</tr>
</thead>
</table>
| Ways to impact a student’s learning strategy | Affects learning strategies | • Practicing affects improving learning strategies
• Need to improve learning strategy labeling variable |
| Tools provide learning strategy | • Course tools show method/strategy
• View example provides a different learning strategy |

Ways to improve MyMathLab. Table 4.9 shows the theme, categories, and two
or three associated codes for the theme ways to improve MyMathLab. Just like any tool
or instructional method, there are always things that need to be improved with that
instructional tool or method (Abrami et al., 2012; Shanahan, 2017). The participants of
the current intervention made recommendations for either the instructor of the course,
MyMathLab technicians, or the school where the course is taught to improve
MyMathLab for future participants. The recommendations that are out of the instructor’s
hands would have to be sent to either the MyMathLab technicians or the appropriate office at the school. Some of the recommendations an instructor can do to improve the students’ perceptions of MyMathLab are choosing how often the daily homework is assigned, how many attempts for each daily homework assignment, and choosing which homework helping tools are available while the students complete their homework.

Some of the recommendations that a MyMathLab technician would have to do are improving the visuals of MyMathLab’s study plan and creating a mobile application of MyMathLab for the students’ smartphones. One of the recommendations that a school would have to do is determining how to incorporate the fees of purchasing MyMathLab into the student’s tuition or school fees.

Table 4.9 Ways to Improve MyMathLab theme with emerging categories and codes

<table>
<thead>
<tr>
<th>Theme</th>
<th>Categories</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ways to improve MyMathLab</td>
<td>Professor needs to show tools</td>
<td>• Professor needs to remind homework help tools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Professor needs to show how to use MyMathLab</td>
</tr>
<tr>
<td></td>
<td>How to improve MyMathLab</td>
<td>• Have homework once a week</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Change the style of structured journal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Study plan needs to be re-setup</td>
</tr>
</tbody>
</table>

How to improve MyMathLab. The participants of this action research made 25 unique recommendations to improve MyMathLab. The recommendations can be divided into the following areas: (a) ways the instructor can improve MyMathLab, (b) ways MyMathLab technicians can improve MyMathLab, and (c) ways the school where the students are at can improve MyMathLab.


Ways the instructor can improve MyMathLab. The instructor can improve MyMathlab by setting the number of tries a student has to attempt an assignment, the number of problems per assignment, the number times homework is assigned throughout the semester, and allowing late work to be submitted. Just like previous research, the participants of the current research did not agree on what is the best way to assign homework (Stoeger & Ziegler, 2008; Tas, Vural, &Oztekin, 2014; Zerr, 2007). Jane said in her focus group interview, “The homework should be assigned Monday and due Wednesday. Then offering a new assignment Wednesday and have it due Friday, because not only do you [the student] have the pressure of finishing your math assignment, but also other classes.” This means assigning homework twice a week. During Joseph’s focus group interview, the following conversation occurred:

Researcher: If the assignment wasn’t assigned daily, let say either weekly or monthly, how would that change your approach to completing the task?

Joseph: I would probably put it off.

Researcher: So, you are saying the daily homework is better for keeping you on task?

Joseph: Yes.

So, Joseph feels that to stay on task better the homework should be daily, to lessen procrastination. Joseph also talked about the number of problems that should be assigned by saying, “I think he [the researcher and instructor of the intervention] gave us like 10 problems once… I think this is not too many problems, because it’s not an overwhelming number of problems.” This means Joseph feels that having five homework problems is not enough homework problems. Lastly, during Rose’s focus group interview, the following conversation occurred:
Researcher: Last question for the interview. Is there anything else you would like to add that was not asked during the interview concerning MyMathLab and self-regulated learning skills and mathematics self-efficacy?

Rose: The only improvement I can think of concerns the structured journal. The weekly structured journals need to have different questions each week, because with the same questions it’s not hard to come up with a different answer weekly. My suggestion for changing is have different questions or reword the questions to get the students to think differently about their goals, studying, time management, etc.

Rose feels that for weekly structured journals, the questions should be changed around or require the students to look at the same question(s) from a different perspective.

Ways the MyMathLab technicians can improve MyMathLab. The participants of this action research gave the following 12 unique ways to improve MyMathLab that MyMathLab technicians to address: making the homework help tools more topic specific, providing more homework help tools, MyMathLab need a progress bar, study plan needs to be synced to the class notes, study plan needs to be re-setup, study plan needs more visuals, MyMathLab needs to be a mobile app, MyMathLab needs to show a description of the homework, need remove view example tool, homework help tools need be re-setup, homepage needs announcements/reminders, and homework help tools need to be linked to the book. All of these recommendations require MyMathLab technicians because they are out of the instructor’s control of manipulating MyMathLab. The participant, Jake, said during his focus group interview “provide more visual learning aids to learn the material instead of just extra problems.” Jake did not explain why he felt this way. Now there is a way I as the instructor can create videos and email them to the class, but for
MyMathLab to have more videos, the MyMathLab technicians would have to create them. Joseph also said “I would like there to be an app, because I tried to pull up MyMathLab on my phone and the writing was too hard to read… Also, I can set notifications on my phone for the app.” This recommendation also requires MyMathLab technicians because they would need to work out all of the technical aspects so that MyMathLab can work on any smartphone or device.

Ways the school can improve MyMathLab. There was only one recommendation that a school can do to improve MyMathLab for future participants. Jasmine said during her focus group interview that “it would be nice if the price of MyMathLab was included in the tuition, because it would be nice not to worry about having to pay extra money to attend school.” This recommendation requires the school because an instructor cannot make the school have the class books be a part of the school’s tuition and fees.

Professors needs to show tools. Alex suggested two things, the only two codes for this category, that I the instructor need to do to help improve future participants' use of MyMathlab tools. Alex recommended the following: “if you [the instructor] were to go in there [MyMathLab] and pull up the examples, links, and videos during the class to show the students what it [MyMathLab] has to offer” and “every now and then remind the students they have all the test keys and study guides here on MyMathLab throughout the semester.” These recommendations are different than the previous recommendations because it does not involve changing anything MyMathLab has to offer, but the professor has to design their class lectures to include showing these MyMathLab tools and how to use them.
Ways to impact a student’s mathematics self-efficacy. Previous research has shown that: students’ opinions of an OHWP positively impacts their mathematics self-efficacy (Gates, 2014), mastering the content positively impacts the students’ mathematics self-efficacy (Kitsantas et al., 2011; Lau et al., 2018; Usher & Pajares, 2009), student’s grades and cognitive strategy use positively impact their self-efficacy (Kim et al., 2014), if a student passed or failed a previous mathematics course impacts the student’s mathematics self-efficacy (Zientek et al., 2019), instructional methods can impact a student’s mathematics self-efficacy (Lia & Hwang, 2016), and course resources impact the students’ mathematics self-efficacy. The participants of this intervention mentioned many ways that either MyMathLab or non-MyMathLab resources that both positively and negatively impacted their mathematics self-efficacy. This theme was split into two subthemes. These subthemes are ways MyMathLab impacts mathematics self-efficacy and ways non-MyMathLab impacts mathematics self-efficacy.

Ways MyMathLab impacts mathematics self-efficacy. Table 4.10 shows the subtheme, categories, and two or three associated codes for the subtheme ways MyMathLab impacts mathematics self-efficacy. This subtheme was created because the participants discussed how MyMathLab and MyMathLab resources affected their confidence, helped their mathematics self-efficacy, providing steps, and used to check their progress.

Tools affect confidence. Affecting confidence is defined as either a helping, positive affect, or lessening, negative affect, of the participants’ confidence during the intervention. The following tools positively helped the participants confidence: old test keys, grades, daily homework, study plan, view example tool, MyMathLab homepage,
and instructor uploaded notes. The study plan tool was the tool that the participants felt helped their confidence the most. Below are the reasons why the participants felt the study plan helped their confidence.

Jacob: I have begun to feel more confident after using my study plan and copying more examples from class.

Alex: I used these tools [study plan and view example] to help me everytime I came across a problem that I had trouble starting myself and to help my confidence with solving word problems.

George: My study plan will walk me through a problem if I'm feeling confused which has definitely help.

So, the participants are showing that the study plan tool is helping their confidence because it is either helping them start the problem or going through the problem step-by-step.

The daily homework had both a positive and negative impact on the participants' confidence. Below are the reasons why the participants had mixed feelings why the daily homework impacted their confidence.

Graham: I feel pretty confident applying the material from this week to future topics because…. as were going through each topic the problems gradually got harder. So, I feel like that could help with future problems.

Jill: I think it [daily homework] also helps kind of boosts confidence because sometimes I used to leave class and do the homework and I would knock that thing out and it would just be like the notes.

George: I feel kind of confident with the new material this week, because it is harder than Chapter 1 material. I feel this way because the problems on the daily homework require more steps, which means it takes more time to complete the problem.
George is showing that the more time consuming a problem is, the weaker his confidence is to complete the problem. Lastly, the participants felt the daily homework was the key reason their confidence was negatively impacted.

Table 4.10 *Ways MyMathLab impacts Mathematics Self-Efficacy subtheme with emerging categories and codes*

<table>
<thead>
<tr>
<th>Subtheme Categories</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tools affect confidence</td>
<td>Previous tests help confidence, Low self-efficacy without helping tools</td>
</tr>
<tr>
<td>Tools helped mathematics self-efficacy</td>
<td>Used homework help tools boost self-efficacy, Study plan boost self-efficacy</td>
</tr>
<tr>
<td>Tools provide steps</td>
<td>View example shows steps, Study plan shows steps</td>
</tr>
<tr>
<td>Tools used to check progress</td>
<td>View example helps solution setup, Similar question help check progress</td>
</tr>
<tr>
<td>Low Mathematics Self-Efficacy without Helping Tools</td>
<td>Low self-efficacy without view example, Low self-efficacy without helping tools</td>
</tr>
</tbody>
</table>

*Tools helped mathematics self-efficacy.* Helped mathematics self-efficacy is defined as having a positive impact and boosting the participants' mathematics self-efficacy. The participants said that homework help tools, seeking help, uploaded notes, grades, study plan, and view example tool helped their mathematics self-efficacy. The participants feel that in general, all of the homework help tools helped the most with
boosting their mathematics self-efficacy. This is supported by the following participants’ quotes:

George: I used these tools when I came across a problem, I had trouble solving a problem myself.

Jane: I use these tools everytime I came across a problem that I have trouble completing.

Alex: … with all the helping tools…. helped get things done and complete the task.

These quotes show how the homework helped complete the problems. Completing homework has been shown to lead students to the topic and improving the participants’ satisfaction (Labhun et al., 2010; Stoeger & Ziegler, 2008), which will improve their self-efficacy (Liu & Haque, 2017). Jill said during her focus group interview “…I used the old tests uploaded on MyMathLab and when I took the test, I realized that they were very similar. This made me feel confident and well prepared for the test.” This shows that Jill looked at the old similar tests to prepare for the upcoming test, which has been shown to improve self-efficacy (Kitsantas & Zimmerman, 2009). Lastly, Claire said in her journal, “I set the goal to complete my homework because I know from past experiences that if the homework is completed, I can complete other task similar to it.”

Tools provide steps. Vicarious experience is defined as how much or how often a student is exposed to peers or non-peers “who demonstrate competence in the subject of interest” (Usher & Pajares, 2009, p. 90). Participants said that different homework help tools, uploaded notes, MyMathLab help bar, and help-seeking tools provide steps to the daily homework they were completing. There is no clear preferred tool used the most for providing steps. Providing steps can be characterized as a vicarious experience with a non-human entity. Abby said in her journal, “My study plan provides… step by step
explanation if I needed it.” This was echoed by three other participants in their journal. Helen discussed during her focus group interview “I enjoy using the view example tool, because it provides you step by step help to complete the task. Also, the view example uses different numbers in their example.” So, these participants feel that MyMathLab and MyMathLab resources positively impacted their vicarious experience.

Tools used to check progress. I defined checking progress as the participants determining if they are attempting the problem correctly. The participants expressed that the study plan, homework tools, emailing the instructor, and view example tool was used to help them check their progress while completing different daily homework. The participants used the view example tool the most to check their progress. This is supported by the following quotes:

Alex: It [view example] gives you a really good view of how the answer should look.

Jane: I only used the view example problems and my notes when I got lost in the problem and I entered the wrong numbers.

Jacob: I used the examples on most of the questions to see if I solved it right.

Jessica: The examples helped me the most, because it better helped me understand the different processes.

Below are reasons why the students used the Ask the Instructor tool and other homework helping tools to check their progress during the intervention.

Janet: If I asked the instructor it was because I went wrong somewhere after following the steps.

Jill: If I still had trouble, I then emailed the instructor to come to better understanding of where and how I went wrong in my steps.

Jane: Using the homework tool and notes I can confirm I am on the right path.
Low mathematics self-efficacy without helping tools. There were many positive attributes that positively impacted their task completion. However, one participant discussed in their journal that they had low mathematics self-efficacy when there were no helping tools provided. This negatively impacted the participants' task completion. Alex said in his journal:

“….I set aside my notebook and not look at the example problems to see if I could accomplish it [daily homework] on my own first, and to be honest I did try it. I tried it and it worked for a few steps, but then I ended up getting lost and had to look back on my notes to see where I went wrong. For some problems I wasn’t so strong without my notes and examples, but I still had to look back them…”

This shows the homework helping tools were available, but the student was attempting to complete the daily homework without it to see if they could complete the assignment without any help.

Ways non-MyMathLab impacts mathematics self-efficacy. Table 4.11 shows the subtheme, categories, and two or three associated codes for the subtheme ways MyMathLab impacts mathematics self-efficacy. This subtheme was created because the participants discussed how the participants’ individual ability to apply the concepts, assessment performance, class grade, confidence, and the participant’s practicing impacts both positively and negatively their mathematics self-efficacy.

Ability to apply concepts. Gates’ (2014) found that students with higher mathematics self-efficacy can apply concepts easier. So, this implies that the ability to apply mathematical concepts can impact a student’s mathematics self-efficacy. Participants of this intervention mentioned what concepts they could or could not apply, how much confidence, or what is needed to be done to apply current concepts to future concepts or on different tasks. Tasks are defined as daily homework and in-class
assessments. The reasons why the participants feel they can apply the concepts are expressed as follows:

George: I feel confident with the knowledge I already have that I can apply it to future topics.

Mark: I feel ok with using the stuff we learned this for future work.

Alex: I feel of applying vertex because it seems easier than the previous material.

Jane: I feel I need is to focus on the basics to be able to apply the concepts to future concepts.

The participants are indicating that their ability to apply concepts will take time, relies on previous knowledge, and the difficulty of the concepts.

**Affects assessment performance.** Previous studies have shown that students who have higher mathematics self-efficacy will have higher test scores in a mathematics classroom (Kitsantas et al., 2011; May, 2009; Peters, 2013). This implies that test scores impact a student’s mathematics self-efficacy. This intervention defines assessment as in-class quizzes and tests. Many participants mentioned how and what can either both positively or negatively impact or affect their assessment performance, applying concepts on assessments, or wanting a certain grade on assessment. Claire said in her journal, “Doing well on the homework was one of my goals because if I can't do the homework, it's going to affect my scores on the quizzes and tests.” Michael said in his journal, “I hope my math test isn't as hard as my psychology test because then I would really be scared.” So, the participants are showing that their either earning certain grades on their homework or their perceptions of one subject to another can affect their performance on different forms of assessments.
Table 4.11 *Ways non-MyMathLab impacts Mathematics Self-Efficacy subtheme with emerging categories and codes*

<table>
<thead>
<tr>
<th>Subtheme</th>
<th>Categories</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ways non-MyMathLab Impacts Mathematics Self-Efficacy</td>
<td>Ability to apply concepts</td>
<td>• Confident apply vertex to concepts</td>
</tr>
<tr>
<td></td>
<td>Affects assessment performance</td>
<td>• Low self-efficacy affects confidence for assessment performance</td>
</tr>
<tr>
<td></td>
<td>Affects class grade</td>
<td>• Studying affects class grades</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Passing assessment affects class performance</td>
</tr>
<tr>
<td></td>
<td>Affects confidence</td>
<td>• Prior knowledge affects confidence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Complex examples affect confidence</td>
</tr>
<tr>
<td></td>
<td>Affects mathematics self-efficacy</td>
<td>• Prior classes high mathematics self-efficacy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Confident with word problems</td>
</tr>
<tr>
<td></td>
<td>Helped confidence</td>
<td>• Positive attitude help confidence</td>
</tr>
<tr>
<td></td>
<td>Lessen mathematics self-efficacy</td>
<td>• Low confidence due to test assessment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Complex concepts lessen mathematics self-efficacy</td>
</tr>
<tr>
<td></td>
<td>More practice</td>
<td>• Need to practice</td>
</tr>
</tbody>
</table>

*Affects class grade.* A previous study found that student’s grades can impact their mathematics self-efficacy (May, 2009). Many participants during the current intervention discussed that either positive or negative class success, setting goals, accomplishing, or not accomplishing goals certain course or assignment grades, the student’s focus or effort, or how different tasks may impact their class grade. The
participants felt that goals oriented around their grades in the class or on their assignments affect their class grade the most, as shown below.

Claire: I want these goals because these are all important to pass the class and to get a better understanding on what is going on in class.

Michael: My goals for this week is to have an 85-overall grade.

George: Also, these were my goals because I need to keep up to good in the class.

Alex: I want to meet these goals, because I want an A in the class.

Helen: If I can do this [earn a specific grade], it would set a good foundation for this class and others I am taking and for my overall GPA.

The participants are showing that they are concerned about their grades and will set goals to meet the grades they want.

**Affects confidence.** Affecting a student’s confidence can impact their mathematics self-efficacy (Chen, 2014; Margolis & McCabe, 2006; May, 2009; Usher & Pajares, 2009). Many participants during this intervention expressed how goals, grades on different tasks, student habits, or concept understanding affects their confidence. Jane said in her journals “I feel this way because some of the stuff we go over is either hard, which makes it harder to understand the concept...” This was echoed by multiple participants in their journals. This shows that the perceived difficulty of a topic affects both the students’ understanding the concept and their confidence. While Abby shows in her journal entry that “… if I keep studying, I'll figure it out.” This was echoed by three other participants in their journal. Here the participants are showing they have low understanding of the concept being taught, but if they keep practicing, they will understand the concepts, which will positively affect their confidence.
**Affects mathematics self-efficacy.** Many participants expressed how goals, grades on different tasks, student habits, and non-online helping tools can affect different components of mathematics self-efficacy. The components of mathematics self-efficacy are level of mastery, belief in oneself, confidence levels, ability to apply, and emotions and attitudes concerning mathematical topics (May, 2009; Usher & Pajares, 2009).

Michael said in his journal “I think I can honestly say that I am confident for the future when we move to harder material, I would just have to work harder.” Here Michael is showing that his own perception will affect his future mathematics self-efficacy. While, George said in his journal “I passed one quiz which made me so happy and it gave me a boost;” which shows his level of self-efficacy is reliant on his assignment grades. Both George and Michael are showing that their individual perceptions of mastery and their mood affect their mathematics self-efficacy.

**Helped confidence.** Multiple participants expressed how goals, grades on different tasks, and student habits helped their confidence. This category is different than the “affect confidence” by focusing on what only helps improve the participants’ confidence. Two participants said in their journals how a positive attitude helped their confidence, shown below.

George: Keeping a positive attitude about what we are learning will help me build confidence in the material.

Alex: Keeping a positive attitude is an important goal to me because as we continue into the semester the material is only going to get more complicated.

As shown, the students’ emotions affect their mathematics self-efficacy, which in turn affects their confidence levels. Jill said in her focus group interview “And if you [professor] don't remind them [the students] that you believe, then our confidence may
decline.” Here Jill is explaining how if the professor shows that if they have confidence in the student, then the student will have more confidence in themselves.

**Lessen mathematics self-efficacy.** Only two participants mentioned in their journals what lessened their mathematics self-efficacy during the intervention. The participants said:

Michael: … but when we make the examples even more complex and challenging, it discourages me because I have a harder time working the problem and then I fear of getting the wrong answer.

George: I am not confident for this week, because we are starting this week with a test. I don’t think I am going to pass because I don’t understand.

So, these two participants expressed that either low confidence in assessments, where assessments are defined as in-class quizzes and tests, or the complexity of topics lessened their mathematics self-efficacy.

**More practice.** More practice is defined as to what concepts they needed or wanted to practice more during this intervention. Also, some of the participants even set goals to practice more on either specific topics or in general the need to practice more. Audrey said, “I will continue my study plan and practice problems and hope to do well.” This was echoed by John “… I do feel confident, but I know that I will never know everything and need to keep practicing.”

**Ways to impact a student’s self-regulated learning skills.** The participants of this intervention expressed many ways that either MyMathLab or non-MyMathLab resources both positively and negatively impacted the following self-regulated learning skills: goal setting, time management, help-seeking, and self-reflection. This theme was split into the following six subthemes: MyMathLab impacts task completion, types of goals students set, ways to impact goals, ways to impact a student’s concept
understanding, ways to impact a student’s class success, and types of self-evaluation the students do. Two previous studies found that goal setting positively impacts a student’s motivation (Littlejohn et al., 2016; Miligan & Littlejohn, 2000), which will then impact the student’s strategic planning and monitoring (Moos & Marroqui, 2010).

**Types of goals students set.** Table 4.12 shows the subtheme, categories, and two or three associated codes for the subtheme *ways goals students set*. One previous study found that achievement goals can impact a student’s metacognitive experience and strategy, and attempting to complete tasks (Efklides, 2011). Another study found that the students set goals that will impact their self-evaluation (Zimmerman & Campillo, 2003). During the current study, participants expressed setting goals that limit which or how much they use certain homework helping tools, setting goals to improve themselves, and what long term goals they had set.

<table>
<thead>
<tr>
<th>Subtheme</th>
<th>Categories</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of goals students set</td>
<td>Goal setting limit helping tools used</td>
<td>• Goal learn math without calculator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Goal to complete homework without helping tools</td>
</tr>
<tr>
<td></td>
<td>Self-improvement goal</td>
<td>• Need improve time management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Set goal to pay more attention</td>
</tr>
<tr>
<td></td>
<td>Set long term goals</td>
<td>• Long term goal improve mathematics self-efficacy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Long term goal to have a high GPA</td>
</tr>
</tbody>
</table>

*Goal setting limit helping tool use.* The participants discussed which tools and why they set a limit to using these tools during the intervention. The participants set
limits on using their calculators, view example tool, helping tools in general, and not seeking help. There is no clear tool that the participants wanted to limit the most. Jill said in her focus interview, “I remember setting my goals one time to not rely on the course tools or examples. I want to try it [the problems] on my own first to see if I could do it.” Here Jill is showing that she does not want to be dependent on the helping tools or examples to complete the assignment. Michael said in his journal, “I want to learn to do the math without the calculator.” Michael did not explain why he wanted to do this, but one of the possible reasons for this is the class has in-class formal assessments that are non-calculator. So, Michael maybe wanting to be prepared for the formal assessments. Abby said in her journal, “I looked at the examples in the book to figure out how to work the problems without my calculator.” Abby did not explain why she did this, but the reasoning for Michael could be applied here too. The limiting of all or some homework tools can build confidence, which will build the mathematics self-efficacy because the participants are relying on their own knowledge, as shown with Jill’s quote.

Self-improvement goal. During this intervention the participants discussed that they wanted to improve the following about themselves: time management, grade performance, recalling knowledge better, paying more attention, staying calm, staying focused, wanting to apply concepts better, arriving to class on time, not giving up on themselves, taking better notes, studying better and more, more effort in learning, seek help more, improve their grade, task completion, seeking help, improving personal confidence, emotions and attitudes, and lessening stress. There is no clear preferred self-improvement goal between the participants. Alex said in his journal, “my goals for the upcoming week is trying not to get in my head and keep pushing through.” This means
Alex does not want to second-guess himself or saying that he cannot do the work. Jane said in her journal, “My goals for this week were the continuous goal … trying to stay on top of my homework and do it in a timely manner.” Here Jane is showing she is wanting to lessen her procrastination and not get behind on assignments.

Set long term goals. There was no clear showing of what long term meant because some the participants discussed long term to mean for a chapter (which lasted about 3 weeks), a semester, future courses, until they earned their degree (which could be either an associates or bachelor’s degree), and future careers. Three participants discussed their long-term goal concerning about earning a degree or their future careers.

John: I have these goals because I know I'll need these classes for what I want to be in life, but also because I want to push myself to do better.

Jill: I also have this goal because I need the grades to make it to the nursing upper division.

Abby: Also, it will look good on my transcript for future jobs and it will show employers that I know my information.

While Jacob said in his journal, “All of my goals add up to one major goal which is to have a high GPA, respectively 3.5 or higher.” The participants are showing that some of their long-term goals also relate to improving oneself, which will help them advance in their degrees’ curriculum or future careers.

Ways to impact goals. Table 4.13 shows the subtheme, categories, and two or three associated codes for the subtheme ways to impact goals. Previous research has stated that if students want to accomplish their goals they need to set attainable goals based on their current tasks and situations (Panadero & Alonso-Tapia, 2014; Puustinen & Pulkkinen, 2001; Ramdass & Zimmerman, 2011; Zimmerman & Capillo, 2003). During the
current intervention, every participant discussed in their journals what positively and negatively impacted them accomplishing their goals.

*Affects goal completion.* Every participant mentioned what affected or helped them accomplish their goals either fully or partially. Some of the things that affected or helped them was the participants paying attention, completing tasks, seeking help, time and task management, concept understanding, and uncertainty of completing the entire or part of the goal. The biggest factor that affected the participants’ goal completion was their uncertainty of accomplishing their goals. Below are the reasons why they participants felt they did not accomplish their goals.

Jacob: My goal is to try to accomplish what we are learning, but there is no guarantee that I will accomplish this.

Alex: I want to think I accomplished my goals for this week but based off the grades I produced on assignments this, that begs to differ.

Aubrey: As for math, my goals were to make A’s on the quizzes, which I didn’t do on the first one, but I think I did well on Thursday’s quiz.

These participants are using either physical evidence of their grades or their performance perceptions to determine if they completed their goals. The level of completion for mini goals can affect the participants’ completion of a long-term goal. This is demonstrated by Audrey’s journal entry “passing all the homework and quizzes would help pull my grade up to achieve my overall goal.”

*Affects not accomplishing goals.* Participants discussed that either not accomplishing part or all the goals and the participant’s level of focus is what affected them from accomplishing their goals during the intervention. Claire said in her journal “No [I did not accomplish my goals because], I can’t seem to learn the subject at all.”
This was echoed by many participants in their journals. Jacob said in his journal, “No I did not accomplish any goals because I didn't set any.” Jacob did not mention why he did not set any goals for that week.

Table 4.13 Ways to Impact Goals subtheme with emerging categories and codes

<table>
<thead>
<tr>
<th>Subtheme</th>
<th>Categories</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ways to Impact Goals</td>
<td>Affect goal completion</td>
<td>• Paying attention affects goal accomplishment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Accomplished goal by review notes</td>
</tr>
<tr>
<td>Affects not accomplishing goals</td>
<td></td>
<td>• Didn’t fully accomplish purchasing school supplies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Didn’t accomplish homework performance goals</td>
</tr>
<tr>
<td>Tools helped goal setting</td>
<td></td>
<td>• Daily homework helps set confidence goals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Structured journals help goal setting</td>
</tr>
<tr>
<td>Tools Assisted setting long term goals</td>
<td></td>
<td>• Journal performance affects long term goal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Daily homework helps set long term goals</td>
</tr>
</tbody>
</table>

Tools assisted setting long term goals. Participants discussed how either the structured journals, homework performance, and studying aided them in setting long term goals during the intervention. The participants felt that the daily homework assisted them the most in setting long term goals, because

Josh: I want to feel comfortable with the material

Abby: to have a higher grade on homework

Jill: My goals for this week were to do well on the homework every day.

Alex: My goals for this week are to … do well on this journal. I want to meet these goals because I want to make an A in this class.
Some of the participants considered the structured journals as homework, even though it was assigned once a week.

*Tools helped goal setting.* The participants felt that the daily homework, structured journal, study plan, help-seeking, and view example helped them set their goals during this intervention. The participants felt the daily homework helped the most because:

George: it [daily homework] helps you to try harder.

Josh: Like if I’m getting the problems right, I feel more confident and I try to set a goal higher to solve a harder problem.

Alex: if you have an average of 100% on all the homework, then you get 4 free quiz 100 grades”, and “to get better with the concepts.

Alex’s quote is using extrinsic motivation to do well on the homework during the intervention and the semester, so that they can earn extra credit at the end of the semester. Lastly, the second quote shows that some of the participants are pushing themselves to set goals that are just above their attainable level.

*Types of self-evaluation the students do.* Table 4.14 shows the subtheme, categories, and two or three associated codes for the subtheme *types of self-evaluation students do.* Previous studies have shown that a student’s self-judgment relies on the goals they set, level of mastery (Kizilcecet al., 2017; Littlejohn, 2016; Puustinen & Pulkinen, 2001; Zimmerman, 2008; Zimmerman & Capillo, 2003), and their self-reactions rely on their satisfaction levels and modify their performance to achieve their goals (Zimmerman, 2008; Zimmerman & Capillo, 2003). During the current intervention, the participants mentioned how they evaluated themselves, evaluated their homework performance, and use of the helping tools.
Evaluation of self. Participants discussed how they evaluated their satisfaction levels on making errors, their understanding of concepts, their effort and factors of self-efficacy levels, and managing their time. Alex said in his journal, “The goal I did not meet was staying ahead of the game and getting off to a strong start.” Rose said in her journal “So by managing my time and relaxing more, I have more time to study, which in turn cancels the stress out.” Jasmine said, “I did not ask questions when I should have to fully comprehend the content.” Rose is showing a positive self-evaluation, which will probably be repeated in future weeks. While Jasmine and Alex are a negative self-evaluation, which means their prior actions will be modified, as shown by Jasmine, so this negative self-evaluation is not repeated.

<table>
<thead>
<tr>
<th>Subtheme</th>
<th>Categories</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Self-Evaluation Students Do</td>
<td>Self-Evaluation of Daily Homework</td>
<td>• Daily homework help set environmental settings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Daily homework not daunting</td>
</tr>
<tr>
<td></td>
<td>Self-Evaluation of Helping Tools</td>
<td>• Practice affects improving learning strategies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Notes not helping confidence</td>
</tr>
<tr>
<td></td>
<td>Self-Evaluation of Self</td>
<td>• Satisfied with minor errors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Able to complete online homework</td>
</tr>
<tr>
<td></td>
<td>Self-Evaluation of Task Management</td>
<td>• Improved time management skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Completed homework on time</td>
</tr>
</tbody>
</table>

Self-evaluation of daily homework. Participants discussed what self-evaluations they did as they completed their daily homework. Jack said during his focus group
interview, “I would say the consistency everyday with working at five or six problems has kept my mind fresh on what we are learning.” This means daily homework problems are helpful to keep the topics current and consistent with what is being taught. Audrey said during her focus group interview, “The daily homework helped me because I’m able to go through each question at my own schedule and when you can write on a clean surface.” Here Audrey is showing that being able to schedule where and when she is able to work on the homework is most beneficial to her. Lastly, Shanna said during her focus group interview “I don't feel like it [daily homework] really negatively affects me. However, if it’s a long homework assignment, then it negatively affects me.” Shanna did not define what was too long for a homework assignment.

**Self-evaluation of helping tools.** Participants discussed how they evaluated the online helping tools they used while completing their homework. Shanna said during her focus group interview that “…following the examples sometimes helped when I don't know what to do and that it becomes like a dependency thing.” Other studies have shown where the students felt that homework helping tools can make them feel dependent on the tool to complete the assignment (Hodges et al., 2015; Locklear, 2012). So, this means that Shanna finds the examples helpful at times, but it is making her become dependent on them to complete the assignment. While Rose stated in her journal, “I didn't use the other tools because once I used the example tool, I normally understood what to do.” Here Rose has evaluated all tools, except for the example tool, as not useful. Jasmine said in her journal, “I used the example tool more…, but when I don’t understand something, I’ll ask my professor because the examples can only explain so much.”
Jasmine and Rose are both demonstrating mixed reviews on how useful the view example tool was.

*Self-evaluation of task management.* Participants discussed their evaluation of their task management skills. Shanna said in her journal, “If I do all these things [completing their daily homework] I will succeed.” Jill said in her focus group interview “it [MyMathLab] doesn’t really do anything for me, because I already knew I had daily homework and journals to do. Also, I don’t just log into MyMathLab for any other reason.” So, this shows that there are mixed perceptions of how effectively MyMathLab and MyMathLab resources helped the participants' task management skills. Also, some of the participants may already be skilled enough to manage their tasks and do not need any further assistance, as shown with Jill’s comment.

*MyMathLab impacts task completion.* Table 4.15 shows the subtheme, categories, and three associated codes for the subtheme *MyMathLab impacts task completion.* Borman and Sleigh’s (2011) found that students were engaged and completed over 90% of their tasks via MyMathLab. Gates’ (2014) also found that an online homework platform’s homework help tools aided the students to complete their tasks. Participants of the current intervention expressed what positively and negatively impacted them completing their tasks and what tools they used to complete their tasks.

*Affects task completion.* Lee’s (2016) found that giving students an option of how they complete their homework will positively impact their homework completion because the better option will best coincide with their strategic plan in completing tasks and increase their learning. Kitsantas et al.’s (2011) found that familiarizing and providing different resources for the students to use while completing their homework will
positively impact their homework completion rate. This is echoed by Gleason’s (2012) study. Gleason’s (2012) study also found that if the instructor emails the students reminders of their homework being due, then the completion rate will increase. In the current study, the participants felt that setting goals were main positive factor that impacted their task completion during the intervention. This is shown in the following quotes:

Abby: My goals for this coming week are going to be the same goals I had this week, which were to improve my studying as well as staying with my homework and getting it done.

Jacob: The goal of homework is something I need to work on especially recently since I'm having trouble understanding what we're doing.

The participants also felt that their own personal physiological state can impact their task completion, as shown in the following quotes:

Jake: I believe I did well with that [completing my goals] since I stayed focused in class and did my homework on time and rushed.

Sue: I’ve relaxed more about the quizzes and the homework…. I’ve required less tries to get the questions right, which is encouraging for next week.

The participants mentioned that either forgetting to complete an assignment or the steps to complete a problem negatively affects their task completion.

Frequently used tools. Frequently was defined as either used most often, used daily, or used every time. The participants used the view example tool and examples from class notes the most. Below are quotes supporting this and explaining why.

Michael: I don’t really use the other tools often. I mainly use the question example.

George: I used the view example more often because it’s right there.
Jill: … by look at examples on how to work the problems…. because they are the ones that help me the most more than others. I used them every day for homework and classwork.

Another most frequently used tool was the Ask My Instructor tool. One participant mentioned in their journal, “I would say that I used this often because I did need help and I knew that I would get it immediately.” This participant was referencing how often and why they used the Ask My Instructor tool. The participants also used practice problems, similar question tool, study plan, textbook, and their calculators frequently during the intervention.

Table 4.15 MyMathLab Impacts Task Completion subtheme with emerging categories and codes

<table>
<thead>
<tr>
<th>Subtheme</th>
<th>Categories</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>MyMathLab Impacts Task Completion</td>
<td>Affects Task Completion</td>
<td>• Goal to boost task management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Environment setting to complete tasks</td>
</tr>
<tr>
<td>Frequently Used Tools</td>
<td></td>
<td>• Class examples most useful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Used notes often</td>
</tr>
<tr>
<td>Tools Helped Complete Homework</td>
<td></td>
<td>• Low self-efficacy without view example</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MyMathLab improved task completion</td>
</tr>
</tbody>
</table>

Tools helped complete homework. The participants discussed how different MyMathLab tools and resources helped them complete their daily homework. The two most common tools and resources that helped the participants complete their homework was the homework being assigned daily and view example. Below are the reasons why the participants feel that the daily homework helped them complete their homework.
Alice: Since the daily homework is major part of my grade, that motivated me to complete my homework daily.

John: Once I start a problem, I’m not going to let it go [give up]…I want to at least finish it and do not to forget an assignment.

Jill: So, it’s [daily homework] like everyday is practice to complete a task.
Alex: I feel like it [daily homework] helped because you get something everyday.

So, since the daily homework was assigned every day and a major component of the participants’ grade, this helped them to complete their daily homework. The participants also discussed why the view example tool helped them complete their daily homework.

Jill: Most of the time I was able to the right answers from the examples.

Michael: I used these specific tools [view example] because they helped me figure out how to do the problem that was at hand.

George: I used the view example tool, because it helped me see how the problem is worked out and finished.

Lastly, Joseph said during his during their focus group interview “with all the helping tools… I am able to get things done and complete the task [daily homework].”

Ways to impact a student’s class success. Table 4.16 shows the subtheme, categories, and two or three associated codes for the subtheme ways to impact a student’s class success. Class success was defined as earning a passing grade in the class, which is having an overall grade of a 70 by the end of the semester. The participants’ stated in their journals and the focus group interviews that their class grade, class and task completion habits, and seeking help impact their success.

Affects class grade. The participants discussed how personal study habits and attitude, quiz and test grades, task completion, concept understanding, and weekly grade goals can both positively and negatively affect their class grade. The participants felt
weekly grade goals affected their class grade the most. Below are some of the weekly grade goals the participants discussed.

Alex: My goals for this week were to start off with good grades and to understand the content. These were the goals I choose... because they would allow me to start off strong and keep up my grade.

Michael: My goal for this week is to have an 85-overall grade.

Abby: My goals for this upcoming week are the same as the previous week, which were to get my grade back to an A.... I want these goals so I can keep my GPA high.

Jane: My goals this week are to...and bring up my grade back up. I want these goals because these are important to pass the class...

These all show what can positively affect the participants' class grades. One participant mentioned in their journal that, “I failed my math test horribly.... which means I am failing math not.” This was the only direct negative affect on class grades.

Table 4.16 Ways to Impact a Student’s Class Success subtheme with emerging categories and codes

<table>
<thead>
<tr>
<th>Subtheme</th>
<th>Categories</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ways to Impact a Student’s Class Success</td>
<td>Affects Class Grade</td>
<td>• Not accomplishing goal affects grade</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Studying affects class grades</td>
</tr>
<tr>
<td></td>
<td>Affects Class Success</td>
<td>• Not focusing affects class progress</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Goal to seek help how pass class</td>
</tr>
<tr>
<td></td>
<td>Help-Seeking Tools</td>
<td>• Using a tutor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Homework help tool class notes</td>
</tr>
</tbody>
</table>

Affects class success. The participants mentioned how goals and personal habits affect their class success both positively and negatively. Jake said in his journal that, “Not accomplishing my set goals, has me performing badly in this class.” While Jacob
mentioned that, “My goals for this week is to do all of my homework and not forget about it…… I wanted these goals because I want to end up having a good grade.” Both of these participants are showing how performing badly affects their class success, but only one showed their use of their self-regulated learning skills to improve upon this.

**Help-seeking tools.** Participants explained which helping tools, both provided by MyMathLab and non-MyMathLab tools, were used to complete tasks and succeed in class. The participants mentioned that they used their class notes and examples the most. This is shown by the following participant quotes:

- June: the tool I used to help with homework were my notes from class.
- Josh: I have recently been using just the notes from class as my homework help tool.
- Abby: I used the hints tool and my notes during the homework assignment.
- Jane: I used my notes and examples from class.
- Jacob: I used my notes in class and the help you steps in the homework.
- Alex: …working through and looking at the examples from class.

Lastly, one participant stated in their journal, “I will also apply the goal of trying to help someone that needs help. I set this goal because I asked for help this week and now, I want to be able to give it back…” This is another vicarious experience the occurred during the intervention.

**Ways to impact a student’s concept understanding.** Table 4.17 shows the subtheme, categories, and two or three associated codes for the subtheme ways to impact a student’s concept understanding. There are multiple ways a student can evaluate their learning. One way is evaluating their understanding of a topic and how to improve their
understanding of the topic (Cleary & Kitsantas, 2017; Efklides, 2011; Puustinen & Pulkkinen, 2001; Zimmerman & Campillo, 2003). Throughout this intervention, the participants expressed what impacted both positively and negatively their concept understanding.

Affects concept understanding. The participants mentioned that goals, completing their tasks, their level of effort and focus, ability to apply the concepts, their confidence, and previous or current knowledge helped or hindered their understanding of the concepts. The participants felt that their confidence was what affected their concept understanding the most both positively and negatively. Below are the quotes of how confidence can both positively and negatively affect the participants' concept understanding.

Jill: I feel confident on some of the units we learned last week.

Jane: I do not feel as strong with apply it to the other things…

Abby: This week was the hardest of them all and I don’t feel confident applying what we learned to future topics.

Jacob: I feel this way because I feel better about applying my work to more work.

Josh: I feel ok with some of the things we learned this week.

Lastly, Jasmine said in her journal “The reason helping a friend also helped me is because I tend to better understand problems when I have to walk someone through their own problems step by step.” Helping a friend is a sign of using their vicarious experience, so this will also help their mathematics self-efficacy.

Affects recalling concepts. The participants expressed how goals, classwork, their personal habits, confidence, self-efficacy, task completion, and grades helped or hindered them in recalling the concepts. Shanna said in her journal “I feel this way because I have
had to apply this to topic to things in the past and did ok on it.” Alex said in his journal
“I feel confident but still feel like I need to keep practicing what we’ve learned to keep it
fresh in my head for the future.” Jane said in her journal, “These are my goals because if
I do not pay attention then I will most likely be lost for the rest of the semester.” So,
these quotes are showing that the individual participant’s mastery experience, prior
experience, and habits affect their ability to recall concepts.

Table 4.17 Ways to Impact a Student’s Concept Understanding subtheme with emerging
categories and codes

<table>
<thead>
<tr>
<th>Subtheme</th>
<th>Categories</th>
<th>Code</th>
</tr>
</thead>
</table>
| Ways to impact a Student’s Concept Understanding | Affects Concept Understanding | • Prior knowledge affects applying concepts
• More time on concepts affects concept understanding |
| Tools Helped Learn Concepts       |                                   | • Study plan helped learn concepts
• Challenging problem affect learning |
| Tools Used to Check Understanding |                                   | • View example helps solution setup
• Similar question to help check progress |
| Affects Recalling Concepts        |                                   | • Accomplishing goals affect concept retention
• Practice affects recall |

Tools helped learn concepts. The participants expressed which MyMathLab tools
and tools helped them learn the concepts being taught. The participants felt that either
the view example tool, study plan, or daily homework was the best tool to learn the
concepts. Joseph said during his focus group interview

“It [daily homework] made me feel better, because taking Pre-Calculus in high
school I remember doing most of this, but it has been a couple of years since
doing it…. The daily homework helped teach the concepts as we did in high school.”

So, Joseph is showing both prior experience and the daily homework are helping him learn the concepts. Here are the reasons why the study plan and view example were used to learn the concepts.

Josh: The reason I used these tools [view example and notes] and not others because they most directly helped me with the daily homework I was trying to complete.

Abby: I used the study plan…. because it helped me better understand the material.

Alex: I used these tools [view example and study plan] because they most directly helped me with figuring out which formula to use to solve the word problems.

The participants felt both view example and study plan were the best tools to use because they fit their needs better.

Tools used to check understanding. Participants expressed which MyMathLab tools and resources were used to help them check their understanding of concepts. The participants did not prefer one tool of the other to check their understanding. Jacob said in his journal “…so when I have the example to turn to I can see where I am struggling or realize I’m starting in the right place.” Jake said in his journal “…the other resources that are on MyMathLab help me better understand the material.” This participant did not mention which tools or resources they used.

Mixed perceptions of MyMathLab. Table 4.18 shows the theme, categories, and one associated code for the theme mixed perceptions of MyMathLab. The participants of this intervention had both negative and positive perceptions of using MyMathLab and MyMathLab’s resources during this intervention, as shown by the ten
categories that merged to form this theme. Previous research has shown that students have had mixed perceptions using MyMathLab and other OHWPs (Borman & Sleigh, 2011; Engelke et al., 2016; Heenehan & Khorami, 2016; Locklear, 2012; Paiva et al., 2015). For this study, the participants’ perceptions of MyMathLab were asked directly in the focus group interviews. However, all the participants discussed their perceptions of MyMathLab in their structured journals.

**Tools helped time management.** Participants discussed that MyMathLab’s homepage and calendar, daily homework, and in general MyMathLab helped their time management skills. The participants felt that both MyMathLab’s homepage and daily homework helped their time management the most. The participants explained why they felt that either having a countdown clock or homework everyday most helped their time management skills.

  Audrey: … I know I will have homework that will provide step-by-step notes to connect what we have in class…and the homework is assigned every single day.

  Abby: If you click on the homework, it tells you how many hours you have left to do it.

  Jane: If the assignments [daily homework] wasn’t assigned daily, I would probably put it off.

The participants also expressed many reasons as to why the homepage helped their time management skills.

  Jack: on the home screen when there’s something new or due it’ll tell you. So, it [homepage] tells me that I need get this homework done by a certain time.

  Josh: it [homepage] tells you what assignments are due next.
Alex: I think it [homepage] keeps on task and it tells you how long you have until certain things are due. This means you know what you have to get done.

Heather: It [calendar on the homepage] shows you like what do you have for the week already on there.

All of these positive quotes show why some of the participants felt that MyMathLab positively impacted their time management skills and also had positive self-evaluation of their task management skills.

**Didn’t help time management.** Two participants felt MyMathLab and daily homework did not help their time management skills. Jill said in her focus group interview, “I don't feel like it has. It's just another thing to do.” In response to how using MyMathLab impacted their time management, Shanna said in her focus group interview, “It doesn’t for me.” In response to how the daily homework impacted their time management, Jill and Shanna did express further in their focus groups that they completed their tasks in an order of what needs to be completed first. This also further shows why the participants evaluated that MyMathLab did not help their task management skills, because they may already have the skills needed to complete and manage their tasks on their own.

**Helping tools help recall.** Participants expressed in either their journals and during their focus group interviews how MyMathLab and MyMathLab resources, homework helping tools, daily homework, and journals helped or impacted the students’ ability to recall concepts. The participants felt that the view example tool was better to use to recall concepts. This is shown in the following quotes:

Audrey: the example tool helped me find my footing when I wasn't sure where to start or what to do next as well as helping me stay on track if I messed up the order the problem went in.
Jacob: I chose this one [view example] to refresh my memory on the way to work the problem.

Heather: I used the view example tool when I am completely stuck and cannot answer the question.

Below are two explanations as to why the participants used their notes.

Jacob: I chose this [uploaded class notes] because in class I follow along well but sometimes the way the homework is worded I do doubt my own knowledge so being able to look back at the day and double check that I am on the right path really helps. I haven’t had to use this tool or other tools as often on homework because I feel confident applying what I have learned to the homework.

Alex: I used these [notes and step-by-step tool] when I didn’t understand every step in the problem.

These quotes show that it depends on the student’s confidence to complete the problem if they need to use the homework help tools.

**Mixed feelings with online tools.** Participants expressed mixed feelings and perceptions on using the homework help tools, study plan, notes, and MyMathLab’s calendar. The “self-evaluation of homework help tools” subcategory is different because it showed the participants evaluation did not change during the intervention. While the current subcategory showed the participants, evaluation changed while or after using the helping tools. Joseph said in his focus group interview “well at first it [homework help tools] helps for most problems.” Joe said in his focus group interview “…the issue here is at a times the calendar shows what is due, but the calendar is not always clear on the time it’s [daily homework] is due.” Jill said in her journal, “I’ve used the study plan many times on MyMathLab and it seems to help a little, but I still don’t know how I feel about it.”
### Table 4.18 Mixed Perceptions of MyMathLab theme with emerging categories and codes

<table>
<thead>
<tr>
<th>Themes</th>
<th>Categories</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed Perceptions of MyMathLab</td>
<td>Mix Success without Tools</td>
<td>• Feel other help tools time consuming</td>
</tr>
<tr>
<td></td>
<td>Mixed Feelings with Online Tools</td>
<td>• Homework helps tools help sometimes</td>
</tr>
<tr>
<td></td>
<td>MyMathLab Cons</td>
<td>• Not enough real-world application</td>
</tr>
<tr>
<td></td>
<td>MyMathLab Pros</td>
<td>• Improved somewhat time management</td>
</tr>
<tr>
<td></td>
<td>Reasons not to Use Online Tools</td>
<td>• Not using homework tools build confidence</td>
</tr>
<tr>
<td></td>
<td>Didn’t Help Time Management</td>
<td>• MyMathLab didn’t impact time management</td>
</tr>
<tr>
<td></td>
<td>Tools Helped with Self-Reflection</td>
<td>• Structured journals help self-reflection</td>
</tr>
<tr>
<td></td>
<td>Tools Similar to Homework</td>
<td>• Notes similar to homework</td>
</tr>
<tr>
<td></td>
<td>Helping Tools Help Recall</td>
<td>• View example helps recall concepts</td>
</tr>
<tr>
<td></td>
<td>Tools Helped Time Management</td>
<td>• Managing study time</td>
</tr>
</tbody>
</table>

**Mix success without tools.** Participants expressed in their journals that they had mixed success in completing daily homework without helping tools. The codes for this category are “mix success no helping tools”, “mixed feeling accomplish goal does not use notes”, “mix success no view example”, and “mix success no notes”. Joseph said, “I
strive not to look at my notes right away when working on the homework and sometimes it works, but then others it doesn’t.” Alex said in their journal “I may have used the view example tool, but it wasn’t an option on a lot of the questions this week and I didn’t need it this week.” So, Alex would have used the view example tool, but the problem did not have it as an option for them to use. However, Jasmine expressed “I tried to attempt the homework without using the view example, but I wasn’t strong enough and I had to go back to the view example tool.” Jasmine’s quote could be an example of not wanting to become dependent on the tools, as mentioned by previous subcategories.

**MyMathLab cons.** Multiple participants expressed negative opinions about MyMathLab and what hindered them from using or completing their work in MyMathLab. Locklear’s (2012) study also showed participants felt the homework was too easy, not interactive enough, not knowing or understanding how to get the solutions, and MyMathLab did not always work (p. 124-125). Jill said in her focus interview with a negative connotation, “I just feel like it's like an online class kind of like you have your work assigned.” Shanna said in her focus group interview “Also, not receiving a notification or reminder of when homework is due.” Lastly, Jane said, “the word problems are jumbly when they [MyMathLab] try to make it a real-world problem.” This last quote would need to be sent to the MyMathLab technicians so that they can fix this issue to make MyMathLab easier to use.

**MyMathLab pros.** Locklear’s (2012) study showed that students enjoyed receiving immediate help from MyMathLab tools, MyMathLab helped understand the concepts, and enjoyed the multiple attempts per assignment. During the current intervention, the participants enjoyed being able to work on the homework at their own
pace, helping tools were helpful, MyMathLab keeps track of their progress, and MyMathLab is easy to read and organized. Jack said during his focus group interview “It's [MyMathLab] always consistent as far as what the program offers and where to find everything.” Abby said in her journal, “Both the view example and ask instructor were easy to use and excellent helpers.”

Reasons not to use online tools. Participants gave reasons as to why someone should not use online tools. George said during his focus group interview “Yeah, at first, I was like, what is this, because I've never had an online class, or even a math class that had a textbook and resources online.” Jill said during her focus group interview “I know one time it was like I did the view an example thing and it was a different way than how we solved it in class.” This last quote was a con in Locklear’s (2012) study concerning the students’ perceptions of MyMathLab. Lastly, the participants mentioned that the homework help tools can cause dependency on them, which is an example as to why not to use the online tools.

Tools helped with self-reflection. Participants felt the structured journals, MyMathLab, gradebook, and daily homework helped with their self-reflection process. The participants felt the daily homework helped the most with their self-reflection process. Below are the reasons why the daily homework helped with the self-reflection process.

Heather: it [daily homework] made me realize I still need to keep doing it, because once I got the material, I would feel good.

Audrey: I feel like with three attempts on the daily homework helped me realize how to solve the problem appropriately.

Jacob: the daily homework made me see what I didn’t know and needed to work on.
Janna said in her focus group interviews “the structured journals helped keep me focus on the goals to succeed in this class. Also, the structured journals help me strive for something more than just a grade.” This subcategory with the subtheme “types of self-evaluation students do” show that MyMathLab positively impacted the participants' self-evaluation skills.

**Tools similar to homework.** Participants stated that the notes, most of the homework help tools, study plan, and view example were similar to the homework. The participants felt the view example tool was the most similar to the daily homework. Jake said in his journal “the example shows you the same problem just slightly different numbers.” Jacob said in his journal “I used these tools because the problems that were being used were also similar to the ones, we did in class...” Jacob is talking about how using the view example and study plan were like class problems.
CHAPTER 5
DISCUSSION, IMPLICATIONS, AND LIMITATIONS

The purpose of this action research was to evaluate the impact of using SRL strategies embedded in the online homework platform, MyMathLab, had on the students’ SRL and mathematics self-efficacy skills while taking College Algebra at Regional College Campus. This chapter presents the findings in relation to the research questions and the literature regarding mathematics self-efficacy and SRL skills. This chapter also includes the recommendations, implications, and limitations of this action research.

Discussion

To answer the research questions pertaining to this action research study, the quantitative and qualitative data were combined and examined with the previous studies’ literature on mathematics self-efficacy and SRL skills. This section is divided into three sections, one section for each research question: (a) Research Question 1: How, and to what extent does, the online homework platform, MyMathLab, impact the students’ self-regulated learning skills? (b) Research Question 2: How, and to what extent does, the online homework platform, MyMathLab, impact the students’ mathematics self-efficacy? (c) Research Question 3: What are the students’ perceptions of how the online homework platform, MyMathLab, impacted their self-regulated learning skills?
Research Question 1: How, and to what extent does, the online homework platform, MyMathLab, impact the students’ self-regulated learning skills?

Throughout the entire data analysis process, MyMathLab impacted goal setting, self-reflection, help-seeking, and time management skills both positively and negatively, as shown by the data.

**Impacted goal setting skills.** During the forethought phase of Zimmerman’s Model of Self-Regulation, students will set a requirement or standard to be completed at the end of a task that will help them achieve their overall educational goals (Kizilcec et al., 2017; Stoeger & Ziegler, 2008). During the five-week intervention, the participants completed weekly journals via MyMathLab using the Test Tool. In these journals, the participants would evaluate their previous week’s goals and set their goals for the upcoming week. Panadero et al.’s (2016) study showed that student diaries, as mentioned in Chapter 2 reflection journals are like student diaries, aided the students in measuring and guiding them in setting their goals. The participants of current intervention also had access to MyMathLab’s course calendar and daily homework, which was meant to aid them in setting daily attainable task completion goals. Thomas et al.’s (2016) found that a computer program helped the students set realistic and more attainable goals. Lastly, as the participants completed their daily homework, they were given a maximum of three attempts to earn the highest grade possible. So, the participants could set goals to earn a perfect score on the homework before using all three attempts.

According to the Wilcoxon Signed-Rank Test, although there is no significant difference in the students’ pre- and post-goal setting scores, the pre- and post-means of the goal-setting subcategory increased from 3.25 to 3.54. This means that on average this
intervention positively impacted the participants’ goal-setting skills. During two different focus group interviews, multiple participants discussed how seeing their grade on MyMathLab helped them to either “strive better” or push themselves “harder to keep improving during the difficult topics”. These are examples of extrinsic and intrinsic motivation, attainable, and step-by-step goals, which has been shown to help the students attain their goals and improve self-efficacy (Mikami, 2020). Also, four different participants mentioned in their journals that they want to “use the study plan to help them study more.” Lastly, the participants in the current intervention mentioned that the homework helping tools and instructor uploaded notes via MyMathLab also assisted them in setting goals in general and long-term goals. This is one possible reason why the mean of the quantitative data improved.

Besides the positive impact, the participants discussed what can negatively impact their goal completion, but none of the qualitative data mentioned pertained to how MyMathLab negatively impacted their goal completion. Two participants mentioned in their journals that they “were uncertain accomplished goals this week.” Multiple participants mentioned in their journals they “did not accomplish their goals, because they did not set any goals.” Lastly, Jill said during her focus group interview “I don’t purposely sit down at home and think about them [goals], but I know what I have to do every week…. have to accomplish…” Therefore, these are possible factors as to why there was an increase in variation of the participants’ responses and why the probability shows that the intervention may not have significantly impacted the participants' goal-setting skills.
In conclusion, using structured journals, daily homework, homework helping tools, instructor uploaded notes, and course calendar via MyMathLab did have a small positive impact on the participants’ goal-setting skills.

**Impacted self-reflection skills.** During the self-reflection phase of Zimmerman’s Model of Self-Regulation, students will evaluate their knowledge, understanding, and satisfaction of the concept being taught, and then adjust their strategic plan and goals to better understand the concept (Kizilcec, et al., 2017; Littlejohn et al., 2016; Puustinen & Pulkinen, 2001; Zimmerman, 2008; Zimmerman & Capillo, 2003). During the five-week intervention, the participants completed weekly journals via MyMathLab Test Tool. In these journals, the participants would evaluate their previous week’s level of mastery of the content, what tools and resources aided them in completing their weekly tasks, and goal setting and accomplishment. Also, the participants received metacognitive and grade feedback as they completed each problem and daily homework assignment. These self-evaluations and feedback would help the participants to modify their levels of satisfaction, goals, and strategic planning to accomplish their overall long-term goal (Efklides, 2011, Labuhn et al., 2010).

According to the quantitative analysis of this intervention, although there is no significant difference in the students’ pre- and post-self-evaluation scores, the pre- and post-means of the self-evaluation subcategory increased from 2.75 to 3.31. This means that on average this intervention positively impacted the participants’ self-reflection skills. Janet said during her focus group interview, “I mean, I guess, the journals have helped me kind of pull it out more.” Three other participants agreed with this statement, indicating that structured journals helped them look more deeply into their self-
analyzation process. One participant, Kayla, mentioned in her structured journal three different times that she wanted to “keep my head afloat and say it’s okay to not get it every once in a while,” which means she is satisfied with making errors, taking time to learn the material, and okay with struggling. This shows that Kayla is a non-formal learner who is more interested in developing their content mastery rather than task completion, which means she will have stronger goal setting and self-reflection skills (Littlejohn et al, 2016). In summary, using the structured journals did have a small positive impact on the participants’ self-reflection skills although it is not significant.

**Impacted help-seeking skills.** Help-seeking will occur during the performance phase of Zimmerman’s Model of Self-Regulation by asking for help from either their peers, teacher, tutor, or uses different resources to understand a concept (Kizilcec et al., 2017). During the five-week intervention, the participants completed daily homework four days a week and were able to use different tools while completing their homework via MyMathLab to complete the task and learn the material. The participants were able to use the study plan, eTextbook, view example, ask my instructor, videos, animations, and PowerPoint presentations. According to the quantitative data analysis, there is no significant difference between the participants' pre- and post-help-seeking skills scores. The pre- and post-means of the help-seeking subcategory decreased from 3.40 to 3.06. Also, the intervention may not have significantly impacted the participants’ help-seeking skills. One factor that might have negatively impacted a participant’s help-seeking skills is having technical issues with either MyMathLab or the helping tool itself. As mentioned by one participant in their journal said, “I tried to use a video one time, but the video didn’t load.” Another factor that can negatively impact a participant’s help-seeking
skills is the helping tool not organized with the class material. As shown by two participants who felt that the study plan needs to be improved by “being more organized with the class material.” Three previous studies showed that not every participant felt that the MyMathLab tools, resources, and homework helping tools to be helpful or useful, with no explanation as to why they felt this way (Holt et al., 2012; Law et al., 2012; Raines, 2016).

However, the qualitative data of the current study shows that the participants used a wide range of helping tools to learn the concepts and complete the tasks. Some of the tools they used were their calculator, tutors, emailing the professor, going to the professor’s office, classmates, MyMathLab’s study plan, daily homework help tool view an example, and uploaded classes notes and study guides. Four different participants discussed in their journals multiple times that they used the study plan frequently, but there was not a clear definition of what frequent is. Also, seven participants said they used the Ask Instructor Tool provided by the daily homework. The participants used it to either “understand how I could have gotten the problem wrong”, “used this [Ask Instructor Tool] because I did need help and I would get an immediate response”, or “for help putting the word problems together”. One study showed that 43 participants had positive perceptions of using both the Help Me Solve This and View an Example Tools (Raines, 2016). This shows that MyMathLab resources and tools can have a positive impact on the participants' help seeking-skills.

In conclusion, students have used the MyMathLab tools which support their help-seeking skills. However, using these tools did not have either a positive or negative impact on their help-seeking skills.
Impacted time management skills. During the forethought phase of Zimmerman’s Model of Self-Regulation, students create and manage a plan to allocate time to perform and complete the tasks at hand so that they can learn the material being taught (Broadbent & Poon, 2015; Collier & Morgan, 2008; Handoko et al., 2019; Zimmerman, 2008). These tasks include, but are not limited to, doing homework, working, or community obligations. During the five-week intervention, the participants were assigned daily homework one hour before the class starts and it was due by the start of the next class. The participants were also assigned structured journals each Friday at noon and were due by 5 pm Sunday during the intervention. When the participants logged into MyMathLab they could view what homework assignments and structured journals were going to be assigned that day and week by looking at the course calendar on the homepage and the assignment page, which can be accessed from the homepage.

Although no significant difference in the participants’ pre- and post-time management scores were found, the pre- and post-means of the time management skills increased from 3.13 to 3.33. This means that on average this intervention positively impacted the participants’ time management skills. The participants discussed both in their journals and focus group interviews on how the different tools and resources of MyMathLab helped their time management skills. One participant said, “the homepage tells the due dates and what time the daily homework is due.” This corroborated by another participant who discussed how the calendar on the MyMathLab homepage helped them manage their time and tasks. Lastly, two studies found that students who are in either blended or online learning environments can effectively allot, manage, and
prioritize their time and tasks that need to be complete (Gecer & Dag, 2012; Handoko et al., 2019).

However, the Wilcoxon Signed-Rank Test showed that the intervention did not positively impact the participants’ time management skills. This was also shown to occur in Holt et al’s (2012) study where they found that students had difficulty managing their time and completing their homework via MyMathLab. This was corroborated by one of the participants who said, “I don’t feel like it [MyMathLab] has affected my time management skills, because it’s just another thing to do. It [MyMathLab] shows a set timer and you have this long to this… I do all that myself already.” Another participant said, “I don’t feel like it [daily homework assigned via MyMathLab] helped my time management because even if I didn’t have daily homework I would still go home and just start on the next task on my list.” Another participant said a very similar thing during their focus group interview. These were the only negative perceptions of MyMathLab not helping the participants’ time management skills. These perceptions show that the three participants can already manage their time effectively and knew how to prioritize their tasks.

In conclusion, using weekly structured journals, daily homework, and using course and assignment calendars via MyMathLab did have a small positive impact on the participants’ time management skills.

In summary, five of the six subcategories of the OSRLQ means improved by the end of the intervention, all the Wilcoxon Signed-Rank Tests showed that the intervention did not significantly impact the participants’ SRL skills, and the participants mostly discussed that the resources and daily homework helping tools via MyMathLab had a
positive impact on their SRL skills. Therefore, this intervention had a positive impact on the participants’ SRL skills.

**Research Question 2: How, and to what extent does, the online homework platform, MyMathLab, impact the students’ mathematics self-efficacy?**

Throughout the entire data analysis process, the data showed that MyMathLab impacted mastery of experience, vicarious and social persuasion, and physiological skills, different components of mathematics self-efficacy.

**Impacted mastery of experience.** During the forethought and self-reflection phase of Zimmerman’s Model of Self-Regulation, students evaluate their understanding of a completed task and if this understanding will help them be successful with the topic being taught (Kontas, & Ozcan, 2018; Lau et al., 2018; Usher & Pajares, 2008, 2009). This means the students are analyzing their levels of mastery of experience, a component of mathematics self-efficacy. During the five-week intervention, the participants were assigned daily homework, via MyMathLab, which contained five problems that were like that day’s in-class lecture. Also, the participants could see their current class and assignment grades on MyMathLab’s homepage and gradebook, which can be accessed via the homepage, and the participants had three attempts to earn a perfect score. Lastly, the students will receive different forms of feedback from the daily homework as they completed each problem.

The Wilcoxon Signed-Ranks Test showed that the intervention did not positively impact the participants' mastery of experience and the pre- and post-means of mastery of experience decreased from 3.71 to 3.39. This means that on average the participants’ mastery of experience was negatively impacted by the intervention. This is corroborated
by the category “mix success without tools” and multiple codes that were created during
the qualitative analysis. One participant said, “I tried it and it worked for a few steps, but
then I ended up getting lost and had to use my notes.” This participant tried to complete
a homework problem without using their notes or notes provided by MyMathLab but had
not mastered the concept yet to fully complete the problem on their own. Another
participant said, “I wanted to use the view example, but most of the questions didn’t offer
that tool. This is why I didn’t do as good on my homework this week.” This
demonstrates that they could not complete the problem because a certain tool was not
available and had not adequately mastered the concept. This is corroborated by a
previous study that showed students who used MyMathLab had a mixed review of how
well MyMathLab impacted the students’ understanding of the concepts (Holt et al.,
2012).

There were also ways non-MyMathLab resources can negatively impact their
mathematics self-efficacy. For example, “I just don’t get all the Greek symbols.” This is
showing that the participant has not fully mastered the concept of manipulating variables.
Another participant said, “I have low self-efficacy with the new concept because the
concept is too complex.” Here the participant is also showing that they have not grasped
the concept because they view it to be complicated. These non-MyMathLab resources
may have factored into why the participants’ scores did not improve during the
intervention.

In contrast, two previous studies showed that MyMathLab helped the students
understand their knowledge better (Law et al., 2012; Locklear, 2012). During the current
study, many participants discussed how different MyMathLab resources and daily
homework helping tools helped their mathematics self-efficacy. For example, one participant said, “I also used the study plan… to better understand the material.” Another participant said, “I mean it [daily homework] made me realize I still needed to keep doing my tasks, because it felt good to know I was finally getting the material.” Both of these excerpts demonstrate that MyMathLab can positively impact the students’ mastery of experience. These positive factors can explain why the pre-mean did not negatively drop too much and the participants’ responses varied more by the end of the intervention.

In conclusion, there is no clear conclusion if MyMathLab positively or negatively impacted the participants' mastery of experience.

**Impacted vicarious experience and social persuasion.** Vicarious experience is defined as how much or how often a student is exposed to peers or non-peers “who demonstrate competence in the subject of interest” (Usher & Pajares, 2009, p. 90). Social persuasion is defined as when a student receives encouragement from peers, family, and non-peers on their ability to demonstrate their knowledge of the content (Usher & Pajares, 2008). Both the vicarious experience and social persuasion occurs during the performance phase of Zimmerman’s Model of Self-Regulation because the students would receive feedback from their classmates, instructor, and tutor while completing their homework (Labuhn et al., 2010; Lee et al., 2010; Panadero & Alonso-Tapia, 2014). Also, vicarious experience and social persuasion occur during the self-reflection phase of Zimmerman’s Model of Self-Regulation because the students are comparing their performance on a task with that of their classmates (Kizilcec et al., 2017; Littlejohn et al., 2016; Puustinen & Pulkinen, 2001; Zimmerman, 2008; Zimmerman & Capillo, 2003).
During the five-week intervention, MyMathLab allowed the participants to email me, the instructor, via the Ask My Instructor Tool while completing their daily homework.

According to the quantitative analysis, there is no significant impact of the intervention on the participants’ vicarious experience, and the pre- and post-means of vicarious experience decreased from 4.12 to 3.65. This means that on average the intervention negatively impacted the participants’ vicarious experiences. This is explained by one participant saying during their focus group interview, “the class feels like it is online the way you have the homework assigned.” This shows that the participant feels that the daily homework and MyMathLab does not offer enough exposure to their peers, family, and non-peers to demonstrate their mathematical abilities. This is corroborated by Locklear’s (2012) found that at least one participant did not enjoy MyMathLab because they did not get the interaction with other people and they learn better with interacting with others. These are accurate findings because during this intervention I did not embed any SRL strategies into MyMathLab for the participants to be interactive with their classmates. However, one participant said, “I am able to help explain the problems to other people in class too, which helps my confidence.” This is a non-MyMathLab resource that helped this participant boost their vicarious experience.

Moreover, according to the Wilcoxon Signed-Ranks Test showed that the intervention did not positively impact the participants’ social persuasion, and the pre- and post-means of social persuasion increased from 3.86 to 3.89. This means that on average the intervention positively impacted the participants' social persuasion. One participant said, “If I still had trouble with a problem, I would email the instructor to get a better understanding and to determine where I went wrong in my steps.” This was corroborated
by other participants. This shows that participants contacted me to demonstrate their knowledge competency. Some participants would email me daily to demonstrate their knowledge and to seek help as to where they may have made errors. Lastly, multiple participants mentioned going to tutoring for help and during these tutoring sessions, the participants get to demonstrate their knowledge competency of the material being taught.

In conclusion, this intervention did not positively impact the participants’ vicarious experience. However, using the Ask My Instructor Tool did positively impact the participants' social persuasion.

**Impacted physiological state.** When a student bases their experiences of learning a task on their anxiety, stress, fatigue, and mood, known as a student’s physiological state,(Kontas, & Ozcan, 2018; Lau et al., 2018; Usher & Pajares, 2008, 2009) occurs during the self-reflection phase of Zimmerman’s Model of Self-Regulation because the student is evaluating their self-efficacy of performing the concepts they learned (Kitsantas et al., 2011; Ramdass & Zimmerman, 2011; Zimmerman, 2008).

During the five-week intervention, students completed weekly structured journals via MyMathLab’s Test Tool, where they reflected on their confidence in applying concepts to future concepts.

Results of the Wilcoxon Signed-Ranks Test showed that the intervention did not significantly impact the participants’ physiological state. Also, the pre- and post-means of the physiological state decreased from 4.49 to 3.39. This means that on average the participants’ physiological state was negatively impacted by the intervention. One participant said the daily homework negatively impacted their physiological state because “as we get into harder problems, I think it will start getting more frustrating for me.” One
previous study had one participant say, “It [MyMathLab] brought forth more problems and frustrations than if I had just completed and turned in written assignments” and “it [MyMathLab] tend not work sometimes, which was a cause of stress…” (Locklear, 2012, p. 124-125). These findings show that assigning homework online and technical glitches in the OHWP can negatively impact the students’ physiological state. Lastly, one participant during the current intervention said, “that when we make examples [in-class] even more complex and challenging, it discourages me… and I fear getting the wrong answer.” This participants’ reflection shows that in-class examples, a non-MyMathLab resource, can negatively impact their physiological state.

However, one participant said, “This is my goal, because I have made much lower grades than I would prefer, and I’d like to feel good about where I am standing in math.” This shows that when participants see their grades on MyMathLab can both negatively and positively impact the participant’s physiological state. Also, another participant said, “[M]y study plan will walk me through a problem if I’m feeling confused, which has definitely helped me.” Another participant said, “I used these tools [study plan and view example] to help me every time I come across a problem that I had trouble with or feel low confidence when trying to solve it by myself.” Both examples show how the study plan and view example tool positively impacted their physiological state, which shows that MyMathLab can have a positive impact on their physiological state. Lastly, one other participant stated, “These were my goals [lessen my stress level], because when I am stressed, I notice that it is more difficult for me to retain the information.” This shows that setting a goal to lessen personal stress levels could have a positive impact on the participants’ physiological state.
In conclusion, the current intervention did not positively impact the participants’ physiological state.

In summary, only the social persuasion subcategory had a mean that increased by the end of the intervention. While the other subcategories means decreased by the end of the intervention. Also, the qualitative data showed that the intervention had both positive and negative impacts on the participants' mathematics self-efficacy. Therefore, this intervention was not fully successful at positively impacting the participants’ mathematics self-efficacy.

**Research Question 3: What are the students’ perceptions of how the online homework platform, MyMathLab, impacted their self-regulated learning skills?**

After analyzing all the of the qualitative data, the participants have mixed perception on how well MyMathlab impacted their task completion, time management, and mathematics self-efficacy skills, MyMathLab tools and resources helped them recall and understand the concepts, MyMathLab impacted their help-seeking abilities, MyMathLab tools provided the participants with learning strategies, and MyMathLab tools and resources assisted them in setting goals.

**Impacted concept understanding.** The participants stated how MyMathLab tools and resources impacted their ability to recall the concepts, check their progress, and learn the concepts. Out of the 91 codes that relate impacting the concept understanding, 25 of those codes showed that participants used the view example tool, 22 of those codes showed that the participants felt the homework helped, and 12 of the codes showed that the participants used the uploaded class notes. The participants also stated they used at least a MyMathLab tool or resource, such as the textbook and emailing the instructor.
One participant said, “I used these tools [study plan and similar question tool] and not the others because these tools directly helped me with the daily homework.” This perception shows that this participant feels that the other homework help tools and MyMathLab resources were not as helpful, this is shown in previous studies (Holt et al., 2012; Law et al., 2012). Another participant said, “Just trying to get that done [daily homework], but it’s definitely helped me learn the concepts and show me where I have questions concerning the material.” Multiple participants said they use the view example tool and their notes to check that they are answering the problems correctly. These perceptions are supported by previous studies (Locklear, 2012; Raines, 2016). So, MyMathLab positively impacted the participants’ concept understanding.

**Impacted goal-setting skills.** The qualitative analysis revealed that three categories showed how MyMathLab impacted the participants’ goal-setting skills. These categories were “tools helped goal setting”, “tools assisted setting long term goals”, and “goal setting limit helping tools used”. One participant said, “I set these goals [passing homework and structured journal assignments] and want to achieve these goals because I want an A in the class.” This participant is showing how their performance on the daily homework and structured journals affects their long-term goal of earning an A. Another participant mentioned that they would set long term goals that increased in difficulty and just above their attainability based on their homework completion rate and grades so that they could earn a passing grade in the class. None of the participants mentioned that they set goals to limit the helping tools used because they did not want to become dependent on the tool, but it could be implied based on Shanna’s comment “…following the examples sometimes helped when I don't know what to do and that it becomes like a
dependency thing.” The participants did say that they set these goals because “I want to learn the math without a calculator”, “… to see if I could accomplish it [daily homework] on my own first”, and “…I figured I should try to work this on my own by using less guidance”. These perspectives show that the participants wanted to boost their confidence and mathematics self-efficacy since on the in-class assessments they will not have access to these helping tools. In conclusion, the participants showed that MyMathLab’s tools and resources can positively impact their goal-setting skills.

**Impacted help-seeking abilities.** The qualitative analysis showed that the participants used many, if not all of the tools and resources that MyMathLab has to offer to help them either complete their tasks, study, goals, practice, manage their tasks, and seek help from their instructor. The view example, study plan, notes, and other homework help tools were used because they were similar to the daily homework. Four different participants said that the view example tool was very similar to their homework and all they had to do was write down the steps from the example and then figure how to use those steps for their problem. This supports Shanna’s comment that using the homework help tools can cause dependency, which is a negative impact for using homework helping tools.

**Impacting learning strategies.** Multiple participants discussed how different MyMathLab tools and resources helped their learning strategies. For example, one participant mentioned that they enjoyed using the different homework help tools because they provide clear step-by-step instructions and other methods to solve a problem. Another participant mentioned that the videos created by MyMathLab correlated to their learning style and enjoyed using them over other helping tools. Another participant said,
“Also, sometimes it [view example] will give you an easier way to solve the problem.”

Lastly, multiple participants enjoyed that the different homework help tools provide multiple methods that are different and easier than what is taught in class.

**Impacted mathematics self-efficacy.** As previously mentioned, the participants stated in their structured journals and focus group interviews both positive and negative perceptions of how MyMathLab impacted their mathematics self-efficacy. The quantitative analysis showed that their pre- and post-means did not improve for all of the subcategories of the mathematics self-efficacy.

**Impacted task completion.** The participants had mixed reviews on how MyMathLab tools and resources impacted their task completion. The participants used a variety of MyMathLab tools and resources to help them complete their daily homework. The main tools used were study plan, view example, MyMathLab homepage, calendar, and notes and study guides uploaded by me, the course instructor, on MyMathLab. Most of the participants felt that the tools and resources provided by MyMathLab had a positive impact on their task completion. However, one participant said, “the homework help tools help for some problems.” This implies that not every tool can help the participants complete their tasks. Another participant said, “I feel like it [homework help tools] both help and hinder at the same time… It [MyMathLab] can cause us to become dependent on the tools.” So, this participant shows that MyMathLab can be helpful, but they may make the students become reliant on the homework help tools, which could cause the students not to learn the content.

**Impacted time management skills.** As previously mentioned, the participants had both positive and negative perceptions of how MyMathLab impacted their time
management skills. The quantitative analysis and a mixture of the qualitative analysis showed that their means and perceptions improved by the end of the intervention. However, both the probability and a mixture of the qualitative analysis showed that the intervention did not significantly impact and hindered their time management skills.

In conclusion, based on the quantitative analysis, on average all the subthemes, except for help-seeking, for SRL skills improved while embedding SRL strategies in MyMathLab. While their respective Wilcoxon Signed-Ranks Test showed that the embedded SRL strategies in MyMathLab did not significantly impact the participants’ self-regulated learning skills. The qualitative analysis showed that embedded self-regulated learning strategies in MyMathLab positively impacted the participants’ self-regulated learning skills with some negatives. These negatives came from both MyMathLab and non-MyMathLab resources. Also, based on the quantitative analysis, on average all the subthemes, except for social persuasion, for mathematics self-efficacy did not improve while embedding SRL strategies into MyMathLab. The Wilcoxon Signed-Ranks Test shows that the embedded SRL strategies into MyMathLab did not significantly impact the participants’ mathematics self-efficacy. The qualitative analysis showed that embedded SRL strategies into MyMathLab positively impacted the participants’ self-regulated learning skills with some negatives. These negatives came from both MyMathLab and non-MyMathLab resources. Lastly, the participants gave suggestions on how to improve MyMathLab that could help future participants self-regulated learning skills in future mathematics courses.
**Implications**

Since there is a significant rise in blended and online learning, the findings of the current research have significant implications. Three categories of implications are discussed: (1) personal use, (2) other instructors that use any online homework platform, and (3) future research.

**Personal Implications**

Throughout this current intervention, I have gained many valuable insights into my role as an educator in the field of education. Reflecting on the process and the findings of this intervention have given me the following insights: (1) my perceptions of my students changed and (2) my teaching methods changed.

**My perceptions of my students changed.** This intervention was designed as an action research, which was beneficial because I was both the educator and researcher gaining deeper insights on the students involved in this action research (Mertler, 2017) as to how MyMathLab impacted their SRL skills and mathematics self-efficacy skills. I learned that my students have had some exposure to an OHWP, including different Pearson products. Even if they did not have the exposure to an OHWP prior to this intervention, this did not seem to hinder their SRL skills or their ability to use MyMathLab. Also, my students started the intervention with stronger SRL skills and mathematics self-efficacy skills then what I initially thought. Even though findings show that intervention did not positively or significantly impact my students’ SRL skills and mathematics self-efficacy skills. The students did demonstrate in their structured journals that they were actively using their SRL skills and mathematics self-efficacy skills during
the intervention to improve their understanding of the content and achieve their overall goal of passing the course.

**My teaching methods changed.** One of the many purposes of action research is for the educator to make well-informed and precise decisions to improve their teaching abilities by gaining valuable information about their students and the environment that they are taught in (Mertler, 2017). I will use the findings of prior research and the current study to make well-informed decisions for improving future learning environments. I will make the following improvements to my teaching methods: (1) structured journals structure changed and (2) need to create more formative assessment questions for homework.

**Structured journals structure changed.** Since Zimmerman’s Model of Self-Regulation is cyclical (Puustinen & Pulkkinen, 2001) the structured journals must be created so that the students can effectively evaluate their SRL skills and mathematics self-efficacy skills. The current study used the same questions for the structured journals during the intervention, which may not have allowed the students to connect their prior reflections to current reflections effectively. So, for future classes, the first journal will be designed for the students to set their overall goals for the semester and to create a plan to meet these goals. The rest of the journals will have the students reflect on their: (1) progress of their overall goals, (2) how did the help-seeking tools, environmental settings, time management, and task completion helped or hindered them in following through with their plan, (3) explain how they can apply the current content to previous, future, and other course content, and (4) how they could help their classmates accomplish their overall goals. Each of these questions focuses on a different component of Zimmerman’s
Model of Self-Regulation and mathematics self-efficacy skills. Lastly, I will provide metacognitive feedback to help guide the students on their progress to their overall goal. The metacognitive feedback has been shown to help students better connect prior weeks of self-reflection to current and future weeks of self-reflection (Puustinen & Pulkkinen, 2001).

*Need to create more formative assessment questions for homework.* Previous research has shown that homework can improve a student’s mathematics self-efficacy because it allows them to self-reflect on why they were able to succeed, repeat their success, and be able to master the concepts being taught (Gates, 2014; Margolis & McCabe, 2006; Ramdass & Zimmerman, 2011). However, during the current study, the participants mentioned multiple times that performing poorly on their formative assessments, in-class quizzes and tests, negatively impacted their mathematics self-efficacy. This means that the students were not adequately prepared by their homework for the formative assessments. For future classes, I will create and add more problems that are aligned with the formative assessments. This will help the students be more prepared for what the formative assessments will ask. Lastly, with creating these problems, I will need to create and assign metacognitive feedback because MyMathLab does not provide metacognitive feedback for instructor created questions. This metacognitive feedback can help the students’ mathematics self-efficacy (Koukounas, 2016; Lau et al., 2018) and SRL because it will explain why they missed or accomplished the problem, instead of just the answering right or wrong (Labuhn et al., 2010; Lee et al., 2010; Panadero & Alonso-Tapia, 2014).
Implications for other Instructors who use OHWP

The findings of the current study can provide valuable insights to other educators who teach using an OWHP in either a blended learning or a completely online environment or are wanting to use an OWHP. The key insight for other educators is choosing an appropriate platform.

Choosing an appropriate platform. Previous research has shown that not every OHWP provides the same amenities and ease of access to users (Balta et al., 2018; Callahan, 2016; Hegeman, 2015; Heenehan & Khorami, 2016; Lin, 2009; Locklear, 2012; Lunsford & Pendergrass, 2016). So educators need to choose a platform that will allow them to: (1) positively impact the students’ self-efficacy and (2) let the students self-reflect on their entire learning process.

Positively impact self-efficacy. Every student wants to know why and how they are going to use what they are learning in the classroom in their everyday life (Korengel, n.d.). There are many ways an OHWP can impact the students’ self-efficacy. One way is allowing instructors to create assignments that will allow the students to apply what they are learning (Kitsantas et al., 2011; Kitsantas & Zimmerman, 2009; Chyr et al., 2017). During the current study, there was a mixed review if the daily homework assignments were helpful in boosting the participants’ self-efficacy. Only one participant felt like MyMathLab did not have enough problems that are real-world applicable, which implies that MyMathLab may not adequately prepare students to apply the concepts they are learning. However, one participant did feel the daily homework did allow them to apply concepts learned in-class without extra assistance, which implies the in-class lectures and
daily homework through MyMathLab are adequately preparing the students to apply the concepts.

Another way an OHWP can positively impact a student’s self-efficacy is providing metacognitive feedback, which has been shown to help the students’ mathematics self-efficacy (Koukounas, 2016; Lau et al., 2018). One participant mentioned in their journal, “I did like how whenever you got the problem wrong, a statement would pop up and would tell you how you need to do the problem.” This shows that MyMathLab provides the students metacognitive feedback. This is corroborated by Lockear’s (2012) findings where students enjoyed receiving “diagnostic feedback” (p. 56) and providing helping tools that help the students learn the material. Lastly, for this metacognitive feedback to be effective, the feedback needs to be immediate, which is provided by many platforms.

The current study also showed that the participants enjoyed using the different homework helping tools and resources provided by MyMathLab because it helped them boost their mathematics self-efficacy. The reasons are: “I also used the study plan… to help me better understand the material”, the uploaded old test keys and study guides “prepared [me] for it [the tests]”, and “view example tool continues to provide me help when I face a problem on the homework”. The participants also mentioned “I used these [study plan, view example, and MyMathLab videos] because they worked best for me”, which implies that the homework helping tools fit their learning styles which can help their self-efficacy. Lastly, many participants enjoyed that the study plan and view example tool provide detailed step-by-step instructions on how to complete the problem.
So, when an instructor is choosing an OHWP they need to make sure that the platform offers different kinds of helping tools that provide clear detail while being used.

**Let the students self-reflect on their entire learning process.** Abrami et al.’s (2012) study showed that with the rise of distance learning educators and instructional designers need to make sure there exist tools that impact all aspects of a student’s SRL process. Self-reflection is key for any SRL because self-reflection helps the students evaluate their current entire learning process and then adjust it so that they can achieve their ultimate goals for the course (Zimmerman & Campillo, 2003). Many OHWPs help with a student’s self-reflection process by showing what their grades are for the course and on each assignment. For some students, this is enough to help in their self-reflection process. However, the current study found that the participants felt that the structured journals “helped me kind pull it [goals] out more, but I still always think about them”, “it’s kind of like a progress check through the semester”, “it at least makes you think about them [goals]”, “it’s [journal and daily homework] good… prepared me for what I have to do the rest of the semester to get the grade I want”, and “at least take a few seconds to think about… what you wanted to accomplish for next week, and what you did and not accomplish in the prior week”. Now the structured journals were something I had to create in MyMathLab, so future instructors would need to design assignments, tools that will help the students in their self-reflection process, or choose a platform that has assignments or tools that will help the students in their self-reflection process.

**Implications for Future Research**

The findings of this study suggest several future research opportunities. These opportunities include: (1) evaluation of how blended learning impacts SRL skills, (2)
evaluation of assigning homework and its impact SRL skills, and (3) evaluation of assigning helpings tools and its impact SRL skills.

**Evaluation of how blended learning impacts srl skills.** Prior research has shown that not just the OHWP impacts a student’s learning, self-efficacy, and SRL skills (Koukounas, 2016; Broadbent & Poon, 2015; Prescott, 2017). The findings of the current study showed that MyMathLab did not significantly impact the participants’ SRL skills and the participants had mixed perceptions of how MyMathLab resources and non-MyMathLab resources impacted their SRL skills. This implies that both online and traditional classroom learning are simultaneously impacting the participants’ SRL skills. Future studies should design instruments and interventions that evaluate how just the OHWP, instructor, and peers impact each component of the participants’ SRL skills.

**Evaluation of assigning homework and its’ impact on srl skills.** Previous research has shown that there is no clear correct method to assign homework for students to complete and learn the concepts being taught (Stoeger & Ziegler, 2008; Tas et al., 2014; Zerr, 2007). A couple of participants suggested that homework should not be assigned daily, the number of problems assigned, and the number of attempts per assignment. So, future studies should assign homework at different rates with a different amount of problems and evaluate which method most positively impacts the participants’ SRL skills.

**Evaluation of assigning helping tools and its’ impact on srl skills.** Previous research has shown that students can become dependent on some or all of the homework helping tools in MyMathLab (Hodges et al., 2015; Locklear, 2012). This was also found in the current study. During the current intervention, the participants had access to all
MyMathLab homework helping tools, except for the “help me solve this tool”, at the start of the problem. Future studies should investigate and evaluate the students’ SRL skills when the instructor changes which MyMathLab homework helping tools are available and gives the students access to those helping tools once they have completed the assignment once.

**Limitations**

All research has limitations and there are several limitations for this current study. The limitations for this study can be broken into the following two categories: (1) design characteristics of the study and (2) limitations associated with the findings.

**Design Characteristics**

The current study had the following limitations based on the design characteristics of the study: the results are not generalizable, sample size, duration of the intervention, I was both the researcher and instructor during the intervention, and not using MyMathLab’s discussion. As Mertler (2017) pointed out, the purpose of action research is to not be generalizable to national or larger-scale studies, because action research focuses on a specific single context for a local researcher and/or instructor where the research and intervention are taking place. Also, the current study had a small sample size of \(N=13\), which means the sample size does not provide enough accuracy to lessen the amount in the confidence errors and the findings are not as precise because they could overestimate the findings (Hacksaw, 2008). Also, the participants came from one College Algebra course on the Regional College Campus, which means this study did not get an accurate representation of the student population at the Regional College Campus who were taking College Algebra or any student population for any college campus.
This study’s intervention only lasted five weeks, which means not enough time to collect an ample amount of data that would give confidence and more reliability for the findings. I was both the researcher and instructor, which means the findings could have personal bias. This bias was lessened by keeping a journal of both the quantitative and qualitative findings and conducting member checking and peer debriefing with my dissertation chair and two cohort members. During the intervention, the only social component of MyMathLab I chose to use was the Ask My Instructor tool. However, MyMathLab offers a discussion portal tool for students to participate in discussion created by the instructor. I did not use this tool because I did not know about it. So not using the discussion portal limited and may have negatively impacted the student vicarious experience and social persuasion.

**Limitations Associated with the Findings**

The data was self-reported by the participants while completing the pre- and post-surveys, structured journals, and focus group interviews which can limit the findings of this intervention. Self-reported findings may not be accurate because the participants may inaccurately judge their levels of SRL and mathematics self-efficacy skills (Azevedo, 2015; Zimmerman, 2008). Some of the inaccuracies can occur because the participants may feel their responses will affect their grade if not answered correctly. This limitation was minimized through triangulation among the surveys by computing and comparing Cronbach’s alpha, focus group interviews, and structured journals, which will provide stronger and more reliable data. Also, the focus group interviews were audio-recorded, then transcribed, and sent to the participants to make sure that the transcripts were accurately transcribed. Lastly, as mentioned before I used member
checking and peer debriefing to help make sure the interpretation of the data was accurate. Another limitation for the findings was not enough previous study concerning how MyMathLab impacted all the aspects of SRL. This made it tougher to verify the current findings were accurate.
REFERENCES


https://doi.org/10.1080/10511970.2015.1085472


https://search.proquest.com/openview/613c6720ece5813a65b9568724712453/1?pq-origsite=gscholar&cbl=18750&diss=y


https://www.scopus.com/inward/record.url?eid=2-s2.0-84856898816&partnerID=40&md5=bd267ce0230c8a6b9ec21af22ca5a3


https://doi.org/10.1007/s11218-018-9431-4


Locklear, D. (2012). *Using online homework in a liberal arts math course to increase student participation and performance*. ProQuest LLC. https://search.proquest.com/openview/c2a0eb6eb5da44de8d3cfd97a8edb253/1?pq-origsite=gscholar&cbl=18750&diss=y


http://scholarworks.waldenu.edu/dissertations/4401


https://doi.org/10.1080/00313830120074206


https://doi.org/10.1177/1932202X1102200202


https://doi.org/10.1007/s11422-012-9442-y


APPENDIX A

IRB APPROVAL LETTER

INSTITUTIONAL REVIEW BOARD FOR HUMAN RESEARCH
DECLARATION of NOT RESEARCH

Allan Pangburn
478 Hubbard Dr
Lancaster, SC 29720 USA

Re: Pro00089081

Dear Mr. Allan Pangburn:

This is to certify that research study entitled Helping College Mathematics Students Facilitate their Self-Regulated Learning Skills and Mathematics Self-Efficacy While using MyMathLab was reviewed on 5/6/2019 by the Office of Research Compliance, which is an administrative office that supports the University of South Carolina Institutional Review Board (USC IRB). The Office of Research Compliance, on behalf of the Institutional Review Board, has determined that the referenced research study is not subject to the Protection of Human Subject Regulations in accordance with the Code of Federal Regulations 45 CFR 46 et. seq.

No further oversight by the USC IRB is required. However, the investigator should inform the Office of Research Compliance prior to making any substantive changes in the research methods, as this may alter the status of the project and require another review.

If you have questions, contact Lisa M. Johnson at lisa@mailbox.sc.edu or (803) 777-6670.

Sincerely,

Lisa M. Johnson
ORC Assistant Director and IRB Manager
APPENDIX B

APPROVAL LETTER TO USE MYMATHLAB

Pearson

Apr 4, 2019

Allan Pangburn

Dear Allan Pangburn,

You have our permission to include content from our text, *MATHEMATICS WITH APPLICATIONS IN THE MANAGEMENT, NATURAL AND SOCIAL SCIENCES, 11th Ed.* by *LIAL, MARGARET L.; HUNGERFORD, THOMAS W.; HOLCOMB, JOHN P.; MULLINS, BERNADETTE*, in your dissertation or doctoral thesis at

Content to be used:
- Pages 43-51, 65-100, 115-134, 225-231 (72 pages in total)

Please credit our material as follows:

Sincerely,
GaynorThomas,
Global Permissions Granting Analyst
APPENDIX C

SOURCES OF MATHEMATICS SELF-EFFICACY SCALE

Select the number that best answers each question, where 1 is definitely false, 2 is false, 3 is somewhat false, 4 is somewhat true, 5 is true, and 6 is definitely true. Mastery Experience (ME), Vicarious Adult (VA), Vicarious Peer (VP), Vicarious Self (VS), Social Persuasion (SP), and Physiological State (PS). The (*) denotes reversed questions.

1. I make excellent grades on math tests? (ME) 1 2 3 4 5 6
2. I have always been successful with math? (ME) 1 2 3 4 5 6
3. Even when I study very hard, I do poorly in math? (ME*) 1 2 3 4 5 6
4. I got good grades in math on my last report card? (ME) 1 2 3 4 5 6
5. I do well on math assignments? (ME) 1 2 3 4 5 6
6. I do well on even the most difficult math assignments? (ME) 1 2 3 4 5 6
7. Seeing adults do well in math pushes me to do better? (VA) 1 2 3 4 5 6
8. When I see how my math teachers solves a problem, I can picture myself solving the problem in the same way? (VA) 1 2 3 4 5 6
9. Seeing kids do better than me in math pushes me to do better? (VP) 1 2 3 4 5 6
10. When I see how another student solve a math problem, I can see myself solving the problem in the same way? (VP) 1 2 3 4 5 6
11. I imagine myself working through challenging math problems successfully? (VS) 1 2 3 4 5 6
12. I compete with myself in math? (VS) 1 2 3 4 5 6
13. My math teachers have told that I am good at learning math? (SP) 1 2 3 4 5 6
14. People have told me that I have a talent for math? (SP) 1 2 3 4 5 6
15. Adults in my family have told me what a good math student I am? (SP) 1 2 3 4 5 6
16. I have been praised for my ability in math? (SP) 1 2 3 4 5 6
17. Other students have told me that I’m good at learning math? (SP) 1 2 3 4 5 6
18. My classmates like to work with me in math because they think I’m good at it? (SP) 1 2 3 4 5 6
19. Just being in math class makes me feel stressed and nervous? (PS*) 1 2 3 4 5 6
20. Doing math work takes all of my energy? (PS*) 1 2 3 4 5 6
21. I start to feel stressed-out as soon as I begin my math work? (PS*) 1 2 3 4 5 6
22. My mind goes blank and I am unable to think clearly when doing math work? (PS*) 1 2 3 4 5 6
23. I get depressed when I think about learning math? (PS*) 1 2 3 4 5 6
24. My whole body becomes tense when I have to do math? (PS*) 1 2 3 4 5 6
APPENDIX D

ONLINE SELF-REGULATED LEARNING QUESTIONNAIRE

Select the number that best answers each question, where 1 is strongly disagree, 2 is disagree, 3 is neutral, 4 is agree and 5 is strongly agree. Goal Setting (GS), Environmental Structuring (ES), Task Strategies (TS), Helping Seeking (HS), and Self-Evaluation (SE). The (*) denotes reversed questions.

1. I set standards for my assignments in online classes? (GS) 1 2 3 4 5
2. I set short term (daily or weekly) goals as well as long term goals (monthly or for the semester)? (GS) 1 2 3 4 5
3. I keep a high standard for my learning in my online courses? (GS) 1 2 3 4 5
4. I set goals to help me manage studying time for my online courses? (GS) 1 2 3 4 5
5. I don't compromise the quality of my work because it is online? (ES*) 1 2 3 4 5
6. I choose the location where I study to avoid too much distraction? (ES) 1 2 3 4 5
7. I find a comfortable place to study? (ES) 1 2 3 4 5
8. I know where I can study most efficiently for online courses? (ES) 1 2 3 4 5
9. I choose a time with few distractions for studying for my online courses? (ES) 1 2 3 4 5
10. I try to take more thorough notes for my online courses because notes are even more important for learning online than in a regular classroom? (TS) 1 2 3 4 5
11. I read aloud instructional materials posted online to fight against distractions? (TS) 1 2 3 4 5

12. I prepare my questions before joining in the chat room and discussion? (TS) 1 2 3 4 5

13. I work extra problems in my online courses in addition to the assigned ones to master the course content? (TS) 1 2 3 4 5

14. I allocate extra studying time for my online courses because I know it is time-demanding? (TM) 1 2 3 4 5

15. I try to schedule the same time everyday or every week to study for my online courses, and I observe the schedule? (TM) 1 2 3 4 5

16. Although we don't have to attend daily classes, I still try to distribute my studying time evenly across days? (TM) 1 2 3 4 5

17. I find someone who is knowledgeable in course content so that I can consult with him or her when I need help? (HS) 1 2 3 4 5

18. I share my problems with my classmates online so we know what we are struggling with and how to solve our problems? (HS) 1 2 3 4 5

19. If needed, I try to meet my classmates face-to-face? (HS) 1 2 3 4 5

20. I am persistent in getting help from the instructor through e-mail? (HS) 1 2 3 4 5

21. I summarize my learning in online courses to examine my understanding of what I have learned? (SE) 1 2 3 4 5

22. I ask myself a lot of questions about the course material when studying for an online course? (SE) 1 2 3 4 5
23. I communicate with my classmates to find out how I am doing in my online classes? (SE) 1 2 3 4 5

24. I communicate with my classmates to find out what I am learning that is different from what they are learning? (SE) 1 2 3 4 5
APPENDIX E

STRUCTURED JOURNAL QUESTIONS

1. What were your goals for the previous week? Explain why these were your goals?

2. Did you accomplish the goals you set for this week? Explain why or why not these goals were or were not met?

3. What are your goals for the upcoming week? Explain why you have these goals?

4. Which homework help tools did you use? Why did you use these specific help tools and not others? How often did you use these tools?

5. Explain how confident you feel applying what you have learned this week to current and future topics? Why do you feel this way?
APPENDIX F

INTERVIEW SCRIPT FOR FOCUS GROUP INTERVIEWS

Interview Script for Focus Group Interviews Before the Recording

Hello and thank you for participating in this focus group interview. First, the purpose of this interview is to evaluate how MyMathLab impacted your self-regulated learning skills and mathematics self-efficacy while taking a College Algebra Course here at Regional College Campus. The interview questions were open-ended, allowing you to explain your perceptions of how MyMathLab impacted your self-regulated learning skills and mathematics self-efficacy. There is no correct or incorrect answer and I will not be upset by your answers. The interview will take about 45 minutes. I am recording the interview and taking notes to make sure the transcription process is accurate. Also, I will not be using your real names, instead, I will use pseudonyms, when transcribing or presenting the findings of this research study. Are there any questions before we begin? Let us begin and I will start recording now.

Interviewer Script for Focus Group Interviews During the Recording

To begin, the definition of mathematics self-efficacy is how you perceive your ability to learn and perform mathematical tasks.

Question 1. Using examples, both positive and negative, explain how did the daily homework of MyMathLab impact your mathematics self-efficacy?
Question 2. Can you explain to me how did the homepage of MyMathLab impact your mathematics self-efficacy?

Question 3. Can you give me an example of how the homework help tools of MyMathLab impacted your mathematics self-efficacy?

Question 4. Describe to me your impressions, both positive and negative, of how MyMathLab impacted your mathematics self-efficacy?

Question 5. Using examples, both positive and negative, tell me how the daily homework affected you in setting your goals to complete the homework and learn the material?

Question 6. Can you provide me an example of how MyMathLab impacted goal setting?

Question 7. Describe to me your impressions, both positive and negative, of how MyMathLab impacted your goal setting?

Question 8. Can you explain to me how the daily homework affected your time management skills?

Question 9. Describe to me your impressions, both positive and negative, of how MyMathLab impacted your time management?

Now let’s define learning strategies as to how you approach to complete an assignment.

Question 10. Using examples, both positive and negative, of how daily homework impacted your learning strategies?

Question 11. Please provide an example of how MyMathLab impacted your learning strategies?

Question 12. Describe to me your impressions, both positive and negative, of how MyMathLab impacted your learning strategies?
Now let’s define task completion as completing an assignment.

Question 13. Using examples, both positive and negative, explain how did the daily homework of MyMathLab impact your task completion?

Question 14. Can you explain to me how did the homepage of MyMathLab impacted your task completion?

Question 15. Can you give me an example of how the homework help tools of MyMathLab impacted your task completion?

Question 16. Describe to me your impressions, both positive and negative, of how MyMathLab impacted your task completion?

Now let’s define self-reflection as to how you evaluate your task completion, goals, learning of the material, and ability to apply learned concepts to other tasks.

Question 17. Using examples, both positive and negative, of how daily homework impacted your self-reflection process?

Question 18. Describe to me your impressions, both positive and negative, of how MyMathLab impacted your self-reflection process?

Is there any other relevant information you want to provide pertaining to the purpose of this interview?

Thank you for your time and willingness to help in this research study. As I mentioned your real names will not be used when presenting the findings of this study.

Turn recorder off.
APPENDIX G

CONSENT LETTER

UNIVERSITY OF SOUTH CAROLINA

ASSENT TO BE A RESEARCH SUBJECT

Helping College Mathematics Students Improve their Self-Regulated Learning Skills and Mathematics Self-Efficacy while using MyMathLab

I am a researcher from the University of South Carolina. I am working on a study about how MyMathLab, an online homework platform, impacts your self-regulated learning skills and mathematics self-efficacy and I would like your help. I am interested in learning more about how MyMathLab impacts your self-regulated learning skills and mathematics self-efficacy. Your parent/guardian has already said it is okay for you to be in the study, but it is up to you if you want to be in the study.

If you want to be in the study, you will be asked to do the following:

• Answer some written questions about how they view their self-regulated learning skills and mathematics self-efficacy, how components of MyMathLab impacted their self-regulated learning skills and mathematics self-efficacy, and basic demographic questions. The pre-survey will be given the second day of class and the post-survey will be given the day after the intervention has been implemented. Both surveys will take 45 minutes to complete.

• Meet with me individually and talk about their perceptions of how MyMathLab impacted their self-regulated learning skills and mathematics self-efficacy. The talk will take about 60 minutes and will take place at the University of South Carolina Lancaster in the classroom where the class lecture is held.

Any information you share with me will be private. No one except me will know what your answers to the questions or listen to the voice recordings of the focus group interviews. You do not have to help with this study. Being in the study is not related to your regular classwork and will not help or hurt your grades. You can also drop out of the study at any time, for any reason, and you will not be in any trouble and no one will be mad at you.
Please ask any question you would like to know about the study.

*For Minors 13-17 years of age:

My participation has been explained to me, and all of my questions have been answered. I am a willing to participate.

__________________________________________    ____________
Print Name of Minor/Non-Minor   Age of Minor

__________________________________________    ____________
Signature of Minor/Non-Minor   Date

__________________________________________
Print Name of Parent or Guardian of Minor

__________________________________________    ____________
Signature of Parent or Guardian of Minor   Date

For IRB Staff Use Only
«University of South Carolina»
IRB Number: «Pr00089081»
Date Approved «May 6, 2019»

178
APPENDIX H

DEMOGRAPHIC QUESTIONS

1. What is your age?

2. What is your gender?

3. What is your ethnicity? Select the appropriate one.
   a. Caucasian
   b. African-American
   c. Hispanic
   d. Native American
   e. Other: Fill in

4. What is your grade level? Select the appropriate one.
   a. College Freshmen, have less than 30 credit hours.
   b. College Sophomore, have more than 30 credit hours, but less than 60
      hours.
   c. College Junior, have more than 60 hours, but less than 90 hours.
   d. College Senior, have more than 90 credit hours.
   e. Dual Credit Student, which means you are taking both high school and
      college courses.

5. What degree are you seeking?

6. How many online courses have you taken?

7. Select all the Pearson products you have used before.
a. MyMathLab
b. MathXL
c. Any of the MyLab Disciplines
d. StatCrunch
e. Revel
f. Pearson MyLab
g. Any of the Mastering disciplines