Using Student Self-Reflections to Improve Student Study Habits

in the Mathematics Classroom

A Capstone Project
Submitted in Partial Fulfillment
of the Requirements for the Degree
of Master of Arts in Teaching: Mathematics

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Summer 2011
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Date of defense: July 6, 2011
Abstract

Students often come to class without being prepared for the exam they are about to take. There are many reasons why a student might not prepare for an exam. This project focused on using a series of self-reflection guides to help high school geometry students to better understand what topics they should review and practice in preparation for an assessment through an increased awareness of their study habits and knowledge of mathematics. This project examined the use of homework reflection guides and pre-assessment reflections that helped students pinpoint their weaknesses in a particular chapter and guide their studies in preparation for an assessment. Following an exam, students then completed a post-assessment reflection to help them understand the types of mistakes they commonly made. Although preparing and completing these reflections took a large investment of time, they helped my students to better identify inadequate knowledge of and understanding in mathematics, prompting them to target problem areas and appropriately focus their study efforts.
Acknowledgements

First of all, I would like to thank my mom and dad for their love and dedication. They raised me to value education and encouraged me to do the best that I can. I strive to do my best and make them proud. I hope to instill these same beliefs and encouragement in my son and the students I work with on a daily basis.

I would also like to thank my husband, Ryan. He supported me through the three-year journey and put up with the countless five hour drives to campus, summers apart while I completed the course work for the program, and numerous late nights typing while completing my paper. Without his support I would not have been able to complete the program when I did.

Finally, I would like to acknowledge the other mathematics teachers I have had the honor to work with. There are many talented and caring individuals that want to improve the field of mathematics education as much as I do. These individuals have given me numerous ideas and support while taking their students to new levels. I hope to continue to work with and learn from other mathematics teachers until the day I retire.
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Chapter One

Introduction

I am in my fourth year of teaching mathematics in a mid-sized urban Midwestern town. During my four years, I have worked with a wide range of student abilities from struggling students to gifted and talented, in both high school and middle school mathematics. Every group of students I taught included students who were not motivated to study and prepare for class. Last year, I introduced a student self-reflection guide that was used after each test. This guide asked each student to look at the questions they got wrong and take a moment to reflect on why they thought they got the question wrong. I used this guide to help my students understand how prepared they were for the test. I received positive feedback from my students. After seeing the positive feedback, I wanted to determine whether adding pre-assessment reflections, along with the student post-assessment reflections, would improve student preparation for a mathematics assessment through increased awareness of their study habits and knowledge of mathematics.

Motivation for the Project

I started doing the post-assessment reflections with my students last year and had a great response from them. I heard many positive comments between students, which were not directed toward me. Other comments from students
came after class. Students told me how much they liked reflecting on what they got wrong on an assessment and became aware of recurring problems.

Some of the best feedback, however, came during parent-teacher conferences when I showed parents their students’ comments and reflections on how they prepared and thought they did on the assessment. The parents were overwhelmingly appreciative of seeing this information. Many parents commented that as their children grew, it was harder for them to get information from their children about concepts with which they struggled and needed help. Their children’s reflections allowed the parents the opportunity to finally understand their children’s perceived strengths and weaknesses.

Hearing the positive feedback gave me the idea to build from the post-assessment reflections from last year and help my students reflect on their study habits all chapter long to better prepare for an assessment. I wanted to encourage my students to reflect on the math with which they struggled, and in turn, I hoped these reflections would help show them how to prepare for a mathematics exam. Hopefully these skills could then be translated into other subject areas.

**Background on the Problem**

I chose to pursue the topic of student self-reflection to help my students grow and reflect on their study habits. While working with students of different mathematical abilities and ages, I realized that many students are not sure how much or what to study when they prepare for a mathematics assessment. In
addition, I realized these students do not understand the impact studying can have on their academic growth.

Most of my students, when they were not able to solve a problem, just moved on to the next one with no regard as to why they were unable to solve the problem. They rarely took the time to think about why they could not solve the problem. I wondered: Did they not understand the vocabulary? Did they not know the formula needed to set up and solve? Did they not understand what they were being asked to solve? I wanted to know if self-reflection enhanced students’ abilities to identify inadequate knowledge of and understanding in mathematics, prompting them to target problem areas and appropriately focus their studies.

I believed understanding and improving students’ study habits could allow them to grow and prepare for a successful post-secondary education. If this skill is not addressed, the students could face a difficult, challenging, and, in some cases, unsuccessful higher education experience. I hoped student reflections helped my students to understand the benefits of studying and preparing for an exam and motivated them to continue self-reflection. They may also adapt it to improve their study habits in other content areas.

**Statement of the Problem**

Many students lacked motivation or understanding of how to take control of their studying, which resulted in lower achievement. I was concerned about these students’ study skills as related to their ability to successfully handle higher
level courses and post-secondary education. I knew that studying for a mathematics assessment is different than preparation in other content areas, and I believed that students do not know how to successfully study mathematics.

**Statement of Purpose**

I wanted to determine whether adding student pre-assessment reflections, along with student post-assessment reflections, would improve student preparation for mathematics assessments through an increased awareness of their study habits. I planned to use self-reflection with my students as a way to increase student awareness of how and what to study when they prepared for a mathematics assessment. I used a series of short student reflection sheets to do this. Prior to mathematics assessments, I had my students fill out homework reflection sheets. These reflections encouraged students to examine why they struggled with particular questions and concepts and what and how they should study for upcoming assessments.

After each mathematics assessment, the students completed another reflection. This post-assessment reflection had the students examine the questions they got wrong and reflect on what they believed their strengths and weaknesses were for the concepts studied.

**Research Questions**

Would student self-reflection increase and improve students’ study skills in preparation for a mathematics course? Scott G. Paris and Linda R. Ayres
(1994) noted while observing a teacher’s class working with reflections that “when children attend consciously to these characteristics, they are more likely to follow them” (p. 77). Would this continuous reflection and awareness of their strengths and weaknesses help my students to be more responsive to what they needed to study? I hoped to help my students take control of their studying and reflect and grow to become effective and efficient students.

Summary

The focus of my research paper was to determine whether implementing pre- and post-assessment student self-reflections would improve students’ preparation for mathematics assessments through an increased awareness of their study habits and knowledge of mathematics. I implemented pre-assessment reflections that focused on the concepts a student had struggled with as a way to increase student awareness of the topics on which they needed extra practice. I then implemented post-assessment reflections to help each student understand their mistakes. In Chapter Two I discussed research findings regarding student reflection and study skills, as well as the needs of teachers and students for effective self-reflections.
Chapter Two

Review of Literature

Every year teachers receive new sets of students, each with varying levels of study habits and skills. As a mathematics teacher I wanted to determine whether student self-reflections, both before and after formal assessments, improved student preparation for mathematics assessments through increased awareness of their study habits and knowledge of mathematics. In this chapter, I described the current research with regard to students’ abilities to manage their study skills. I summarized the needs of both the student and the teacher when developing appropriate study skills. Finally, I presented the benefits of teaching self-regulatory skills to students.

Student Self-Reflections

Transitioning from an elementary school to a secondary school is a common topic of study for educational researchers. Zimmerman and Cleary (2006) noted that students must transition from having one teacher watch over their educational progress and growth, to having a number of different teachers and classmates. They went on to point out that research illustrates students are often left on their own to manage their progress and request help when necessary, all while trying to handle more difficult content. Schunk and Meece (2005) found similar research noting that “self-perceptions of competence begin to decline in Grade 7 or earlier” (p. 77) and are more evident in mathematics.
This ability to self-regulate and assess one’s own study habits and learning can have a huge impact on the student’s psyche. The lack of ability to self-regulate can cause grades to drop, which in turn can cause a huge loss in self-efficacy (Zimmerman & Cleary, 2006). Paris and Ayres (1994) made the important distinction that not all students have the natural ability to regulate and manage their studying. They noted that many students need help developing these skills. Without help, teenagers often end up unsuccessful at “employ[ing] task-specific strategies such as preparing for tests” (Zimmerman & Cleary, 2006, p. 47).

Prompted by this research to conduct a research study, Zimmerman and Cleary (2006) found that middle and high school students’ self-efficacy was affected by how well they managed their studies. This includes the abilities of “setting optimal goals, implementing effective strategies, self-monitoring accurately, self-evaluating using appropriate criteria, and attributing causation to adaptable process” (p. 65). Their research study demonstrated the following positive findings: these skills are teachable, and if taught, “adolescents are significantly empowered to make this vital developmental transition” (p. 65). In their study, Masui and De Corte (2005) found similar research results, noting that study skills and meta-cognitive information, that is, understanding one’s own knowledge, are teachable.
A student’s ability to self-assess also plays an important role in developing these needed study skills. Paris and Ayres (1994) noted, research confirms that self-assessment increases students’ desire to monitor their learning and study habits. Studies suggest that because of their improved study habits, students’ ability in specific content areas will increase, which in turn improves the quality of goals students will set and allows for individual growth to be tracked (Zimmerman & Cleary, 2006).

Although the aforementioned research is widely supported, there are people who disagree with almost every educational practice. Marzano and Kendall (1998) noted that “some parents, and even some educators, question the validity of student self-assessment assuming that students will always provide inflated assessments of their own understanding and skill” (p. 42). Although this might be a valid topic to explore, Marzano and Kendall disagreed with the statement and determined that “those who have made extensive use of student self-assessment do not support these fears” (p. 42). They noted research studies that concluded students “demonstrated a ‘clear-headed capacity’ to evaluate their own work” (p. 43). Others noted that parents felt their student’s self-assessment was a more accurate detail of his or her ability than the teacher would say.

**Role of Students**

Students are the backbone of the school system and thus, teachers, principals, and other school stakeholders must pay close attention to student
needs. This section reviews the research literature concerning students’ needs with regard to self-reflection and responsibility.

Stiggins (1998) stated that in most classrooms, grades are the only motivation for students. He went on to state that many students have no personal motivation for achieving high marks and therefore lose interest in content that they feel has no place in their personal lives. He stressed the importance for students “to take responsibility for their own academic success” (p. 14) which can help to promote motivation that might be lacking. Paris and Ayres (1994) agreed with this idea and emphasized that to succeed, students must “be active participants in assessment of their own learning rather than passive respondents to a series of tests” (p. 7).

To be successful in school, students need to be shown effective self-regulatory study skills (Schunk & Meece, 2005; Zimmerman & Cleary, 2006). Suskie (2004) stated that these study skills help to guide students toward achieving any goals that were set and teaches them the benefit of monitoring the progress of these goals. Black and Wiliam (2010) had similar advice for educators. They determined that learning these skills helps students to “understand the main purposes of their learning and thereby grasp what they need to do to achieve” (p. 85).

Making sure students are informed and aware of the learning targets and standards that they will be responsible for demonstrating knowledge in is another
factor that can affect student success in school. Research done by Stiggins and Chappuis (2005) stressed the importance of students receiving a copy of the learning standards because “student success hinges on the clarity of these expectations” (p. 15). Chappuis also noted the importance of providing students “clear and understandable” lists of the content expectations “in language your students understand” (p. 40).

Schunk and Meece (2005) stated that students need “learning environments that are intellectually challenging and supportive of individual progress and mastery” (p. 89). Self-reflection is one method to promote the awareness of student achievement and progress in different content areas. Suskie (2004) stated that having students complete before-and-after reflections provides students the opportunity to understand and appreciate their own “growth and development” (p. 173) in a wide range of topics.

**Role of Teachers**

Teachers’ daily contact with their students is an important reason for teachers to take a vital role helping to monitor and encourage their students’ self-reflections. This section summarizes the research literature regarding a classroom and the teacher’s role in the student self-reflection process.

Zimmerman and Cleary (2006) stated that, although the primary goals of high schools are to ensure the students are learning the standards-based skills mandated by each state, they believe that a “long-term goal of secondary
education should involve empowering students to become independent, self-regulated learners” (p. 56). They went on to state that these skills, if successfully learned in high school, play a powerful role for those students when they enter a post-secondary school or the workforce.

Focusing specifically in a mathematics classroom, Ramdass and Zimmerman (2008) stated that teachers play a vital role in showing students how these study skills and self-efficacy connect to their abilities in mathematics. In their study of 21 fifth-grade students and 21 sixth-grade students, Ramdass and Zimmerman found that “accurate self-reflection is important to students’ success in math” (p. 19) and that teachers help by providing “frequent opportunities to evaluate what they have learned or where they erred after completing a task” (p. 19).

Schunk and Meece (2005) agreed when they stated classrooms that focus on self-improvement are beneficial to students and help to maintain or improve individual self-efficacy. They stress to teachers that studies have shown that teenagers “need classroom environments that help them set goals for their learning, support their goal progress, and focus on improvement and mastery” (p. 82).

Masui and De Corte (2005) stated that beneficial self-reflection can be broad or specific. In other words, teachers can have their students reflect on a whole unit or focus on their work for just one problem. They stressed the
importance of teachers needing to spend time on the reflections they give their students. This entails time for the teacher to appropriately design the reflections, to explain the purpose of the reflection to the class, and to ensure students understand what is being asked of them. This time invested allows students to give the most honest answers and ensures the student and teacher can get the most out of their self-reflections.

Ramdaas and Zimmerman’s (2008) study suggested the need for teachers to supervise their students’ reflections. One way to easily monitor reflections is to have students set specific goals, which Zimmerman and Cleary (2006) stated made it easy for teachers to check progress and observe growth being made.

Although these tasks can be accomplished with teacher and student investment, Schunk and Meece (2005) cautioned that a “challenge for educators is to facilitate optimism in students while ensuring that they have the skills to be successful” (p. 76).

**Benefits of Student Self-Reflection**

Self-reflection has been studied extensively over the years, and many benefits are being linked to this relatively simple exercise. This section reviews the current research with regard to the benefits to student self-reflection and monitoring.

Several studies have found that one of the best benefits from self-reflection relates to the way it encourages meta-cognition, that is, the skill of
learning how to learn (Masui & De Corte, 2005; Paris & Ayres, 1994; Suskie, 2004). Masui and De Corte found that students gain powerful insight from “finding out which strategies, learning aids, allocation of time, and effort made a contribution to the learning outcomes” (p. 352).

Zimmerman and Cleary (2006) found similar results stating that self-reflection is important because “it helps learners discriminate between effective and ineffective performances and helps to isolate the source of error or confusion when one is performing poorly” (p. 60). They also stated that students “can increase their confidence levels to perform specific tasks in school” (p. 63) by being trained in self-regulating skills. Achieving similar results, Schunk and Meece (2005) elegantly stated that those students “who feel self-efficacious about learning or performing a task competently are apt to participate more readily, work harder, persist longer when they encounter difficulties, and achieve at higher levels” (p. 73).

Paris and Ayres (1994) cautioned that self-regulation must be a continuing process. They worked with a classroom teacher who believed that “when children attend consciously to these characteristics, they are more likely to follow them” (p. 77). Stiggins (1998) agreed that students must be actively involved and become “partners in monitoring their own level of achievement” (p. 13). The National Council of Teachers of Mathematics (NCTM, 2005) had similar advice to teachers in its updated, well-known Principles and Standards for School
Mathematics. The NCTM stated that “students learn more and learn better when they can take control of their learning by defining their goals and monitoring their progress” (p. 21).

**Summary**

The research indicated that self-regulating skills are important, yet not always naturally occurring, skills that help students transition to monitoring and being responsible for their learning. These skills, if taught, monitored, and nurtured regularly, increased student persistence and helped them achieve individual goals. They also aided in students’ abilities to monitor their learning as they transition from an elementary setting to adolescent and adult activities.

Although these skills were shown to be beneficial, students and teachers need to take an active role in the growth of students’ abilities. Self-reflection and student monitoring skills quickly diminish if not successfully monitored and encouraged by both the students and their teachers.
Chapter Three

Research Design and Method

This study determined whether pre- and post-assessment student self-reflections improved student preparation for mathematics assessments through an increased awareness of their study habits and knowledge of mathematics. During this study, high school sophomore and junior geometry students were asked to complete a series of self-reflection guides that helped them determine the concepts with which they struggled and on which they then focused their practice while preparing for an upcoming mathematics assessment. After completing the mathematics assessment, students were asked to reflect on whether the pre-mathematics assessment reflections helped them more effectively focus their mathematical studies.

Setting

This study took place in a section of high school geometry that included 22 students, 14 females and eight males. The students varied in grade level from sophomores to juniors, with the vast majority being sophomores. The school was located in a mid-sized urban Midwestern town with 1,545 students enrolled in grades 10 through 12.

Factors that affected the study included student attendance and meaningful participation. Student attendance for the study was important to ensure students received the reflection handouts in a timely manner and were able to use them to
prepare for upcoming assessments. Their participation was also vital to be sure the students were honest with themselves and the areas they thought should be the focus of their attention while preparing for an assessment.

**Intervention/Innovation**

I think math students are used to receiving a concept review before a mathematics assessment that includes problems similar to those that have been covered in class and similar to those on the upcoming assessment. Since these review sheets covered a whole chapter worth of material, I thought these reviews were overwhelming to students, and as a result, students were unaware of where to focus their attention while preparing for the assessment. The series of self-reflections that I gave would help students to learn where to focus their attention.

Throughout the three chapters, my students were required to complete simple homework reflection sheets for each section, which included five or six per chapter. These sheets included one question that asked students to identify the question they struggled the most with and reflect on what made the question so difficult (e.g., they did not understand what they were being asked to find; they did not know the formula required to solve the problem). This homework reflection sheet also asked students to identify the questions they were most confident with and reflect on what made the questions easy. The students kept this sheet to remind them of the types of problems with which they struggled and the types they were more confident with while completing the homework.
When the class began preparing for a unit assessment, students were given a second reflection sheet that allowed them to go through a list of standards that they were required to complete on the mathematics assessment. Research done by Stiggens and Chappuis (2005) stressed the importance of students receiving a copy of the learning standards because “student success hinges on the clarity of these expectations” (p. 15). Chappuis (2005) also noted the importance of providing students “clear and understandable” lists of the content expectations “in language your students understand” (p. 40). For this reason, the standards were written in student friendly “I can” statements. The reflection sheet included a checklist of topics that were covered on the test. Students indicated their level of comfort with each topic, whether they needed to review the topic, or whether they needed a lot of help to become proficient with the concept. The students were given time to complete the sheet in class and then used the guide to help focus their attention while they prepared for the upcoming mathematics assessment.

The final reflection sheet came after an assessment while students reviewed their work. The students were asked to reflect on each question and why they thought they got the question wrong. After reflecting on the reason they got each question wrong, they compared the questions they got wrong to their pre-assessment reflections sheets. At the end of the study, the students then reflected on whether they used the pre-assessment reflections to focus their studying on particular concepts and if they thought this helped them prepare for the exam.
After completing a chapter, the students turned in all homework and pre-assessment and post-assessment reflections. These reflections were used to help me determine if there was a connection between the pre- and post-assessment reflections.

**Design**

This action research project on student self-reflections used a qualitative approach. The results are not generalizable to other classes and only used to inform my teaching and my students’ learning. I also kept a journal to document the changes in student questions in preparation for upcoming mathematics assessments. A student pre- and post-survey was given to determine the students’ opinions of their ability to prepare for a mathematics assessment. I used the results to learn more about how students prepared for a mathematics assessment and the benefits of reflecting on their prior work while preparing for a mathematics assessment.

**Description of Methods**

Before beginning the project in my classroom, the Minot State University Institution Review Board provided written approval of the study (see Appendix A). All participants were informed of the study and a letter preapproved by the Minot State University Institution Review Board was sent home to the participants’ parents/guardians that asked permission for their students to take part in the study (see Appendix B). The student participants also signed a student
assent letter, similar to the letter parents/guardians signed (see Appendix C). Written consent was also requested from school officials to allow the study to take place in my classroom (see Appendix D). All participants remained confidential and information about their views and achievement were presented only in aggregate form so no individual could be identified.

Once all consent letters were collected, students took a pre-study survey (see Appendix E) to get an understanding of their study habits and practice regarding how to prepare for a mathematics assessment. This survey asked students to rate each statement on a strongly agree to strongly disagree continuum, similar to a four-point Likert scale. The questions used came from or were adapted from “Math Study Skills Inventory” survey by Dr. Carolyn Hopper (2001). Along with those questions the students responded to two open-response questions that asked them about their study habits. The students then began their first unit of study for the quarter.

Throughout the chapter, as students completed their homework, they were required to fill out a short reflection (see Appendix F). This reflection had students reflect on their hardest homework problem and why they thought it was hard (e.g., they did not know the formula required; they did not understand the instructions; they did not know the vocabulary) and note the problems they felt the most comfortable with.
These reflections continued throughout the chapter. Three days before the assessment, students were given a pre-assessment reflection guide (see Appendix G). In student-friendly “I can” statements, this guide described the concepts students must know on the upcoming assessment. This reflection was set up to allow students to focus on concepts on which they thought they needed the most practice. I encouraged students to use this self-reflection, along with their homework reflections that described topics or concepts on which they struggled throughout the chapter, to guide their studying for the next few days.

The day after the mathematics assessment was given (see Appendix H), students were required to reflect on their test results, specifically on the questions they got wrong. A post-assessment reflection guide (see Appendix I) was given to each student. This reflection was aligned with the assessment of the topic or concept each question addressed. While students looked over the test, they used the reflection sheet as a guide to reflect on why they thought they missed the question. The post-assessment reflection also had some open-ended questions that required the students to reflect on their strengths and weaknesses in the chapter, to set a goal for the completion of the quarter, and to note their opinions regarding the pre-assessment reflection and the role it played in preparation for the assessment.

After going through each question, students then had the chance to reflect on their achievements and effort throughout the unit. The goal of this part of the
reflection was for the students to truthfully assess how well they thought they prepared for the assessment.

This process was then completed for two additional chapters that were covered during the third quarter. The homework reflection journals were not changed from one chapter to the next, but the pre- and post-assessment reflections were updated for the new topics/concepts that were addressed in the new chapters.

In addition to the steps above, I kept a journal throughout the study. This journal helped me monitor any changes in attitudes or habits that I noticed with students. I also kept students’ comments that were made regarding the reflections.

At the completion of the study, I interpreted the surveys, reflections, and journal entries to help determine any conclusions that could be made.

**Expected Results**

My expectation was that my students would gain a better understanding of how to prepare for a mathematics assessment through the use of self-reflections. I expected the students would be better prepared for an assessment with the self-reflections acting as a guide to help determine the concepts and skills on which they should focus.

**Timeline for the Study**

This research study took place in an eight-week period of time during the third quarter of the academic school year, from the middle of January through the middle of March. There were three units of study covered during this time in
which students were required to complete a formal mathematics assessment after each unit.

**Summary**

The action research study discussed in this chapter was completed with my high school geometry students. This study involved students using a series of self-reflections to help them prepare for upcoming mathematics assessments. I used student reflections, student survey results, and my personal journal to analyze the use of student self-reflections as a guide to help students prepare for assessments. The results of my study are discussed in the next chapter.
Chapter Four

Data Analysis and Interpretation of Results

This study examined whether pre- and post-mathematics assessment student self-reflections improved student preparation for mathematics assessments through an increased awareness of their study habits and knowledge of mathematics. During this study, my high school geometry students were asked to complete a series of self-reflection guides to help them determine the concepts with which they struggled and on which they should then have focused their practice while preparing for an upcoming mathematics assessment. After completing the mathematics assessment, students were asked to reflect on whether the pre-mathematics assessment reflections helped them more effectively focus their mathematical studies. This chapter includes the results from the three unit assessments, the pre- and post-surveys, and my journal entries.

Data Analysis

Throughout the research study, I collected data using a variety of methods. The first instruments, pre- and post-surveys, were used to collect data regarding the students’ study habits and attitude toward preparing for a mathematics assessment. The next instrument used to collect data was the homework reflection sheets that the students completed for each section within the three chapters. Although these sheets did not give me numerical data, I analyzed them for trends to help me determine whether they helped the students focus their attention
effectively toward the concepts they struggled with throughout a chapter. The next instruments used to collect data for my project were the pre- and post-assessment reflection guides. The pre-assessment reflection guides were used to help the students know where to focus their attention while preparing for the upcoming assessment. The post-assessment reflection guides were used to help the students determine the types of errors they were making on the assessment, and if the problems they got wrong on the tests were the same as the topics they thought they struggled with as marked on the pre-assessment reflection guides. The final instrument used to collect data was my journal that I kept throughout the study. My comments and reflections were used to help keep an accurate account of the events that happened during the study.

The pre- and post-surveys, which can be seen in their entirety in Appendix E, had seven statements which had students indicate their level of agreement (strongly agreed, agreed, disagreed, or strongly disagreed). Two additional open-response questions asked the students to write about their opinions.

The results from the survey’s first seven statements are found in Table 1. This table lists the percent of students who marked each option. The results are rounded to the nearest tenth of a percent.

The student responses for the first statement remained consistent from pre-survey to post-survey. The post-survey results revealed more students strongly agreed with statement two about being able to identify what they know.
Table 1

<table>
<thead>
<tr>
<th>Statement</th>
<th>Survey</th>
<th>SA</th>
<th>A</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When I don’t understand something, I get help from a classmate, parent, math resource center or teacher.</td>
<td>Pre-Survey</td>
<td>18.2%</td>
<td>77.3%</td>
<td>4.6%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>18.2%</td>
<td>77.3%</td>
<td>4.6%</td>
<td>-</td>
</tr>
<tr>
<td>2. I can easily identify what I have learned and what I have not yet learned before I take a test.</td>
<td>Pre-Survey</td>
<td>18.2%</td>
<td>81.8%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>27.3%</td>
<td>59.1%</td>
<td>13.6%</td>
<td>-</td>
</tr>
<tr>
<td>3. I start studying for quizzes and tests at least several days before I take them.</td>
<td>Pre-Survey</td>
<td>-</td>
<td>18.2%</td>
<td>54.6%</td>
<td>27.3%</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>4.6%</td>
<td>18.2%</td>
<td>63.6%</td>
<td>13.6%</td>
</tr>
<tr>
<td>4. I try to determine exactly when I got confused and exactly what confused me.</td>
<td>Pre-Survey</td>
<td>13.6%</td>
<td>72.7%</td>
<td>13.6%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>13.6%</td>
<td>63.6%</td>
<td>22.7%</td>
<td>-</td>
</tr>
<tr>
<td>5. I work problems until I understand them, not just until I get the answers listed in the back of the book.</td>
<td>Pre-Survey</td>
<td>27.3%</td>
<td>50.0%</td>
<td>22.7%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>40.9%</td>
<td>40.9%</td>
<td>18.2%</td>
<td>-</td>
</tr>
<tr>
<td>6. When I get my tests back, I note the types of mistakes I made.</td>
<td>Pre-Survey</td>
<td>22.7%</td>
<td>22.7%</td>
<td>45.5%</td>
<td>9.1%</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>31.8%</td>
<td>40.9%</td>
<td>22.7%</td>
<td>4.6%</td>
</tr>
<tr>
<td>7. When I prepare for a math test, I look over the problems I originally struggled with while completing the homework.</td>
<td>Pre-Survey</td>
<td>18.2%</td>
<td>50.0%</td>
<td>13.6%</td>
<td>18.2%</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>22.7%</td>
<td>50.0%</td>
<td>22.7%</td>
<td>4.6%</td>
</tr>
</tbody>
</table>
However, for the same question more students also marked disagree on the post-
survey than on the pre-survey. Regarding the statement “I start studying for
quizzes and tests at least several days before I take them,” the post-survey
revealed that fewer students indicated strongly disagree with the statement, while
the strongly agree and disagree categories increased.

Statements five, six, and seven all increased in the percentage of students
who marked strongly agree or agree from pre-survey to post-survey. Statements
describe the students thoroughly working and reworking
problems they struggled with, while statement six was regarding the students
examining their tests for the types of errors made.

Table 2 displays the values for the measures of central tendency, which
include the mean, median, and mode, for the seven survey statements. In order to
determine statistical descriptors of the data, numeric values were assigned to the
response categories. A value of four was given for a response of “strongly agree,”
a value of three was given for a response of “agree,” a value of two was given for
a response of “disagree,” and a value of one was given for a response of “strongly
disagree.” Results for the mean are rounded to the nearest hundredth.

For the first statement, the mean value was the same on the pre- and post-
survey. The mean value had a slight decrease of 0.04 and 0.09 for statements two
and four, respectively. The mean for statements three, five, six, and seven all
increased from pre-survey to post-survey. The increases were much larger
**Table 2**

*Pre-Survey and Post-Survey Measures of Central Tendency for Statements 1-7*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Survey</th>
<th>N</th>
<th>M</th>
<th>Mdn</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When I don’t understand something, I get help from a classmate, parent, math resource center or teacher.</td>
<td>Pre-Survey</td>
<td>22</td>
<td>3.14</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>22</td>
<td>3.14</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2. I can easily identify what I have learned and what I have not yet learned before I take a test.</td>
<td>Pre-Survey</td>
<td>22</td>
<td>3.18</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>22</td>
<td>3.14</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3. I start studying for quizzes and tests at least several days before I take them.</td>
<td>Pre-Survey</td>
<td>22</td>
<td>1.91</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>22</td>
<td>2.14</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4. I try to determine exactly when I got confused and exactly what confused me.</td>
<td>Pre-Survey</td>
<td>22</td>
<td>3.00</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>22</td>
<td>2.91</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5. I work problems until I understand them, not just until I get the answers listed in the back of the book.</td>
<td>Pre-Survey</td>
<td>22</td>
<td>3.05</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>22</td>
<td>3.23</td>
<td>3</td>
<td>3 &amp; 4</td>
</tr>
<tr>
<td>6. When I get my tests back, I note the types of mistakes I made.</td>
<td>Pre-Survey</td>
<td>22</td>
<td>2.59</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>22</td>
<td>3.00</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7. When I prepare for a math test, I look over the problems I originally struggled with while completing the homework.</td>
<td>Pre-Survey</td>
<td>22</td>
<td>2.68</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>22</td>
<td>2.91</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
than the decreases found in statements two and four. The increases ranged from 0.18 to 0.41.

The median values for the pre- and post-survey were the same for each statement except six where the median value on the post-survey was three compared to the median of two on the pre-survey. The pre- and post-survey modes were the same on each statement except for statements five and six. Statement five went from having a single mode of 3, based on the pre-survey results, to being bimodal, with modes of 3 and 4, based on the post-survey results. The mode for statement six changed from two to three. However, with a sample size of 22 students, the data is most significant for my personal reflection as a teacher.

The median and mode values for most of the statements for this part of the survey did not change from pre-survey to post-survey. However, there was a trend of more students who strongly agreed and fewer students who strongly disagreed with many of the statements. These data are displayed in Table 3. A positive number represents the increase in the number of students who marked that response from pre to post-survey, while a negative number represents the decrease in the number of students who marked that response from pre- to post-survey.

As already noted, the values for statement one did not change from pre-survey to post-survey. For each statement, the number of students who strongly agreed with the statement either remained the same or increased; while the
Table 3

**Number of Changes from Pre-Survey to Post-Survey for Statements 1-7**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Survey</th>
<th>SA</th>
<th>A</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When I don’t understand something, I get help from a classmate, parent, math resource center or teacher.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2. I can easily identify what I have learned and what I have not yet learned before I take a test.</td>
<td>2</td>
<td>-5</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>3. I start studying for quizzes and tests at least several days before I take them.</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>-3</td>
<td></td>
</tr>
<tr>
<td>4. I try to determine exactly when I got confused and exactly what confused me.</td>
<td>0</td>
<td>-2</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5. I work problems until I understand them, not just until I get the answers listed in the back of the book.</td>
<td>3</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>6. When I get my tests back, I note the types of mistakes I made.</td>
<td>2</td>
<td>4</td>
<td>-5</td>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>7. When I prepare for a math test, I look over the problems I originally struggled with while completing the homework.</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>-3</td>
<td></td>
</tr>
</tbody>
</table>
number of students who strongly disagreed with the statement either remained the same or decreased.

The two open-response questions on the survey provided me with insight as to my students’ thoughts toward preparing for assessments in the mathematics classroom and for other disciplines. The results from these questions are displayed in Table 4. This table lists the percentage of students who marked each option. The results are rounded to the nearest tenth of a percent.

<table>
<thead>
<tr>
<th>Question</th>
<th>Survey</th>
<th>Yes</th>
<th>Kind Of</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Do you think you know how to prepare for a mathematics assessment? Why?</td>
<td>Pre-Survey</td>
<td>50.0%</td>
<td>27.3%</td>
<td>22.7%</td>
</tr>
<tr>
<td>9. Do you think you are better at preparing for an assessment in a content area other than math? Why?</td>
<td>Pre-Survey</td>
<td>63.6%</td>
<td>4.5%</td>
<td>31.8%</td>
</tr>
<tr>
<td></td>
<td>Post-Survey</td>
<td>54.5%</td>
<td>9.1%</td>
<td>36.4%</td>
</tr>
</tbody>
</table>

I looked beyond a simple yes or no answer to question eight to understand why students thought they did or did not know how to prepare for a mathematics assessment. After reading through the students’ responses I determined four main categories for how students prepared for a mathematics test: 1) work problems they struggled with during homework; 2) by keeping up with homework and paying attention on a daily basis in class; 3) they don’t know how to study; and 4) they don’t study or prepare for a mathematics test. The percentage of students
who responded for each reason is displayed in Table 5. The results are rounded to 
the nearest tenth of a percent.

Table 5

Pre-Survey and Post-Survey Responses for Question 8

<table>
<thead>
<tr>
<th>Response</th>
<th>Pre-Survey</th>
<th>Post-Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student works problems they struggled with during homework</td>
<td>36.4%</td>
<td>59.1%</td>
</tr>
<tr>
<td>The student keeps up with the homework and pays attention on a daily basis in class</td>
<td>31.8%</td>
<td>22.7%</td>
</tr>
<tr>
<td>The student does not think they know how to study</td>
<td>27.3%</td>
<td>18.2%</td>
</tr>
<tr>
<td>The student does not study or prepare for a mathematics test</td>
<td>4.5%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

The last question on the survey asked, “Do you think you are better at 
preparing for an assessment in a content area other than math? Why?” Prior to 
completing the project, 14 students responded yes, they thought they were better 
at studying in content areas other than math; seven students responded no, they 
thought they were better at studying for a math test; while one student responded 
he/she did not study for tests. After completing the research project, there was a 
slight change in these results. At the completion of the study, 12 students stated 
they thought they were better at preparing for a test in other content areas; eight 
stated they thought they were better at preparing for a test in math; while two 
students stated they thought they were about the same in any content area.
After students completed the pre-survey, the class started the first chapter for the study, and students began filling in the student homework reflection guides. The student homework reflection guides can be seen in Appendix F. I analyzed student responses on these reflection guides to see how helpful they were when students prepared for tests.

The first question of the survey asked the students to identify the problem they struggled with the most and what the problem asked them to do. With this information, I hoped they could easily look at their reflection guides and remind themselves of the types of problems they struggled to understand. When looking over these guides for each chapter, some students did not provide very descriptive answers to these questions. Some very vague responses to the question “What did the question ask me to do?” included:

“Rotate the figure.”

“State the segment.”

“Decide if the statement is true or false.”

These responses would not be very helpful to a student looking over the reflection guide in preparation for a test. Other students were more descriptive with their responses to the same question. Some examples included:

“Rotate the figure 270° clockwise.”

“Draw an octagon with only 2 lines of symmetry.”

“Find the distance between the two points.”
“Describe the composition of transformations.”

These responses, in contrast to the first set, were much more descriptive. If students were to look at this sheet while preparing for an upcoming test, they would have a better idea as to the type of problem they struggled with and specifically what the question asked.

I determined similar results for the second part of the question on the homework reflection guides. This question asked the students to respond to what made the problem easy or hard. Again, some students replied with very vague answers and others gave very descriptive answers that would be great reviews or study guides in preparation for the upcoming test. Examples of vague responses included:

“I couldn’t do the math.”

“They took longer.”

“They are the problems that don’t have a lot of work.”

If a student were to use their homework reflection guide as a study tool, these responses would not provide the student with any idea as to what to study. In contrast, other students took the extra minute to make sure their responses were complete and descriptive. Some examples included:

“I am not good at using the distance formula. Simplifying is difficult.”

“If it’s not on a grid, it’s hard for me to reflect an image.”

“I struggle with setting up the proportions.”
These responses were very specific. A student or teacher could look back at what the student wrote and know exactly what the student struggled with and would be able to quickly determine the topics on which the student should focus.

After completing chapter seven, I took a few minutes to show the class examples of what I considered good and bad responses for the reflections. Although five students’ reflections remained vague or minimally completed throughout the research project, I did notice nine students that improved their descriptive responses. Throughout the study, the eight students that started out chapter seven with descriptive responses remained descriptive through the remaining chapters.

The next instruments used during the research project were the pre- and post-assessment reflection guides. The pre-assessment reflection guides can be seen in Appendix G, and the post-assessment reflection guides can be seen in Appendix I. After going over a test, I collected the pre- and post-assessment reflections for each student. I then looked at all students’ reflection guides, along with their tests, to analyze their results. For each question I noted whether the student gave a correct or an incorrect answer. I then compared the student’s response (got it, needs work, or help) three days prior to the test on the pre-assessment reflection. Finally, for any questions that the student completed incorrectly, I also noted the type of error the student made on that problem.
These data supplied me with a wide range of information. I first compared what the student marked on the pre-assessment reflection to whether the student got the question correct or not. This information can be found in Tables 6 and 7.

Table 6 displays the average percentage for the questions that the students got correct matched to the reason marked on the pre-assessment reflection. There were three possible responses on the pre-assessment for each question a student got correct on the test, “Got It,” “Needs Work,” or “Help.” The data in Table 6 are broken down to those three categories and then separated by chapter. The mean and standard deviation are rounded to the nearest tenth of a percent.

Table 6

<table>
<thead>
<tr>
<th>Category</th>
<th>Test</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct on the Test- Marked “Got It” on Pre-Assessment</td>
<td>Chapter 7</td>
<td>22</td>
<td>65.5%</td>
<td>16.2%</td>
</tr>
<tr>
<td></td>
<td>Chapter 8</td>
<td>22</td>
<td>58.9%</td>
<td>15.5%</td>
</tr>
<tr>
<td></td>
<td>Chapter 9</td>
<td>22</td>
<td>56.8%</td>
<td>27.4%</td>
</tr>
<tr>
<td>Correct on the Test- Marked “Needs Work” on Pre-Assessment</td>
<td>Chapter 7</td>
<td>22</td>
<td>9.9%</td>
<td>8.1%</td>
</tr>
<tr>
<td></td>
<td>Chapter 8</td>
<td>22</td>
<td>13.3%</td>
<td>10.8%</td>
</tr>
<tr>
<td></td>
<td>Chapter 9</td>
<td>22</td>
<td>12.0%</td>
<td>16.1%</td>
</tr>
<tr>
<td>Correct on the Test- Marked “Help” on Pre-Assessment</td>
<td>Chapter 7</td>
<td>22</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td></td>
<td>Chapter 8</td>
<td>22</td>
<td>1.3%</td>
<td>3.5%</td>
</tr>
<tr>
<td></td>
<td>Chapter 9</td>
<td>22</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

The average for students getting questions correct on the test and marking “Got It” on the pre-assessment decreased 6.6% from chapter seven to chapter eight and decreased another 2.1% from chapter eight to chapter nine. The average for students getting questions correct on the test and marking “Needs Work” on
the pre-assessment increased 3.4% from chapter seven to chapter eight, however, from chapter eight to chapter nine there was a slight decrease of 1.3%. For chapters seven and nine, no students marked “Help” on the pre-assessment and got the question correct on the test. For chapter eight the same category had an average of 1.3%.

Table 7 displays the average percentage for the questions that the students got incorrect matched to the reason marked on the pre-assessment reflection. Again, there were three possible responses on the pre-assessment for each question a student got incorrect on the test, “Got It,” “Needs Work,” or “Help.” The data in Table 7 are broken down to those three categories and then separated by chapter. There is an additional category that displays the average total incorrect for each chapter. The mean and standard deviation are rounded to the nearest tenth of a percent.

The average for students getting questions incorrect on the test and marking “Got It” on the pre-assessment remained steady from chapters seven to eight and increased 1% from chapters eight to nine. The average for students getting questions incorrect on the test and marking “Needs Work” on the pre-assessment increased 1.8% from chapter seven to chapter eight and increased an additional 3.9% from chapter eight to chapter nine. The average for the total incorrect on each test increased 1.9% from chapter seven to chapter eight and increased an additional 4.7% from chapter eight to chapter nine.
Table 7

Percentage Incorrect by Chapter Test and Student Pre-Assessment Rating

<table>
<thead>
<tr>
<th>Category</th>
<th>Test</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect on the Test- Marked “Got It” on Pre-Assessment</td>
<td>Chapter 7</td>
<td>22</td>
<td>20.5%</td>
<td>13.3%</td>
</tr>
<tr>
<td></td>
<td>Chapter 8</td>
<td>22</td>
<td>20.6%</td>
<td>12.8%</td>
</tr>
<tr>
<td></td>
<td>Chapter 9</td>
<td>22</td>
<td>21.6%</td>
<td>17.3%</td>
</tr>
<tr>
<td>Incorrect on the Test- Marked “Needs Work” on Pre-Assessment</td>
<td>Chapter 7</td>
<td>22</td>
<td>3.9%</td>
<td>5.6%</td>
</tr>
<tr>
<td></td>
<td>Chapter 8</td>
<td>22</td>
<td>5.7%</td>
<td>5.7%</td>
</tr>
<tr>
<td></td>
<td>Chapter 9</td>
<td>22</td>
<td>9.6%</td>
<td>16.8%</td>
</tr>
<tr>
<td>Incorrect on the Test- Marked “Help” on Pre-Assessment</td>
<td>Chapter 7</td>
<td>22</td>
<td>0.3%</td>
<td>1.2%</td>
</tr>
<tr>
<td></td>
<td>Chapter 8</td>
<td>22</td>
<td>0.2%</td>
<td>0.9%</td>
</tr>
<tr>
<td></td>
<td>Chapter 9</td>
<td>22</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Total Incorrect</td>
<td>Chapter 7</td>
<td>22</td>
<td>24.6%</td>
<td>13.5%</td>
</tr>
<tr>
<td></td>
<td>Chapter 8</td>
<td>22</td>
<td>26.5%</td>
<td>14.0%</td>
</tr>
<tr>
<td></td>
<td>Chapter 9</td>
<td>22</td>
<td>31.2%</td>
<td>19.4%</td>
</tr>
</tbody>
</table>

The final categories analyzed were the types of errors the students made.

The post-assessments had the students categorize the reason they thought they got a question wrong. The categories included “Error in setup,” “Error in simplifying,” “Algebra or arithmetic error,” “Vocabulary mistake,” or “I didn’t study that concept.” While analyzing the data, I also added a category to count any questions in which the student did not mark a reason. The data are summarized in Table 8 by the type of error made. The average percentage for each type of error is also broken down by chapter. Each percentage is rounded to the nearest tenth.

Errors that included the problem being setup incorrectly accounted for roughly 50% of all errors made for every chapter. Errors in simplifying a final
answer accounted for just 1% of the errors in chapter seven but 17.6% of the errors in chapter nine. On the other hand though, vocabulary mistakes accounted for 24.6% of the errors in chapter seven, but only 1.6% of the errors in chapter nine. Errors that were made because a student did not review or study a particular concept accounted for 17.8% of the errors in chapter seven, 6.6% of the errors in chapter eight, and 14.7% of the errors in chapter nine.

Table 8

*Student Reasons for Incorrect Answers by Chapter Test*

<table>
<thead>
<tr>
<th>Error Type</th>
<th>Test</th>
<th>N</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error in setup</td>
<td>Chapter 7</td>
<td>22</td>
<td>48.8%</td>
<td>30.2%</td>
</tr>
<tr>
<td></td>
<td>Chapter 8</td>
<td>22</td>
<td>48.8%</td>
<td>27.0%</td>
</tr>
<tr>
<td></td>
<td>Chapter 9</td>
<td>22</td>
<td>50.2%</td>
<td>33.7%</td>
</tr>
<tr>
<td>Error in simplifying</td>
<td>Chapter 7</td>
<td>22</td>
<td>1.0%</td>
<td>3.7%</td>
</tr>
<tr>
<td></td>
<td>Chapter 8</td>
<td>22</td>
<td>13.6%</td>
<td>23.8%</td>
</tr>
<tr>
<td></td>
<td>Chapter 9</td>
<td>22</td>
<td>17.6%</td>
<td>26.1%</td>
</tr>
<tr>
<td>Algebra or arithmetic mistake</td>
<td>Chapter 7</td>
<td>22</td>
<td>3.7%</td>
<td>6.1%</td>
</tr>
<tr>
<td></td>
<td>Chapter 8</td>
<td>22</td>
<td>19.0%</td>
<td>24.9%</td>
</tr>
<tr>
<td></td>
<td>Chapter 9</td>
<td>22</td>
<td>10.4%</td>
<td>16.6%</td>
</tr>
<tr>
<td>Vocabulary mistake</td>
<td>Chapter 7</td>
<td>22</td>
<td>17.8%</td>
<td>22.8%</td>
</tr>
<tr>
<td></td>
<td>Chapter 8</td>
<td>22</td>
<td>6.6%</td>
<td>11.5%</td>
</tr>
<tr>
<td></td>
<td>Chapter 9</td>
<td>22</td>
<td>14.7%</td>
<td>28.2%</td>
</tr>
<tr>
<td>I didn’t study that concept</td>
<td>Chapter 7</td>
<td>22</td>
<td>4.1%</td>
<td>10.1%</td>
</tr>
<tr>
<td></td>
<td>Chapter 8</td>
<td>22</td>
<td>1.1%</td>
<td>5.3%</td>
</tr>
<tr>
<td></td>
<td>Chapter 9</td>
<td>22</td>
<td>0.9%</td>
<td>4.3%</td>
</tr>
</tbody>
</table>
While analyzing the data, I noticed the standard deviation seemed large for some of the categories. While looking into why this was, I realized that there were many students who continually made the same type of mistake and rarely or never made a different type of mistake. For example, some students struggled with vocabulary but were very strong with their algebra and simplifying errors or vice-versa. I also noticed the data were very spread out for other categories. For example, some students marked on the pre-assessment reflection that they thought they “Got It” for every topic, but did poorly on the test. This is an interesting situation and is discussed in the interpretation section.

Because of these differences, I wanted to determine if there were any trends for individual groups of students. To do this, I separated the students into three categories including the top students in one, the lowest students in another, and the middle students in the third. To separate the students, I first found each student’s average percentage of incorrect problems over the three tests. I arranged this information from smallest, which represents the students who had the highest average test score, to the largest, which represents the students who had the lowest average test score. I then found the first, second, and third quartiles of the average test scores and used these three values to determine the groups. Students whose scores were in the top 25% of the data were placed in the top group. Students whose scores were in the middle 50% of the data (from first quartile to third quartile) were placed in the middle group. Students whose scores were in the
lower 25% of the data were placed in the lower group. With these new groups, I calculated the same information that was displayed in Tables 6, 7 and 8.

With these new categories, I first looked at the average percentage for the questions that the students got correct matched to the reason marked on the pre-assessment reflection. Figure 1 displays the data for the percentage right and marked “Got It,” the percentage right and marked “Needs Work,” and the percentage right and marked “Help” for the low, middle, and top groups of students. Figure 2 displays the same three categories except for the percentage incorrect. The percentages are rounded to the nearest hundredth of a percent.

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**Figure 1.** Chart of Mean Percentages Correct by Level.
In Figure 1, the lower students, on average, only had 45.01% of their questions correct and marked “Got It” on the pre-assessment reflection, in contrast to the top students, who on average had 81.38% in the same category. On the other hand, in Figure 2, looking at the questions incorrect that the student had marked “Got It” on the pre-assessment reflection, 34.14% of the lower end students fit this category, while only 10.89% of the top students did.

**Figure 2. Chart of Mean Percentages Wrong by Level.**

I also analyzed the types of errors each of these groups made. Figure 3 displays the average percentage of each type of error by the lower, middle, and top groups of students. The average percentages are rounded to the nearest hundredth.
There was a wide range between the lower and the top students for errors made in the setup as well as errors made because they did not study a particular concept. The lower group of students had 36.81% of their errors made while setting up the problem. The top students were well above that at 59.23% of their errors made in the setup. There were almost no students in the top group that indicated they got a problem wrong because they did not study a topic, while 26.74% of the errors made by lower end students were caused by a lack of studying. The middle group of students was at 12.44% of errors made from not studying.

![Chart of Mean Percentages of Reasons for Errors by Level](image)

*Figure 3. Chart of Mean Percentages of Reasons for Errors by Level.*
On the other hand, the lower and top groups of students were very similar with the percent of errors made in the simplifying process, at 9.94% and 9.05%, respectively. The middle group’s percentage was slightly higher than the others at 11.75%. The percentages were also close together for the errors made on the algebra or arithmetic and the vocabulary. The three groups of students were all between 9.05% and 15.56% for these two categories.

Finally, I wanted to take a closer look into the category of an error caused by not studying, since this topic relates the closest to my research question. Still keeping the lower, middle, and top students separate, I analyzed each individual test as well. These data can be seen in Figure 4. The data represent the average percentage of students who indicated they got a question wrong on the tests because they did not study. The percentages are rounded to the nearest hundredth of a percent.

The top students did not have anyone note that the reason they got a question wrong was because of a lack of studying in chapters eight and nine. Both the lower and middle students’ averages decreased by at least 10% from chapter seven to chapter eight, but then increased from chapter eight to chapter nine. The middle group of students had only a slight increase of about 4% from chapter eight to chapter nine; however, the lower group of students had a much more substantial increase of 25.5%.
The final instrument used to analyze data was a journal that I kept throughout the study. This journal was used to help to keep an accurate detail of the events that happened during the study. I also made notes of my personal thoughts and student comments regarding the use of reflections. The journal entries are discussed in more detail in the Interpretation of Results.

**Interpretation of Results**

The homework reflection guides and the pre- and post-assessment reflections and the corresponding tests provided data about my students and their thoughts about the mathematics topics they thought they knew and their study habits in preparation for a mathematics test. In this section, I reviewed the data...
collected and provided my thoughts about information these data provide and try to explain different reasons for the data.

When getting ready to go over the chapter seven test, one student commented that “I don’t need to see my test because I looked at my score online.” The school’s grading system allows students to have instant access to their grades through an online web address. Although this system is great and allows the students and parents to keep up-to-date with every grade, I believe it also puts an emphasis on the percentage the student is earning versus the content the student knows. I responded to this student and the class that they do not take a test only for a percentage to put in the grade book, but rather tests are used to help them (and me) understand topics they are or are not proficient at and to learn from their mistakes. As a class, before going over the test, the students and I talked for a few minutes about why I believed the reflection guides were important and could help the students reflect on their progress.

Looking through my journal entries for the days the class went over the chapter seven and chapter eight test results, I noticed an increase in the number of students that asked questions about how to solve problems on the test or showed an increased interest in the material they got wrong on the test. While going over the chapter seven tests and completing the post-assessment reflections, only three students asked a question about how to solve some of the problems from the test. However, when completing the post-assessment reflections for chapter eight, 10
students asked a question about a problem from the test. I was pleased to see this increase since I wanted students to focus on reflection of their work and ability.

The results from the pre-survey and post-survey were expected for some statements and data, while surprising for others. While analyzing the median and mode, I noticed a few differences from the pre-survey to the post-survey results. Overall, the only statement in which the median changed from pre-survey to post-survey was for statement six which asked, “When I get my tests back, I note the types of mistakes I made.” On the pre-survey, the median value was two, which corresponds to a response of “disagree,” however, on the post-survey, the median value increased to a three, which corresponds to a response of “agree.” I am not surprised by this change and was glad to see it, since a large part of the project involved students reflecting on their test results to determine if they were making common mistakes on each assessment.

Although the median did not change for any of the other statements, I also examined the mode, which calculates the most frequently selected answer. The mode did again increase from a two to a three, or from “disagree” to “agree,” for statement six. However, the mode did also change for statement five which stated, “I work problems until I understand them, not just until I get the answers listed in the back of the book.” For this statement, the mode changed from a single mode of three on the pre-survey, which corresponds to “agree,” to being bimodal with three and four, which corresponds to “agree” and “strongly agree,” on the post-
survey. I was happy to see this fluctuation. While working on the homework reflection guides with the students during each section, I encouraged them to look at the problems they noted as struggling with to determine where or why they struggled and try to rework the problems. I believe the increase in the mode for the statement can be justified by the students’ increased awareness of and focused attention on the questions they struggled with throughout the chapters.

While analyzing the responses for questions eight and nine (see Table 4), the two open-response questions, I was extremely pleased with the results. The whole purpose of the research study was to help students learn how to focus their attention toward what they need to study to be successful in completing mathematical assessments. It was great to see that on the post-survey only one student still did not think he/she knew how to study for a mathematics test. This student noted on his/her survey, “[I] don’t know how to get problems set up so I can practice for a test.” Although this is concerning to me as a teacher, this response has to do more with understanding, or lack thereof, of the content than it does with knowing what to study for the test, which was the main focus of my research study.

Looking more closely at the response to question eight, “Do you think you know how to prepare for a mathematics assessment? Why?”, I again noticed a positive change (see Table 5). At the beginning of the study, eight students stated they reworked problems they struggled to understand and complete, while at the
end of the study, 13 students stated they did this. I was happy to see this increase. I was hoping the homework reflections used after each section (see Appendix F) and the pre-assessment reflections used for each chapter (see Appendix G) would help guide students to the concepts and topics they originally struggled to understand and help them know what to study and review in preparation for an upcoming assessment.

Another positive result from the data for this question was a decrease in the number of students who responded that, if they just do the homework and pay attention in class, they will be ready for a chapter test. Although for some students this may be true, I want to discourage this practice because of the difficulty of upcoming higher level mathematics courses. I have seen a number of students who were able to breeze through an algebra course with very little outside-of-class preparation because the content came easily to them. Then, they started a geometry course expecting the same outcome and ended up struggling because the content did not come as easily to them and they needed to put in extra time; however, because they never needed to study before, they did not know how to study for a mathematics test. I want to prevent students from getting to higher level mathematics courses without knowing how to study; thus, I want to discourage students from thinking they can just pay attention in class and learn the material with very little practice outside of class.
The results for question nine, however, were not quite what I expected because of the reasons many students listed. The question asked: “Do you think you are better at preparing for an assessment in a content area other than math? Why?” A wide variety of students based their answers on how well they were at a particular subject or the type of work required for a test. For example, one student stated, “Math is one of my strongest subjects” as a reason why he/she could study better for a math course. To me this response does not necessarily indicate the student is better at studying for a mathematics exam, but that since he/she is “good” at this subject he/she does better on math tests.

Other students’ responses were varied. One student explained he/she was better at preparing for a math test because “in other classes you have to read a lot and study for a long time.” Other students thought they were better at preparing for tests in other content areas because they “understand other subjects more.” Another common response centered on facts and memorization. Some students stated they were better at preparing for a math test because they didn’t like memorizing facts, while other students preferred memorization over having to work out problems in a step-by-step manner.

Based on the students’ responses, I believe many students based their answers to this question on how “good” they were in a particular subject. I believe my results for this question cannot be generalized because of the different ways students interpreted the question.
With the exception of question nine, I believe the results from the pre- and post-survey help to justify my research question which asked if student self-reflection would increase and improve students’ study skills in preparation for a mathematics course? The results show an increase in students being able to identify what they need to study and a more conscious effort to work problems until they understand them.

I was pleased with the change in quality of the homework reflection guides from chapter seven to chapter nine. After completing chapter seven and getting a chance to look over the responses the students had for each question, I took some time to go over different examples with the students. I noted in my journal that I took five minutes with my class to discuss what makes a good descriptive response versus a vague response. Since I had a chance to go through the results from chapter seven, I was able to clarify to my students how to get the most benefit from the homework reflection guides.

The five students whose homework reflection guides remained vague or minimally completed throughout the study all had attendance issues. From my journal and attendance records, I can confirm that two of the students were absent on the day I discussed with the class what makes a good versus a bad description. The other three students missed many class days throughout the study. These students were absent many of the days we completed the homework reflections and did not take the time to complete them on their own.
Based on the increase of eight to 17 students who had descriptive responses on their homework reflection guides from chapter seven to chapter nine, I believe this also helps to confirm my research question. Using the homework reflection guides provided students a place to reflect on their progress on the content and they could easily review what they thought about their knowledge when it came time to prepare for an upcoming test.

The final instruments used in my study were the pre- and post-assessment reflection guides. I believe these were extremely helpful for the students in preparing for a test; however, I was not happy with the lack of students marking “Help” on the pre-assessment reflection. Throughout the study, there were only three individuals who marked the “Help” category. Two of these individuals only marked “Help” on one of the reflections. Based on the students’ test results, in-class questions, and my professional opinion on some students’ understanding of certain mathematics topics, I think this number is too low.

I remember when I first presented these reflection guides to my students and again when we completed the reflections for chapter eight, I spent time going through what I meant by each category. I explained that “Got It” should be selected if the student could solve a problem requiring that skill right now with no review at all. The “Needs Work” option should be selected if students were comfortable doing those problems, but would like to quickly look back at some examples or rework a few problems to refresh their memories. The final category,
“Help,” should be selected if the students struggled with that topic when it was first introduced and were still not comfortable with the problems. Based on the help I provided my students and the results from the quizzes leading up the chapter tests, I believe many more students should have selected the “Help” option for certain problems.

Only one student selected “Help” for any concept on the chapter nine pre-assessment reflection. This chapter is typically one of the hardest for students in geometry, and the test results, which show an average of 31% incorrect, confirm that they struggled (the average incorrect for one of my tests is typically 22-24%). One reason for this high percentage could be due to the fact that, for medical reasons, I was not present when the students completed chapter nine and filled in the pre-assessment reflection. This issue is discussed further in Chapter Five.

I originally grouped the class as a whole to analyze the questions they got correct and incorrect as compared to those they marked on the pre-assessment reflection guides (“Got It,” “Needs Work,” or “Help”). These data were presented in Tables 6 and 7. The categories I noticed right away were the correct and “Needs Work,” as well as incorrect and “Needs Work,” since one of my goals was to determine whether the reflection guides helped the students know what they needed to study. The percentage of correct and “Needs Work” responses increased from chapters seven to nine: 9.9% on chapter seven, 13.3% on chapter eight, 12.0% on chapter nine. I was happy to see this increase since it suggests
that the students were better able to determine the concepts they needed to study and were reviewing those before the test. The average percentage for incorrect questions and marking “Needs Work” were 3.9%, 5.7% and 9.6% for chapters seven, eight, and nine, respectively. Although these percentages do also increase, I am happy to see they were all smaller than the corresponding percentages for the questions that were correct. This increase could in part be caused by the increase in difficulty from chapters seven to nine.

One category that seemed high to me was the average percentages for the incorrect question that the students had marked as “Got It” on the pre-assessment reflection. Each chapter had averages of approximately 21% for this category. When I first looked at this I was unhappy; it seems to indicate that the students had a false sense of ability with certain concepts. In other words, they thought they knew how to solve a particular type of problem, but really did not. After looking back on some of the tests in which this combination occurred, I realized that this category included problems that were set up and solved correctly, but at the end of the problem students simplified their final answers incorrectly. I realize this does not account for all of the mistakes in this category, but I know it justifies some of them. I discuss this combination in further detail later in this chapter when I look at different groups of students.

Next, I looked at the types of errors students made. I am surprised to see that approximately 50% of all the errors made were based on mistakes while
setting up the problems. I am not sure why this is. I will have to reflect on the reasons for this since this type of error is based on a lack of understanding of the concepts. One thing to note, however, is that the standard deviations were high as well for these errors, so the data is very spread out with some students making almost no errors in this category while other’s errors were almost exclusively made based on the setup.

A wide range of percentage of errors were made while simplifying and based on the vocabulary from chapter seven to chapter nine. Errors in simplifying accounted for 1% in chapter seven but 17.6% in chapter nine. Errors based on vocabulary accounted for 24.6% in chapter seven and only 1.6% in chapter nine. These wide ranges can be accounted for based on the topics covered in each chapter. Chapter seven had many more vocabulary words. If a student did not know their vocabulary, many problems could not be solved or would be difficult to solve. On the other hand, chapter nine had very little vocabulary, but did involve working with fractions and radicals which require simplified answers.

After analyzing the class as a whole, I then looked at groups based on low, middle, and top performers. The first thing that stuck out to me was the wide range that occurred in the percentages for the lower to top groups in the correct and “Got It” category as well as the incorrect and “Got It” category. In the correct and “Got It” category, an average of 45.01% of the lower students had indicated this reason, while 81.38% of the top performers did. In the incorrect and Got It”
category, an average of 34.14% of the lower students had selected this, while 10.89% of the top group marked it.

I believe these numbers strongly indicate the level of comfort the top performers had with understanding what they knew. On the other hand, I believe this indicates that the lower group had a false sense of comfort with what they knew. They may have thought they knew how to solve a problem, but when they attempted to do so, they were unable. I did note in my journal one day in the middle of chapter eight, that a student was not taking notes because he thought the material was easy. This student was grouped in the lower end. Looking back on his test for chapter eight, I see just how bad he did. I think many students watched me solve a problem on the board, thought it looked easy, and believed they understood it so they did not do the homework. When it came time for the test, they did not remember how to solve the problem because they did not get any practice on their own.

Another reason for the lower students having a lower percent in the correct and “Got It” category and a high percent in the incorrect and “Got It” category could be because of laziness while filling in the pre-assessment reflections. In my journal for the days that the class filled in the pre-assessment reflection guides, I noted that there were some students who just filled in “Got It” for every category. Although they were given ample time to complete the reflections in class, they did not take the time to read through the sheet and truly reflect on what they knew.
The last thing I analyzed were the types of errors made by lower, middle, and top groups of students. I noticed a wide range between the lower and top group of students in two categories: error in setup and error because of a lack of studying. I was surprised to see that the lower group of students had only 36.81% of their errors made in the setup, while the top group had 59.23%. I would have thought that the lower group of students would be higher than the top. Based on my experience working with geometry students, I usually see the lower students struggle to start a problem. They can easily get overwhelmed by the number of formulas and struggle with identifying what a problem is asking of them.

One explanation for this issue can be found in the data for the percentage of errors made because students did not study. The lower group of students had 26.74% of their errors in this category, while the top group had only 0.83%. Many of the students who may have had an error in setup, instead did not even review a particular concept so they marked that they did not study that topic.

Another item that surprised me was how close the percentages were for errors in simplifying, errors in algebra or arithmetic, and errors in vocabulary for the lower, middle, and top groups. For example, errors made in simplifying were within 2.70% for the three groups of students. The algebra or arithmetic errors were also close for the three groups with a range of only 6.51%. These numbers surprised me because I was thinking before I saw the data, that the lower to average students would struggle much more in these two categories than the top
group would. Similar to the last example, this may in part be caused by the lack of studying seen in the lower and to a lesser extent in the middle group, so these students did not even make it to the part of the problem that required the algebra or simplifying skills.

Taking a closer look into the errors due to a lack of studying, I noticed an improvement in the studying from chapter seven to chapter eight for both the lower and middle groups of students. I was happy to see this improvement since, as already mentioned, I had spent time after chapter seven explaining how students could improve their homework reflection sheets and I gave a better explanation of how to reflect on their progress while filling in the pre-assessment reflection guides.

Although the improvement in studying from chapters seven to eight was great, there was a setback in the progress from chapters eight to nine. The lower students decreased 10.65% in the percentage of errors made due to a lack of studying from chapter seven to eight, but then gained 25.54% in the percentage of errors due to a lack of studying from chapter eight to nine. This increase in the lack of studying was disappointing to me.

I can think of a few reasons that might be the cause of the increase in percentage of errors made due to a lack of studying. One reason being the difficulty of the chapter. Chapter nine is typically one of the toughest chapters for students; so many of the lower students could have easily felt overwhelmed and
given up. Another reason may be because I was not present when the students finished the chapter and completed the pre- and post-assessment reflection guides. Since I was not there to remind the students of the importance of these reflections, some students may not have taken them seriously.

One final reason for the change could be caused by the repetitive use of the reflections. When working with students, there is always the possibility that students can get bored with the activity and can start to lose interest or not participate fully. By the time we finished chapter nine, the students had been filling in homework reflections guides for every section in the three chapters. They had also completed the pre- and post-assessment reflections for the three chapters. I know from experience, if students do not see the point of an assignment, they will not take it seriously or may not complete it all together.

**Summary**

The use of student reflection guides in my geometry classroom provided me with a large amount of data to analyze to determine the value of these guides in my mathematics classroom. Overall, I believe these reflections helped my students to better understand what they did and did not know in preparation for a mathematics test. They encouraged my students to be aware of the different errors they made. The reflections also provided me with information about the study habits and thoughts of my students. This information can help me encourage
future students to avoid these mistakes and learn better skills for preparing and studying in upper level mathematics courses.

In Chapter Five I reflected on the data analyzed in this chapter and noted my future ideas and changes that I plan to make while using student reflection guides. I also offered advice to other teachers that want to start using student reflections in their classrooms.
Chapter Five

Conclusions, Action Plan, Reflections, and Recommendations

The use of student reflection guides in my classroom has been a great learning experience both for me and my students. The action research process encouraged me to expand on a small idea I had used in the past to help my students reflect on their mathematical abilities. This chapter includes a discussion of my thoughts on the reflections guides and how I plan to continue to use them in the future.

Conclusions

After reviewing the pre-survey, post-survey, assessment data, and my journal entries, I think that overall the various reflections used had a positive effect on the students’ study ability. Although there were declines in the students’ data from chapter eight to chapter nine, I believe that these declines can be attributed, at least in part, to the harder content in chapter nine and the fact that I was not present to finish the chapter and assessment with the class. I believe, because of those reasons, the increases seen in the data from chapter seven to chapter eight are more prevalent for a conclusion that confirms the benefits of the reflections used.

As the review of literature suggested, the use of reflections requires an initial time investment. There has to be careful planning to insure the reflections are beneficial, as well as time invested with the students explaining the purpose of
the reflections and how to get the most out of them. After class discussions of how to appropriately use the homework reflection guides, many students displayed a change in their homework reflections that demonstrated they were improving on the skill to honestly reflect on their ability to perform mathematical tasks.

However, one must be cautious to not overwhelm the students with too many reflections that they become monotonous. Based on my observations and journal entries, I believe frustration and/or boredom were displayed in some students towards the end of the study. I plan to continue to use reflections in my mathematics courses in the future, but do plan to streamline some of the sheets used to hopefully prevent these feelings.

**Action Plan**

I am extremely pleased with the outcome of using reflection guides and plan to continue to use them, with a few changes to some. The homework reflections will be changed the most. Overall, I love the concept of them, but from student comments, I believe students thought they became repetitive after awhile. I plan to change the homework reflections to a one page sheet that asks students to list topics that they believe they are proficient and other topics that they feel they struggle to understand or need more practice. I plan to also include a section where they can make a quick note to remind them about why they struggled with that topic. I am not sure how the final version of this sheet will look; I know I
want it more streamlined than what I used in the study, but with the same
reminders for the students.

Although the look of the homework reflections will change, I plan to use
them in a similar way. I will encourage students to complete them as they check
over their homework in class. Since there will be time provided in class, I hope
students will complete them throughout the year.

I also plan to continue to use the pre- and post-assessment reflection
guides in the future. I really liked the setup of these guides and plan to continue to
use this format for every chapter. I believe the pre-assessment reflections are a
great way to help students focus in on topics of an upcoming test. I will, however,
have a discussion with the students at the beginning of the school year to make
sure they are aware of the meaning of each category (“Got It,” “Needs Work,”
and “Help”) and when to select each. I plan to again allow a few minutes in class
for these guides to be completed and will monitor the students throughout the year
to make sure they are truly reflecting on their skills and marking the appropriate
categories.

I also plan to continue to use the post-assessment reflection guides. I like
the format of these guides; however, I may change a few things. For some
chapters, I might have to change some of the choices the students can select as a
reason they think they got the problem wrong. For example, at the beginning of
the school year when we cover proofs in class, no algebra or simplifying is
required on the test for that chapter. In its place, I can add topics more closely related to logic. Overall, I really like these guides and plan to continue to use them. I plan to reincorporate them back into parent-teacher conferences as well. I received positive feedback when I showed them to parents a couple years ago while using a similar format. I plan to show them again next year with the updated version. I think it is a great way to show parents the kinds of errors their child is making.

I will continue to modify these reflections as I come up with ideas or see the need based on student response. I also plan to continue to follow other studies or advice from professionals with new ideas. Overall I have seen positive results that help students realize where their strengths and weaknesses are.

**Reflections and Recommendations for Other Teachers**

This project has allowed me to research and expand on a simple idea I have used in the past. I loved being able to try something in my classroom and really analyze the pros and cons of its use.

I believe the research process is a great way to incorporate new ideas and be forced to take a step back to look at the benefits and detriments from a new perspective. Typically when I try something new, I will go into the project with an idea of what I think will happen. Although I did go into this project with a hopeful outcome, the action research process forced me to look at the reflection guides
from all angles and made me think of student opinions and thoughts that otherwise I might not have considered.

I loved seeing my students become more aware of their abilities as we progressed through the project. I do, however, plan to make the changes noted above to help prevent some of the unfavorable outcomes that were seen.

I do have some advice for other teachers who want to incorporate these or similar reflections into their classes. I believe reflections and student self-awareness of skills are truly important for students; however, they do require a large investment from everyone. The teacher has to be willing to provide class time to explain the reflections as well as time for the students to complete these reflections. The students must also be willing to be honest in their reflections and be able to ask for help when needed.

**Summary**

I believe that using the various types of reflections in my high school geometry class helped students become aware of their strengths and weaknesses which provided them with an outline of what they needed to study. I plan to continue to develop these reflections in the coming years and will continue to work with students to build this skill. I believe that with my continued and growing support of my students and their abilities to reflect on their skills, I will see continued growth in their study habits and, hopefully, their mathematics scores.
References


Appendices
Appendix A

IRB Approval Form

MINOT STATE UNIVERSITY

Notice of IRB Approval

Name of Principal Investigator: Nancy Daly

University Address: Math & Computer Science

Title of Project: Using Student Self-Reflection to Improve Student Study Habits in the Mathematics Classroom

January 7, 2010

The above project has been reviewed and approved by the IRB under the provisions of Federal Regulations 45 CFR 46.

This approval is based on the following conditions:

1. The materials you submitted to the IRB provide a complete and accurate account of how human subjects are involved in your project.

2. You will carry out your research strictly according to the procedures as described in materials presented to the IRB.

3. You will report to the chair of the Institutional Review Board any changes in procedures that may have a bearing on this approval and require another IRB review.

4. If any changes are made, you will submit the modified project for IRB review.

5. You will immediately report to the IRB Chair any problems that you encounter while using human subjects in your research.

[Signature]

Dr. Brent A. Aakre
Chair, Minot State University's IRB
Appendix B

Research Participant Consent Form

Using Student Self-Reflection to Improve Student Study Habits in the Mathematics Classroom

Nancy Daly

Purpose of the Research
I am currently completing work towards my Masters of Arts of Teaching: Mathematics degree through Minot State University. For my final degree requirement, I am conducting an action research project during quarter 3, January 19th through March 23rd, to determine if student self-reflection improves the mathematics study habits of geometry students through an increased awareness of their study habits and knowledge of mathematics.

Specific Procedures
Students in this geometry classes will cover the normal geometry curriculum while completing self-reflections occasionally in class. At the beginning of the study, your student will complete a survey to assess his/her current attitudes toward and study habits in preparation for a mathematics assessment. Throughout the quarter, students will complete self-reflections regarding homework problems that they struggled on and pre-assessment reflections that will focus on the concepts they must know for upcoming assessments. At the end of the quarter, students will complete the survey again to assess his/her current attitudes toward study habits in preparation for a mathematics assessment. Survey responses, student reflection sheets, and my observations will be analyzed to determine whether self-reflection improves the mathematics study habits of my geometry class. My results will be summarized and included in my research paper. None of the students in my class will be identified in my results. Mr. Bertsch, principle of Fargo South High School, and Dr. Grosz, assistance superintendent of Fargo Public School District, have both approved this research study.

Duration of Participation
Your student will participate in self-reflections during quarter three of the academic school year. They will be expected to complete two surveys and student self-reflection sheets during the duration of the unit.
Benefits to the Individual
There are no direct benefits in participating in this study, but participation will give your student additional tools to help him/her prepare for math tests. The study may show the benefits of self-reflection to help students focus on specific math content for which they need more practice.

Risks to the Individual
The risks to your student are no more than he/she would encounter in a regular classroom setting.

Confidentiality
All data will be treated confidentially by the researcher. Names of participants and their data sets will kept in a locked filing cabinet in the researcher's office and will be destroyed once the paper has been defended and approved. The researcher agrees to maintain strict confidentiality which means your student’s name will not be discussed or divulged with anyone outside of this research project. The researcher will also make sure confidential information will not be discussed in an area that can be overheard that would allow an unauthorized person to associate or identify the student with such information.

Voluntary Nature of Participation
During this study, the survey responses and reflection sheets from your student do not have to be included. However, I hope you approve of your student being involved in this study because a large sample size improves the accuracy of the results of my study. If you decide to participate, you are free to withdraw your consent at any time. If you do not consent or withdraw your consent, your student’s data will not be included in my results and your student will not complete the surveys, but your student will still be asked to complete the self-reflections since these are a regular part of my course.

Human Subject Statement
The Institutional Review Board of Minot State University has given me permission to conduct this research. If you have questions regarding the right of research subjects, please contact the Chairperson of the MSU Institutional Review Board (IRB), Brent Askvig at 701-858-3051 or Brent.Askvig@minotstateu.edu.
Offer to Answer Questions
If you have any questions or concerns now or during the study, feel free to contact me at 446-2135 or email me at nancy.daly@fargo.k12.nd.us. Thank you for your consideration.

Consent Statement
You are voluntarily making a decision whether or not to participate in this study. With your signature below, you are indicating that upon reading and understanding the above information, you agree to allow your student’s survey and reflection results to be used in this study. You will be given a copy of the consent form to keep.

___________________________________
Participant (Please Print Student’s Name)

___________________________________
Signature of Parent or Guardian Date

___________________________________
Signature of Researcher Date
Appendix C

Student Participant Assent Form

Using Student Self-Reflection to Improve Student Study Habits in the Mathematics Classroom

Nancy Daly

Purpose of the Research
I am currently completing work toward my Masters of Arts of Teaching: Mathematics degree through Minot State University. For my final degree requirement, I am conducting an action research project during quarter 3, January 19th through March 23rd, to determine if student self-reflection improves the mathematics study habits of geometry students through an increased awareness of their study habits and knowledge of mathematics.

Specific Procedures
You will cover the normal geometry curriculum while completing self-reflections occasionally in class. At the beginning of the study, you will complete a survey to assess your current attitude toward and study habits in preparation for a mathematics assessment. Throughout the quarter, you will complete self-reflections regarding homework problems that you have struggled on and pre-assessment reflections that will focus on the concepts you must know for upcoming assessments. At the end of the quarter, you will complete the survey again to assess your current attitude toward study habits in preparation for a mathematics assessment. Survey responses, student reflection sheets, and my observations will be analyzed to determine whether self-reflection improves the mathematics study habits of my geometry class. My results will be summarized and included in my research paper. None of the students in my class will be identified in my results. Mr. Bertsch, principle of Fargo South High School, and Dr. Grosz, assistance superintendent of Fargo Public School District, have both approved this research study.

Duration of Participation
You will participate in self-reflections during quarter three of the academic school year. You will also be expected to complete two surveys and student self-reflection sheets in class during the duration of the unit.
Benefits to the Individual
There are no direct benefits in participating in this study, but participation will give you additional tools to help prepare for math tests. The study may show the benefits of self-reflection to help you focus on specific math content for which you need more practice.

Risks to the Individual
The risks to you are no more than you would encounter in a regular classroom setting.

Confidentiality
All data will be treated confidentially by the researcher. Names of participants and their data sets will kept in a locked filing cabinet in the researcher’s office and will be destroyed once the paper has been defended and approved. The researcher agrees to maintain strict confidentiality which means your name will not be discussed or divulged with anyone outside of this research project. The researcher will also make sure confidential information will not be discussed in an area that can be overheard that would allow an unauthorized person to associate or identify the student with such information.

Voluntary Nature of Participation
During this study, the survey responses and reflection sheets do not have to be included. However, I hope you approve of being involved in this study because a large sample size improves the accuracy of the results of my study. If you decide to participate, you are free to withdraw your consent at any time. If you do not consent or withdraw your consent, your data will not be included in my results and you will not complete the surveys, but you will still be asked to complete the self-reflections since these are a regular part of my course.

Human Subject Statement
The Institutional Review Board of Minot State University has given me permission to conduct this research. If you have questions regarding the right of research subjects, please contact the Chairperson of the MSU Institutional Review Board (IRB), Brent Askvig at 701-858-3051 or Brent.Askvig@minotstateu.edu.

Offer to Answer Questions
If you have any questions or concerns now or during the study, feel free to contact me at 446-2135 or email me at nancy.daly@fargo.k12.nd.us. Thank you for your consideration.
Consent Statement

You are voluntarily making a decision whether or not to participate in this study. With your signature below, you are indicating that upon reading and understanding the above information, you agree to allow your survey and reflection results to be used in this study. You will be given a copy of the consent form to keep.

___________________________________
Participant (Please Print Student’s Name)

___________________________________
Signature of Participant

___________________________________
Signature of Researcher

___________________________________
Date

___________________________________
Date
Appendix D

School Principal Consent Form

Dear Mr. Bertsch:

I am completing work toward the Master of Arts in Teaching Mathematics degree through Minot State University. As a degree requirement, I am to conduct a research project in my classroom during the third quarter this year. I am planning to implement pre- and post-assessment student reflections to determine whether these reflections improve student preparation for mathematics assessments through an increased awareness of students' study habits and knowledge of mathematics. To accomplish this, I would like to work with the students in my geometry classes.

During this time, students will take pre- and post-study surveys regarding their beliefs about preparing for mathematics assessments. They will complete homework self-reflections during each chapter and will reflect on their study progress through pre- and post-assessment reflections. I will also be taking notes on my own observations.

At the completion of the study, I will analyze the data from the surveys and my personal journal of student comments and progress to determine the results. Classroom and student confidentiality will be observed regarding all data collected and no individual will be identified by name.

Before the study begins, I will send home consent forms for parents/guardians to notify them of this project and request their permission allowing their student to participate in the research study. A copy of this letter is attached for your inspection.

I am requesting that you permit me to carry out this research in my classroom. Please contact me if you have any questions. Thank you for your consideration.

☐ I grant permission for Nancy Daly to conduct the above mentioned research in her classroom.

☐ I DO NOT grant permission for Nancy Daly to conduct the above mentioned research in her classroom.

Signature of Mr. Todd Bertsch, Principal at Fargo South High School

Date

11-19-2010
Appendix E

Research Student Survey

Name: ________________________________

Date: ________________

Study and Preparation for Mathematics Assessment Survey:

SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree

<table>
<thead>
<tr>
<th>Question</th>
<th>SA</th>
<th>A</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When I don’t understand something, I get help from a classmate, parent, math resource center or teacher.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I can easily identify what I have learned and what I have not yet learned before I take a test.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I start studying for quizzes and tests at least several days before I take them.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I try to determine exactly when I got confused and exactly what confused me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I work problems until I understand them, not just until I get the answers listed in the back of the book.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. When I get my tests back, I note the types of mistakes I made.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. When I prepare for a math test, I look over the problems I originally struggled with while completing the homework.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Please write your thoughts about the questions below.

8. Do you think you know how to prepare for a mathematics assessment? Why?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

9. Do you think you are better at preparing for an assessment in a content area other than math? Why?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
Appendix F

Student Homework Reflection Guides

Name: ___________________________

Chapter 7 Homework Reflections

For each assignment this chapter, you will be keeping a homework reflection that keeps track of the topics that you have struggled with. For each section be honest with which problems you have struggled with and the reason why you think they were hard.

Section 7.1:

The problem I struggled with most with was # ________ which asked me to __________
____________________________________________________________

Write 2-3 sentences about which part of the problem made it difficult for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

The problem(s) I did the best with asked me to __________________________________
_____________________________________________________________________

Write 2-3 sentences about what made these problem(s) easy for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Section 7.2:

The problem I struggled with most with was # ________ which asked me to __________
Write 2-3 sentences about which part of the problem made it difficult for you.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

The problem(s) I did the best with asked me to ____________________________________

________________________________________________________________________

Write 2-3 sentences about what made these problem(s) easy for you.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Section 7.3:

The problem I struggled with most with was # ________ which asked me to __________

________________________________________________________________________

Write 2-3 sentences about which part of the problem made it difficult for you.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

The problem(s) I did the best with asked me to ________________________________

________________________________________________________________________

Write 2-3 sentences about what made these problem(s) easy for you.

________________________________________________________________________
Section 7.4:
The problem I struggled with most was # ________ which asked me to __________

Write 2-3 sentences about which part of the problem made it difficult for you.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

The problem(s) I did the best with asked me to __________________________________

Write 2-3 sentences about what made these problem(s) easy for you.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Section 7.5:
The problem I struggled with most was # ________ which asked me to __________

Write 2-3 sentences about which part of the problem made it difficult for you.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
The problem(s) I did the best with asked me to ______________________________________
_________________
_______________________________________________________

Write 2-3 sentences about what made these problem(s) easy for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Chapter 8 Homework Reflections

For each assignment this chapter, you will be keeping a homework reflection that keeps track of the topics that you have struggled with. For each section be honest with which problems you have struggled with and the reason why you think they were hard.

Section 8.1:

The problem I struggled with most with was # ________ which asked me to __________
________________________________________________________________________
Write 2-3 sentences about which part of the problem made it difficult for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
The problem(s) I did the best with asked me to __________________________________
________________________________________________________________________
Write 2-3 sentences about what made these problem(s) easy for you.
________________________________________________________________________
________________________________________________________________________

Section 8.2:

The problem I struggled with most with was # ________ which asked me to __________
________________________________________________________________________
Write 2-3 sentences about which part of the problem made it difficult for you.
The problem(s) I did the best with asked me to __________________________________

________________________________________________________________________

________________________________________________________________________

Write 2-3 sentences about what made these problem(s) easy for you.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Section 8.3:

The problem I struggled with most with was # ________ which asked me to __________

________________________________________________________________________

Write 2-3 sentences about which part of the problem made it difficult for you.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

The problem(s) I did the best with asked me to _________________________________

________________________________________________________________________

Write 2-3 sentences about what made these problem(s) easy for you.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Section 8.4:
The problem I struggled with most was # ________ which asked me to __________
________________________________________________________________________
Write 2-3 sentences about which part of the problem made it difficult for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
The problem(s) I did the best with asked me to __________________________
________________________________________________________________________
Write 2-3 sentences about what made these problem(s) easy for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Section 8.5:
The problem I struggled with most was # ________ which asked me to __________
________________________________________________________________________
Write 2-3 sentences about which part of the problem made it difficult for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
The problem(s) I did the best with asked me to __________________________
Write 2-3 sentences about what made these problem(s) easy for you.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Section 8.6:

The problem I struggled with most with was # __________ which asked me to __________

________________________________________________________________________

Write 2-3 sentences about which part of the problem made it difficult for you.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

The problem(s) I did the best with asked me to ______________________________

________________________________________________________________________

Write 2-3 sentences about what made these problem(s) easy for you.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Chapter 9 Homework Reflections

For each assignment this chapter, you will be keeping a homework reflection that keeps track of the topics that you have struggled with. For each section be honest with which problems you have struggled with and the reason why you think they were hard.

Section 9.1:
The problem I struggled with most was # ________ which asked me to __________
________________________________________________________________________
Write 2-3 sentences about which part of the problem made it difficult for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
The problem(s) I did the best with asked me to __________________________________
________________________________________________________________________
Write 2-3 sentences about what made these problem(s) easy for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Section 9.2:
The problem I struggled with most was # ________ which asked me to __________
________________________________________________________________________
Write 2-3 sentences about which part of the problem made it difficult for you.
The problem(s) I did the best with asked me to __________________________________

________________________________________________________________________

________________________________________________________________________

Write 2-3 sentences about what made these problem(s) easy for you.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Section 9.3:

The problem I struggled with most with was # ________ which asked me to __________

________________________________________________________________________

Write 2-3 sentences about which part of the problem made it difficult for you.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

The problem(s) I did the best with asked me to _________________________________

________________________________________________________________________

Write 2-3 sentences about what made these problem(s) easy for you.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Section 9.4:
The problem I struggled with most with was # ________ which asked me to __________
___________________________________________________________
Write 2-3 sentences about which part of the problem made it difficult for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
The problem(s) I did the best with asked me to __________________________________
________________________________________________________________________
Write 2-3 sentences about what made these problem(s) easy for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Section 9.5:
The problem I struggled with most with was # ________ which asked me to __________
___________________________________________________________
Write 2-3 sentences about which part of the problem made it difficult for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
The problem(s) I did the best with asked me to __________________________
Write 2-3 sentences about what made these problem(s) easy for you.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Section 9.6:
The problem I struggled with most was # ________ which asked me to __________
________________________________________________________________________

Write 2-3 sentences about which part of the problem made it difficult for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

The problem(s) I did the best with asked me to ____________________________
________________________________________________________________________

Write 2-3 sentences about what made these problem(s) easy for you.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
### Appendix G

#### Pre-Mathematics Assessment Reflection Guides

**GEOMETRY CHAPTER 7 PRE-ASSESSMENT SELF-REFLECTION**

**IDENTIFY STRENGTHS & AREAS FOR IMPROVEMENT FOR UPCOMING TEST**

| Name: ___________________ | Date: ____________ | Period: ____________ |

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>GOT IT!</th>
<th>NEEDS WORK!</th>
<th>HELP!</th>
</tr>
</thead>
<tbody>
<tr>
<td>I know the difference between an image and preimage. Section 7.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I understand what properties are needed to have an isometry. Section 7.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can identify a reflection. Section 7.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can accurately name a reflection being completed. Section 7.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I know how to construct a reflection over an axis in a coordinate plane. Section 7.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can identify how many lines of symmetry a figure has. Section 7.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can identify a rotation. Section 7.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Given an angle of rotation, I can identify the image of a point. Section 7.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I know when an image and preimage are the same during a rotation. Section 7.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I know how to construct a rotation of 90°, 180°, 270° in a coordinate plane. Section 7.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOPIC</td>
<td>GOT IT!</td>
<td>NEEDS WORK!</td>
<td>HELP!</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>---------</td>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>I can identify the rotational symmetry of a figure. Section 7.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can find the angle of rotation given two reflections over intersecting lines. Section 7.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can identify a translation. Section 7.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I know how to construct a translation in a coordinate plane. Section 7.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can find the distance of translation given two reflections over parallel lines. Section 7.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I know how to read (or name) a vector. Section 7.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Given a vector, I can identify its translation in component form. Section 7.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Given a vector, I can identify its translation in coordinate form. Section 7.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Given a composition of transformations, I can identify the transformations used. Section 7.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I know when order is important in constructing a composition of transformations. Section 7.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I know how to construct a composition of transformations in a coordinate plane. Section 7.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*** I know the vocabulary for chapter 7. *** All Chapter-Look over vocab packets.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
GEOMETRY CHAPTER 8 PRE-ASSESSMENT SELF-REFLECTION
IDENTIFY STRENGTHS & AREAS FOR IMPROVEMENT FOR UPCOMING TEST

Name: _______________  Date: _______________  Period: _______________

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>GOT IT!</th>
<th>NEEDS WORK!</th>
<th>HELP!</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can setup and simplify a ratio of two numbers. Section 8.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can setup and solve a proportion. Section 8.1 (and throughout)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I know the properties of proportions and can use them to find equivalent expressions. Section 8.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can find the geometric mean of two numbers. Section 8.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can identify similar polygons. Sections 8.3, 8.4 (AA~), and 8.5 (SSS~ and SAS~)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can find the scale factor of two similar polygons. Section 8.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can setup and solve a proportion involving measurements in similar figures. Section 8.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can use proportionality theorems to identify parallel lines. Section 8.6</td>
<td></td>
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<td>I can use proportionality theorems to setup proportions and calculate segment lengths. Section 8.6</td>
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<td>I can identify different dilations (reductions and enlargements) and their scale factor. Section 8.7</td>
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<tr>
<td>TOPIC</td>
<td>GOT IT!</td>
<td>NEEDS WORK!</td>
<td>HELP!</td>
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<tr>
<td>----------------------------------------------------------------------</td>
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<tr>
<td>I can set up and solve proportions given a dilation.</td>
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<td>I can draw a dilation given a specific scale factor.</td>
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<td>*** I know the vocabulary for chapter 8. ***</td>
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<td>All Chapter-Look over vocab packets.</td>
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# GEOMETRY CHAPTER 9 PRE-ASSESSMENT SELF-REFLECTION
IDENTIFY STRENGTHS & AREAS FOR IMPROVEMENT FOR UPCOMING TEST

Name: ___________________  Date: _____________  Period: _____________

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>GOT IT!</th>
<th>NEEDS WORK!</th>
<th>HELP!</th>
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<td>I can solve an equation to find a missing side length of a right triangle. Section 9.2</td>
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<td>I can identify a Pythagorean Triple. Section 9.2</td>
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<td>Given 3 side lengths, I can classify the triangle as acute, right, or obtuse. Section 9.3</td>
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<td>I can find the hypotenuse given the length of a leg in a 45-45-90 triangle. Section 9.4</td>
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<td>I can find the length of the legs given the hypotenuse in a 45-45-90 triangle. Section 9.4</td>
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<td>I can find the exact value of the sine, cosine, and tangent of 45°. Section 9.4</td>
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<td>I can find the length of the longer leg given the shorter leg in a 30-60-90 triangle. Section 9.4</td>
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<td>TOPIC</td>
<td>GOT IT!</td>
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<tr>
<td>I can find the exact value of the sine, cosine, and tangent of 60°. Section 9.4</td>
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<td>I can setup a cosine ratio for an acute angle in a right triangle. Section 9.5</td>
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<td>I can setup a tangent ratio for an acute angle in a right triangle. Section 9.5</td>
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<tr>
<td>I can use the inverse cosine function to solve for an acute angle measure. Section 9.6</td>
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<tr>
<td>I can use the inverse tangent function to solve for an acute angle measure. Section 9.6</td>
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<tr>
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Appendix H
Mathematics Assessments

Geometry

Chapter 7 Test

40 Points Total

For 1-3, classify the transformation as a rotation, reflection, or translation. (1 point each)

1. __________________
2. __________________
3. __________________

In Exercises 4-7, use the diagram. (1 point per blank)

4. Identify the transformation that maps DEFHIJK onto STMGHPQR. Be specific.

________________________________________

5. What is the preimage of Q? ________________

6. What is the image of E? ___________________

7. Is $RS$ congruent to $KD$? __________________

For 8-10, use the diagram in which lines $m$ and $n$ are lines of reflection. (1 point per blank)

8. Identify the transformation that maps figure onto figure $T'$.

________________________________________
9. Identify the transformation that maps figure T onto figure T”.

10. If the measure of the acute angle between \( m \) and \( n \) is \( 85^\circ \), what is the angle of rotation from figure T to figure T”?

Name the vector and write its component form and coordinate form. (1 point per blank)

11. ________

Component Form: __________
Coordinate Form: __________

12. ________

Component Form: __________
Coordinate Form: __________

In Exercises 13-15, use the diagram in which \( k \) is parallel to \( m \). (1 point per blank)

13. Identify the transformation that maps figure R onto figure R’.

14. Identify the transformation that maps figure R onto figure R”.
15. If the distance between \( k \) and \( m \) is 5 inches, what is the distance between corresponding parts of figure R and figure R’?

16. What type of transformation is a composition of a translation followed by a reflection in a line parallel to the translation vector? (1 point)

17. Sketch a quadrilateral that has both line symmetry and rotational symmetry. (2 points)

18. Multiple Choice:
   Which of the following letters (if drawn as simply as possible) has at least one line of symmetry? (1 point)


19. Give an example of a composition of transformations where order in which the two transformations are performed affects the final image. (1 point)

   ____________________________________________

   ____________________________________________

20. When a rotation is completed, are there any points that can remain in the same location after the rotation? List any/all situations and explain how it occurs. (3 points)

   ____________________________________________

   ____________________________________________

   ____________________________________________
For 21-22, Complete the composition of transformations in the order listed. Make sure you label your figures appropriately and make your final image bold. Then answer the question regarding the composition. (3 points each)

21. First: Reflect in the y-axis
Then: \((x, y) \rightarrow (x, y - 5)\)

22. First: Rotate 90° Clockwise
Then: Reflect in the x-axis

Does the order in which you perform the composition matter?

___________

23. Find the vector that maps \(\triangle ABC\) onto \(\triangle A'B'C'\). (1 point)
(use the diagram at right)

24. Explain what it means for a figure to be an isometry, be specific. (2 points)
Use the figure of the flag of Tanzania to answer questions 25-26. (1 point each)

25. Does the flag have any lines of symmetry? 
___________________

26. Does the flag have rotational symmetry? 
___________________

Use the figure below to answer questions 27-28. (1 point each)

27. A clockwise rotation of 60° about P maps M onto __________.

28. A clockwise rotation of 120° about J maps K onto __________.

Bonus: 
If the radius of a circle is tripled, what happens to the area? Circle your final answer. $A = \pi r^2$
Geometry

Chapter 8 Test

40 points

Solve for the value of the variable in each proportion. (2 points each)

1. \( \frac{18}{x} = \frac{15}{25} \)

2. \( \frac{d - 4}{d} = \frac{3}{7} \)

3. Simplify \( \frac{20\text{ft}}{5\text{yd}} \). Remember 3 ft = 1 yd. (2 points)

4. Nancy sold 170 adult tickets and 70 student tickets to a school play. Write the ratio of student tickets to adult tickets in lowest terms. (1 point)

5. A survey indicated that 7 out of 8 doctors used “Geo Brand” of aspirin. If 4800 doctors were surveyed, how many use “Geo Brand” aspirin? (2 points)

6. \( \triangle PQR \cong \triangle STU \), the perimeter of \( \triangle PQR \) is 96, \( PQ = 36 \), and \( ST = 24 \). What is the perimeter of \( \triangle STU \)? You may find it helpful to sketch a picture. (3 points)
7. Given: $\triangle ABC \sim \triangle A'B'C'$. Find the value of $x$ to the nearest tenth. Show your work. (2 points)

8. Given that $\frac{RU}{UT} = \frac{RV}{VS}$, what is the relationship between segments $UV$ and $TS$? (1 point)

9. Use the diagram to finish writing the proportion. (1 point each)

10. Solve for $a$. Show your work. (2 points)
11. If \( \frac{a}{b} = \frac{m}{n} \), then which of the following is not necessarily true? (1 point)

a) \( \frac{a}{m} = \frac{b}{n} \)  

b) \( \frac{a}{n} = \frac{b}{m} \)  
c) \( an = bm \)  
d) \( \frac{b}{a} = \frac{n}{m} \)

For questions 12 and 13, are the triangles similar? If so, state the postulate or theorem that can be used to prove that the triangles are similar. (1.5 points each)

12. 
\[ \begin{array}{c}
P \\
\downarrow 12 \\
Q \\
\downarrow 16 \\
M \\
N \\
\downarrow 9 \\
R \\
\downarrow 12 \\
\end{array} \]

13. 
\[ \begin{array}{c}
P \\
\downarrow 8.5 \\
Q \\
\downarrow 4 \\
R \\
\downarrow 10 \\
M \\
N \\
\downarrow 9 \\
G \\
\downarrow 8 \\
H \\
\downarrow 6 \\
J \\
\end{array} \]

14. Use the diagram to find the value of x. (1 point)

14. x = \text{__________}

15. The ratio of CD:AD is 3:5. Solve for y. (2 points)

15. y = \text{__________}
16. Use the diagram on the right to answer the questions
   (1 point per question)

   A) Circle one: Enlargement or Reduction

   B) Scale Factor: _________________

   C) The two triangles are: Similar or Congruent

   D) Is this dilation an isometry? Yes or No

17. Find the geometric mean of 4 and 36. (2 points)

    17. _________________

18. Farmer Gastón has a triangular field with two parallel irrigation pipes
    marked p1 and p2 on the map below. Use the information below to answer
    the question. (3 points)

    She wants to find the distance from barn B to the north (top of the page) end of
    pipe 2. The distance from the barn to the south end of pipe 1 is 106 ft, the
    distance from there to the south end of pipe 2 is 28 ft, and the distance from the
    barn to the north end of pipe 1 is 125 ft. How far is barn B from the north end of
    pipe 2? **Round your answer to the nearest foot.** The map is not drawn to scale.
19. Use the origin as the center of the dilation and a scale factor 2 to find and sketch the coordinates of the vertices of the image of the triangle. (2 points)

A' = (_____, _____)
B' = (_____, _____)
C' = (_____, _____)

20. A lighting designer wants a spotlight to illuminate a triangular section of stage floor. If a screen is placed in front of the light, what is the scale factor of the dilation shown? In the diagram: L represents the spotlight, P represents the screen, and P' represents the stage floor. (3 points)

20. ______________
1. Find $QS$ and $QR$. Simplify answers that are radicals. (2 points)

$$QS = \underline{\phantom{000}}$$

$$QR = \underline{\phantom{000}}$$

2. Find the unknown side length. Simplify answers that are radicals. (2 pts)

$$x = \underline{\phantom{000}}$$

3. Decide whether the numbers can represent the side lengths of a triangle. If they can, classify the triangle as right, acute, or obtuse. (1 point)

20, 21, 28

3. ___________________

4. Find the value of each variable in these special right triangles. Write answers in simplest radical form. (4 points)

a) $X = \underline{\phantom{000}}$

b) $Y = \underline{\phantom{000}}$

c) $X = \underline{\phantom{000}}$

d) $Y = \underline{\phantom{000}}$
5. Solve the right triangle. Round decimals to the nearest tenth. (4 points)

![Right triangle diagram]

a) \( m\angle N = \)______

b) \( m\angle P = \)______

c) \( m\angle Q = \)______

d) \( NP = \)______

e) \( PQ = \)______

f) \( QN = \)______

For question 6-8, complete and solve the proportion for \( x \). (2 points each)

6. \( \frac{x}{12} = \frac{?}{8} \)

? = ________________

\( x = \)______________

7. \( \frac{?}{6} = \frac{6}{4} \)

? = ________________

\( x = \)______________
8. \[ \frac{x}{16} = \frac{16}{?} \]

\[ ? = \frac{16}{x} \]

\[ x = \frac{16}{\text{?}} \]

For questions 9-10, find the unknown side length. Tell whether the side lengths form a Pythagorean triple. (2 points each)

9. \[ \begin{array}{c}
40 \\
41 \\
x
\end{array} \]

10. \[ \begin{array}{c}
x \\
3 \\
1.6
\end{array} \]

\[ a) x = \text{__________} \]

\[ b) \text{Pythagorean Triple: Yes or No} \]

For questions 11-12, find the sine, the cosine, and the tangent of \( \theta \) in the triangles. Express each value as a decimal rounded to four places. (3 points each)

11. \[ \begin{array}{c}
B \\
5 \\
C \\
12 \\
\theta
\end{array} \]

12. \[ \begin{array}{c}
C \\
\sqrt{12} \\
\sqrt{13} \\
1 \\
\theta
\end{array} \]

\[ a) \sin \theta = \text{__________} \]

\[ b) \cos \theta = \text{__________} \]

\[ c) \tan \theta = \text{__________} \]

13. In a 45-45-90 triangle, the side opposite the 90° angle is \( \sqrt{5} \) unit long. Find the legs of the triangle. Write answers in simplest radical form. (2 points)
Find the following calculations. Give exact answers in simplified radical form. You may find it helpful to sketch out a 45-45-90 or 30-60-90 triangle. (1 point each)

1. \( \sin 45^\circ = \) ______________

2. \( \cos 45^\circ = \) ______________

3. \( \tan 45^\circ = \) ______________

4. \( \sin 60^\circ = \) ______________

5. \( \cos 60^\circ = \) ______________

6. \( \tan 60^\circ = \) ______________

7. \( \sin 30^\circ = \) ______________

8. \( \cos 30^\circ = \) ______________

9. \( \tan 30^\circ = \) ______________
Appendix I

Post-Mathematics Assessment Reflection Guides

GEOMETRY CHAPTER 7 SELF-REFLECTION
TO IDENTIFY STRENGTHS AND AREAS FOR IMPROVEMENT

Name: ____________________ Date: _____________ Period: ________

Please look at your corrected test and mark whether each problem is right or wrong. Then look at the problems you got wrong and decide if you setup the problem wrong, made a mistake in simplifying, made an algebra/arithmetic mistake (ex: did you add 5 to both sides of an equation, but you meant to subtract 5 from both sides), you didn’t know the vocabulary for the question, or you didn’t study/prepare for that concept.

For the questions you got wrong, choose a reason you got the question wrong.

Choose One:

<table>
<thead>
<tr>
<th>Problem #</th>
<th>Learning Target</th>
<th>Wrong</th>
<th>Error in Setup</th>
<th>Error in Simplifying</th>
<th>Algebra or Arithmetic Mistake</th>
<th>Vocab Mistake</th>
<th>I Didn’t Study This Concept</th>
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<td>1</td>
<td>Identify a translation</td>
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<td>Identify a reflection</td>
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<td>Identify a reflection in a coordinate plane</td>
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<td>Find the angle of rotation given two reflections over intersecting lines</td>
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<td>11-A</td>
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<td>Identify a translation in component form, given a vector</td>
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<td>Find the distance of translation given two reflections over parallel lines</td>
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<td>Identify lines of symmetry and rotational symmetry</td>
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<td>Construct a reflection over the y-axis in a coordinate plane</td>
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<td>Identify the translation given a vector</td>
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<td>24</td>
<td>Understands an isometry</td>
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<td>25</td>
<td>Identify lines of symmetry</td>
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<td>26</td>
<td>Identify rotational symmetry</td>
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<td>27</td>
<td>Identify an image given the angle of rotation</td>
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<td>Identify an image given the angle of rotation</td>
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SCALE:  4=EXCELLENT;  3=GOOD;  2=NEEDS IMPROVEMENT; 1=UNACCEPTABLE

A: EFFORT RUBRIC

4  I worked on all assignments/vocabulary in the chapter until they were completed. I pushed myself to continue working on the material even when difficulties arose or a solution was not immediately evident. I viewed difficulties that arose as opportunities to strengthen my understanding.

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Comment on your scoring of your EFFORT RUBRIC.

I am most proud of:  ________________________________________________________________
________________________________________________________________________________

I want to improve on:  ______________________________________________________________
________________________________________________________________________________

My goal for the end of the quarter is:  ______________________________________________
________________________________________________________________________________
B: ACHIEVEMENT RUBRIC

4  I exceeded the objectives within each lesson the chapter.
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Comment on the scoring of your ACHIEVEMENT RUBRIC.

Are you happy with your test? Why or why not?  ____________________________________________
_______________________________________________________________________

Did the pre-assessment reflection guide help you focus in on what to prepare for? Why or why not?
________________________________________________________________________

My strengths in this chapter are: ___________________________________________

My weaknesses in this chapter are: __________________________________________

GEOMETRY CHAPTER 8 SELF-REFLECTION
TO IDENTIFY STRENGTHS AND AREAS FOR IMPROVEMENT

Name: ____________________  Date: ____________  Period: ______

Please look at your corrected test and mark whether each problem is right or wrong. Then look at the problems you got wrong and decide if you setup the problem wrong, made a mistake in simplifying, made an algebra/arithmetic mistake (ex: did you add 5 to both sides of an equation, but you meant to subtract 5 from both sides), you didn’t know the vocabulary for the question, or you didn’t study/prepare for that concept.

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<td>1</td>
<td>Solve a proportion</td>
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<tr>
<td>2</td>
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<tr>
<td>3</td>
<td>Simplify a ratio</td>
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<td>4</td>
<td>Setup and simplify a ratio</td>
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<td>5</td>
<td>Setup and solve a proportion</td>
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<td>6</td>
<td>Setup and solve a proportion involving measurements in similar figures</td>
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<td>8</td>
<td>Use proportionality theorems to identify parallel lines</td>
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<tr>
<td>9-A</td>
<td>Use proportionality theorems to setup proportions</td>
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<tr>
<td>9-B</td>
<td>Use proportionality theorems to setup proportions</td>
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<tr>
<td>10</td>
<td>Use proportionality theorems to setup proportions and calculate segment lengths</td>
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<td>11</td>
<td>Use properties of proportions to find equivalent expressions</td>
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<td>12</td>
<td>Identify similar polygons (SAS~)</td>
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<td>14</td>
<td>Use proportionality theorems to setup proportions and calculate segment lengths</td>
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<td>15</td>
<td>Setup and solve a proportion</td>
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<tr>
<td>16-A</td>
<td>Identify different dilations (reduction)</td>
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<td>16-B</td>
<td>Identify the scale factor of two similar triangles</td>
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<tr>
<td>16-C</td>
<td>Identify similar polygons</td>
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<tr>
<td>16-D</td>
<td>Identify the scale factor of two similar triangles</td>
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<tr>
<td>17</td>
<td>Calculate the geometric mean of two numbers</td>
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<tr>
<td>18</td>
<td>Use proportionality theorems to setup proportions and calculate segment lengths</td>
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<tr>
<td>19</td>
<td>Draw a dilation given a scale factor</td>
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<tr>
<td>20</td>
<td>Identify the scale factor of a dilation</td>
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4=EXCELLENT; 3=GOOD; 2=NEEDS IMPROVEMENT; 1=UNACCEPTABLE

**A: EFFORT RUBRIC**

<table>
<thead>
<tr>
<th>Score</th>
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<tr>
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<td>I worked on all assignments/vocabulary in the chapter until they were completed. I pushed myself to continue working on the material even when difficulties arose or a solution was not immediately evident. I viewed difficulties that arose as opportunities to strengthen my understanding.</td>
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Comment on your scoring of your **EFFORT RUBRIC**.

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<tr>
<td>I am most proud of:</td>
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</tr>
<tr>
<td>I want to improve on:</td>
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GEOMETRY CHAPTER 9 SELF-REFLECTION
TO IDENTIFY STRENGTHS AND AREAS FOR IMPROVEMENT

Name: ____________________ Date: _____________ Period: ________

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<td>Setup and solve a geometric mean expression in a right triangle</td>
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<tr>
<td>2</td>
<td>Setup and solve an equation using Pythagorean's Theorem</td>
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<tr>
<td>3</td>
<td>Classify a triangle given 3 side lengths</td>
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<tr>
<td>4-A</td>
<td>Calculate the longer leg given the shorter leg in a 30-60-90 triangle</td>
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<tr>
<td>4-B</td>
<td>Calculate the hypotenuse given the short leg in a 30-60-90 triangle</td>
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<tr>
<td>4-C</td>
<td>Calculate the hypotenuse given the leg in a 45-45-90 triangle</td>
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<tr>
<td>5-A</td>
<td>Use inverse trig functions to find an acute angle measure in a right triangle</td>
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<td>5-D,E,F</td>
<td>Use Pythagorean’s Theorem to setup and solve for the missing side in a right triangle</td>
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<td>9-B</td>
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<td>10-A</td>
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<td>11-A</td>
<td>Setup a sine ratio</td>
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<tr>
<td>11-B</td>
<td>Setup a cosine ratio</td>
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<tr>
<td>11-C</td>
<td>Setup a tangent ratio</td>
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<td>12-B</td>
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<td>Calculate the length of the legs given the hypotenuse in a 45-45-90 triangle</td>
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<td>1-NC</td>
<td>Find the exact value of the sine of 45°</td>
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<td>2-NC</td>
<td>Find the exact value of the cosine of 45°</td>
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<td>3-NC</td>
<td>Find the exact value of the tangent of 45</td>
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<td>4-NC</td>
<td>Find the exact value of the sine of 60°</td>
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<td>5-NC</td>
<td>Find the exact value of the cosine of 60°</td>
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<td>6-NC</td>
<td>Find the exact value of the tangent of 60</td>
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<td>7-NC</td>
<td>Find the exact value of the sine of 30°</td>
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<td>8-NC</td>
<td>Find the exact value of the cosine of 30°</td>
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<tr>
<td>9-NC</td>
<td>Find the exact value of the tangent of 30</td>
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