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Student Perspective and Frequency of Mathematical Textbook Use

Lance Kruse
Bowling Green State University, lancek@bgsu.edu

STUDENT PERSPECTIVE AND FREQUENCY OF MATHEMATICAL TEXTBOOK USE

LANCE KRUSE

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Dr. Jonathan Bostic, School of Teaching and Learning, Advisor

Dr. Heath Diehl, Honors College, Advisor

The purpose of this action research study was to explore students' perspective and use of their mathematical textbook as a resource to learn mathematics. Participants were 18 students who attended an eighth grade mathematics class for 45 minutes each day in a suburban school setting. An initial survey was provided to participants to gauge perspective about current use of textbook as a resource and was then followed up with a focus group interview of six participants. Specifically designed instruction was aimed at creating a reader-centered learning environment by instructing participants about key components of the textbook and encouraging proper reading skills through guided notes. A second survey and focus group interview was held to determine if targeted instruction proved influential to the participants' views and textbook use. The results indicated that the targeted instruction proved beneficial for all participants by increasing textbook use, improving their comfort and confidence of reading and note taking, increasing the perspective of viewing the textbook as a resource, while decreasing the use of outside resources.

Introduction

Schools spend hundreds of thousands of dollars on textbooks, all aimed at improving student learning. However, what use is a textbook if students only use it for their homework assignment? It is no surprise that many students fall short of the expectations that teachers hold for their students in regards to the use of the textbook to aid in mathematical understanding and learning. Some educators blame textbook-centered models that do not fully account for student learning and comprehension but instead focus on memorization and regurgitation of information from the textbook on to paper (Weinberg and Weisner, 2004). Others believe that it is the type of textbook that impacts student learning (Post, Monson, Anderson, & Harwell, 2012; Reys & Reys, 2004). What is clear is that textbook use might be more impactful on students' academic achievement than the type of textbook (Tarr, J., Reys, R., Reys, B., Chavez, O., Shih, J., & Osterlind, S. 2008).

Teachers need strategies that promote beneficial textbook use and some strategies are more successful than others. This study's findings are not intended to generalize to all classrooms due to the small sample size of 18 students in one classroom at one school. The sample population is not a representative sample of the student population and therefore does not account for all differences including, but not limited to, race, religion, socioeconomic class, home life, prior learning, or personal issues/concerns. Also, due to the classroom setting that includes a student teacher and a cooperating mentor teacher (CMT) the results obtained in the study might be influenced by other outside uncontrollable factors. Nevertheless, the purpose of this study was to explore a unique instructional tool (i.e. guided notes) within a reader-centered environment. It was hypothesized that these two factors would increase students' perspective of and use of the textbook as a resource to aid in learning.

Literature Review

The purpose of this action research was to explore student's perspective towards and use of textbook as a resource to learn mathematics. It is important to understand various types of background knowledge such as the components and characteristics of United States textbooks currently used in the classroom, how teachers implement and utilize the textbook in the classroom, and previous research involving textbook use by students in the classroom. Throughout this study, the term "curriculum" will be used in reference to the textbook(s) used in the classroom. Graphic organizers, lesson plans, study aids, or other resources related to the textbook will be discussed as different components.

Background on Textbooks

School districts in the United States of America (hereafter U.S.) have a variety of types of textbooks to choose from to purchase for the classroom. Most school administrators do not ask for the effectiveness of the textbook during field tests, and as a result, developers do not field-test and revise new materials on the basis of evidence of effectiveness before publishing and distributing new textbooks (Reys, Reys, & Chavez, 2004). Additionally, the U.S. does not require mathematics textbooks to adhere to national standards, such as those set forth by the National Council Teachers of Mathematics (2000). Thus, the way in which mathematics content is organized and presented greatly varies between textbooks.

Table 1

Comparison of U.S. and International Mathematics Textbooks

	U.S. Mathematics Textbooks	International Mathematics Textbooks of High Achieving Countries (i.e. Singapore, Japan, etc.)
Average size of fourth-grade mathematics textbook	530 pages	170 pages
Average number of new topics introduced each year between fourth and eighth grade mathematics textbooks	1 – 2	6 – 7
Secondary mathematics textbook content presentation	Content is separated by grade level	Content is integrated throughout grade levels

U.S. textbook companies arrange mathematical content in a unique fashion compared to international textbook companies. As seen in Table 1, in comparison to textbooks from other countries where students excel in mathematics such as Japan and Singapore, U.S. textbooks are much bigger in size, contain more information and only introduce one to two new topics from one grade level to the next (Reys, Reys, & Chavez, 2004). U.S. textbooks also separate the different areas of mathematics (e.g., algebra content is separate from geometry and trigonometry) and as a result introduce only about one or two concepts per grade level (Reys, Reys, & Chavez, 2004). Other countries integrate different mathematical concepts throughout various grade levels (e.g. students learn algebra alongside geometry and trigonometry each year). Thus, six to eight new topics are explored in each grade level (Reys, Reys, & Chavez, 2004). Even though U.S. textbooks only introduce one to two new topics each year, they are still rather large due to the repeated information. This constant repetition of the same material “leads to shallow treatment of mathematics and fails to stimulate student interest or challenge student thinking” (Reys, Reys,

& Chavez, 2004, p. 63). The repetition found in U.S. textbooks might negatively impact how students view mathematics. Therefore, teachers ought to consider how to spark students' interest with available textbooks. Educators have noticed these differences between international textbooks and they are taking steps towards reworking the U.S. textbook to better meet the needs of the students.

Established Research

Reader-oriented theory. One way to improve student understanding of mathematical textbooks is through fostering a reader-centered learning atmosphere. An article by Weinberg and Weisner (2010), discusses how students can better understand mathematical textbooks through reader-oriented theory. The authors claim that many educators focus on reading as a process of decoding and duplicating technical information from the textbook. This means students' main role in reading mathematical texts is simply extracting information. However, some mathematics educators may view reading as a component of learning mathematics because they expect students to read their textbook to understand concepts, which makes the focus of extracting information at odds with most modern learning theories (Weinberg & Weisner, 2010). A major issue with textbooks is that when mathematics teachers read them, the explanations seem logical and well-written; however, when students read them, the explanations seem confusing (Weinberg & Weisner, 2010). Therefore, mathematics educators must structure their instructional methods in a way that addresses this confusion and aids in understanding of mathematics.

Reader-centered frameworks characterize reading as a meaning-making process and "encourages more thematic and critical responses" (Weinberg & Weisner, 2010, p. 56). At the other end of the continuum, some textbooks encourage students to passively accept the facts presented within them, which results in a text-based reading model. The authors stress the importance of a reader-centered model because they encourage students to raise questions, make connections, take new perspectives, and actively work out meanings with their peers (Weinberg & Weisner, 2010). Most research equates students' success at reading with their ability to translate mathematical language in order to extract information. However, this is at odds with most modern learning theories in which learners are taught to construct personal meanings with mathematical concepts (e.g., embodied cognition, situated learning, radical constructivism, etc.). Therefore, mathematics instruction ought to draw on reader-centered models to ensure students are responding to textbooks in a mathematically valid and appropriate manner. Readers continuously interact with the textbook and therefore obtain understanding of the reading; but not all understanding may advance mathematical understanding. Thus, instructors play an important role in developing reader-centered models to assist with proper textbook understanding to aid in mathematical understanding.

Reader-oriented theory has shaped the way in which the textbook was used in this study. The participants were engaged in a reader-centered model where they were asked to actively interact with the reading in the textbook through making personal connections, raising questions, and developing a personal understanding for the concepts. There was an effort to ensure that the intended reader, implied reader, and empirical reader all aligned in order to promote mathematical understanding and comprehension

Textbook effectiveness. The National Science Foundation (hereafter NSF) funded 13 projects to align mathematics classroom curriculum consistent with the NCTM standards of 1986 (Reys & Reys, 2007). Over the past 20 years, these textbooks have been implemented into various classrooms across the country in hopes to improve mathematical instruction; however, only 10-20 % of textbooks used in K-12 classrooms are these NSF-funded textbooks (Reys & Reys, 2007). Results of NSF-funded curriculum have been debated among the authors of various studies. The purpose of one study was to determine the effect NSF-funded textbooks versus commercially-developed textbooks had on post-secondary education student achievement in mathematics (Post, Monson, Andersen, & Harwell, 2012). The authors conducted five different studies through the Minnesota Achievement Project (MNMAP). MNMAP is a longitudinal research project that involved more than 16,000 students from 366 high schools who attended 32 four-year regional colleges and universities in the upper Midwest. All of these students graduated from a Minnesota high school and completed three or more years of college-intending high school mathematics (e.g. Algebra, Geometry, and Algebra 2). The three first-edition NSF-funded curricula was *Contemporary Mathematics in Context*, *Interactive Mathematics Projects*, and *Mathematics Modeling our World*. The commercially-funded curricula included textbooks from over 20 companies such as Laidlaw, Holt, Addison-Wesley, and Saxon. MNMAP used a quantitative approach to examine students' mathematical achievement who completed one of two different types of high school curricula; specifically NSF-funded curricula and commercially-developed curricula. The study measured student performance (i.e., level of difficulty, grades earned, number of courses completed) in eight semesters of college mathematics.

The MNMAP results supported the conclusion that there was no relationship between students' high school curriculum and their resulting level of mathematics difficulty or grades earned. As a result, the type of textbook used did not have any lasting effect on the students' academic career. Simply utilizing an NSF-funded textbook will not improve student achievement. A logical conclusion from these findings is that the manner in which the textbook is used within the classroom might be more important than the type of textbook.

A related research study was conducted to determine the effect that NSF-funded textbooks, commercially-funded textbooks, and the classroom environment had on student achievement. The study by Tarr et. al. (2008) differs from the MNMAP study by analyzing the classroom environment in addition to the type of textbook. While the findings of Post et. al. (2012) suggest that NSF-funded curriculum led to no post-secondary achievement differences, a large number of studies showed that NSF-funded curriculum materials influence teachers' decisions and actions.

This study took a sample of 2,533 students in sixth, seventh, and eighth grade mathematics classrooms from ten different schools of varying types. The researchers analyzed the learning environment in each classroom observed, determining if the teacher maintained a Standards Based Learning Environment (SBLE). SBLE refers to how well the teachers establish and maintain a learning environment consistent with the National Council Teachers of Mathematics (2000) Standards. The two tests used to determine student achievement was the TeraNova Survey (TNS) and the Balanced Assessment in Mathematics (BAM). The TNS is a measure of student performance on all five Content Standards (i.e., numbers and operations, algebra, geometry, measurement, and data analysis and probability), whereas the BAM is a measure of mathematical reasoning, problem solving, communication, as well as proficiency in skills and procedures.

The results show that the curriculum type alone was not a significant predictor of student achievement on the BAM or TNS, which is similar to the findings of Post et. al. (2012). However, when NSF-funded textbooks were used in a moderate to high SBLE, students had a statistically significant positive improvement on the BAM. There was no statistically significant impact of NSF-funded curriculum in classrooms with low SBLE on the BAM. Also, there was no significant impact of either curriculum with varying levels of SBLE on the TNS.

While there are many factors that could contribute to the success of students on the BAM and TNS, the authors took many precautions to ensure they were assessing the correct data. The researchers studied to what extent the textbooks were used by analyzing the frequency of textbook use by the teacher and students during instruction, frequency of textbook use for homework assignments, influence of textbook on lesson content and presentation, and the percentage of textbook covered. The authors note that the manner and frequency of textbook use did not differ with regards to NSF-funded textbooks or commercially-funded textbooks. Also, more frequent textbook use in the classroom did not result in a higher BAM or TNS score. However, NSF-funded curricula normally resulted in a higher SBLE whereas commercially-funded curricula resulted in a lower SBLE. Therefore, if teachers use NSF-funded curricula, then they are more likely to have a SBLE, which should result in greater learning in the BAM tested areas.

This study accounted for middle school students' achievement and it reaffirms that NSF-funded texts do not have a significant impact on student achievement. School achievement is more likely to be determined by the classroom environment. If a classroom has a high SBLE, then students are more likely to have better test scores. NSF-funded textbooks normally lead to a higher SBLE. If schools use NSF-funded textbooks then a SBLE might follow and thus improve student achievement. Nevertheless, even if a teacher uses a commercially-developed textbook, the teacher should encourage a SBLE and that could positively impact student achievement. The analysis of the Tarr et. al. (2008) study, encouraged this study to focus on manipulating the learning environment instead of the type of curriculum by using a reader-centered model.

Student achievement is important yet there are also other important outcomes to consider such as self-efficacy, self-concept, and interest in learning mathematics. Some educators focus on improving students' involvement with their textbooks through guided notes, assigned readings, and other assignments. An example of one way to get students involved in reading their mathematics textbook is through guided notes.

Note launchers. One calculus instructor created reading guides (i.e., *Note Launchers*) for each section covered in the textbook and shared them with students one day prior to covering the material in class (Helms & Helms, 2010). The Note Launchers had three different stages: (1) mostly fill-in-the-blank questions, very structure, very specific; (2) mixture of fill-in-the-blank and open-ended questions, mildly structured, allowed for more student input; (3) completely open-ended questions to allow for complete reliance upon the student to take accurate notes. It was hoped that these various stages would increase students' note-taking skills and increase their confidence related to reading mathematics textbooks. Surveys were given at mid-semester and at the end of the year.

According to the study, 50 to 60 percent of the students agreed or strongly agreed that *Note Launchers* helped them understand the lesson objectives and 76 percent agreed or strongly agreed that Note Launchers encouraged them to take notes in other classes (Helms & Helms, 2010). These results suggest that *Note Launchers* taught a transferable skill, by encouraging them to take notes in other classes. At the end of the year, 56 percent of the students agreed that the instructor should continue offering Note Launchers (Helms & Helms, 2010).

Offering some sort of guided notes could teach students the importance of reading their mathematics textbook by assisting the student in identifying, organizing, and understanding the mathematics content in the textbook. By providing guides along the way, the instructor can help the students utilize their textbook as a resource to learn mathematics.

Drawing upon this literature, the type of textbook (NSF-funded or commercially-funded) may not matter as much as some think, but instead it depends more on how the classroom environment is set up (with a high SBLE) or organized through a reader-centered model. This information shaped the current study. Specifically, the current study hypothesized that combining these two concepts (i.e. reader-centered model and guided notes) would improve participants' perception of the textbook as useful and their frequency of use.

Methodology

Participants

The participants of this study were 18 students from one eighth grade mathematics classroom in a suburban school setting. The class met every weekday for 45 minutes and was considered an advanced mathematics class. Eleven of the participants were female and seven were male. There was a diverse range of participants representing different socioeconomic and ethnicity backgrounds.

Procedure

Materials. Guided notes are a variation of the Note Launchers from Helms and Helms (2010). The notes were provided to all participants to use for note taking at home the day before the lesson. The first set of guided notes (see Appendix A) was quite structured in order to show participants how to identify important concepts in the textbook and how to make personal connections with the material. The second set of guided notes (see Appendix B) was less structured and contained more open-ended questions and prompts to encourage participants to adapt a reader-centered model where the participants raise questions, propose their own ideas, and make personal connections with the content. The goal was to encourage participants to understand the importance of partaking in a reader-centered learning environment by being actively engaged with the textbook and not passively accepting the facts. The participants' progression through the guided notes would ultimately prepare participants to use their textbook and take notes in future classes even if the instructor does not facilitate such requirements.

The participants utilized the Connected Mathematics 3 Program (CMP3) (Lappan, G., Phillips, E. D., Fey, J.T., & Friel, S. N., 2014). Connected Mathematics 3 Program is a student-centered and investigation-based textbook series that builds on the tradition of the Connected Mathematics Program materials. The textbooks do not contain in-depth explanations or sample problems. The curriculum focuses on student-centered approaches, various tactics, and the process of mathematical reasoning and problem-solving to fulfill the desired learning objective. The participants had been using the Connected Mathematics 3 Program for the past two years, that is, since the sixth grade.

Timeline. At the beginning of the school year in September 2014, a pre-survey was provided to all participants asking about their perspective towards using their mathematical textbook as a resource to understand and learn the mathematical content and their frequency of use. The instructor identified two participants who did not find their textbook useful and rarely used it, two participants who viewed their textbook as somewhat useful and moderately used it, and two participants who viewed their textbook as very useful and frequently used it. Interviews were then conducted with each participant asking them to personally explain how, why, and to what extent they used their textbook.

In February 2015, the instructor held one day of instruction in which the properties of the textbook were reviewed (i.e. glossary, chapter titles, index, etc.) as well as the characteristics of the textbook (i.e. boldface text, sample problems, and listed questions). This was intended to be helpful to the participants by aiding them in using their textbook as a resource to understand the content.

Following the textbook lesson, guided notes were then provided for two weeks (ten days of instruction) for participants to take home and utilize while reading the textbook for the next day's lesson. As described previously, the first two guided notes were more rigid and structured while the following guided notes were less rigid and more open-ended. This allowed participants to learn how to identify important information in the textbook while also making personal connections, which helped to create a reader-centered model for the participants. The completion of the guided notes was required and counted as a homework grade.

At the end of the two week period of guided notes, the participants took another survey to determine if the instruction and guided notes provided good reason to encourage participants to use their textbook as a resource to understand content. Additionally, the same six participants from the initial interviews were asked to participate in a final one-on-one interview to personally explain their opinion, rational, and perspective on using their textbook as a resource.

Data Collection and Analysis

The study utilized an explanatory mixed-methods design as suggested by Creswell (2012) where quantitative analysis is performed to gain an understanding of the results and is then followed up by qualitative analysis to interpret the results. All 18 participants completed a survey prior to the study and again two weeks after the study's onset. The pre-survey consisted of ten quantitative questions that measured the participants' frequency of and perspective towards using the mathematics textbook as a resource to learning. The participants rated to what degree they agreed with each statement by using the following rating scale: Strongly Agree, Agree, Neutral, Disagree, or Strongly Disagree. The responses were then associated a weighted point value in which “strongly agree” was scored as a five, “agree” was scored a four, “neutral” was scored a three, “disagree” was scored a two, and “strongly disagree” scored a one. Associating a score for each response allowed for a descriptive analysis to be conducted on the survey data (i.e. means, standard deviations, and significance). From the survey data, six participants were chosen for an interview following the pre-survey and again two weeks after the study’s onset. Two participants were selected for the interview who did not find their textbook useful and rarely used it, two participants were selected who found their textbook somewhat useful and moderately used it, and two participants were selected who found their textbook very useful and frequently used it. The interview allowed participants to elaborate on responses provided in the survey (i.e. reasoning for how frequently they use their textbook, in what ways they use it, their perspectives on the textbook, etc.). The interview questions that ask for elaboration and explanation were examined using a qualitative approach.

The interview transcripts were first analyzed using a *preliminary exploratory analysis*, which requires a general review of the data to obtain a basic understanding of the information, thinking about the structure of the data and noting areas that need more information (Creswell, 2012). After gaining a broad sense of the data, I immersed myself in the data to engage the *coding process*, which included a number of steps. The first step was to make sense out of text data by dividing it into text segments. Each text segment was then labeled with codes and the codes were examined for overlap and repetition. Lastly, similar codes were grouped together to create broad themes (Creswell, 2012). The concept of *lean coding* was utilized by only coding each interview with about ten codes in order to make the theming process easier (Creswell, 2012). After the entire text was coded, a list was made of all code words. The similar codes were grouped together, with redundant codes identified. Throughout the review of the data, fewer than 25 codes remained at the end the coding process. The data were then reviewed to find quotes and data that directly support these codes. At this point, the data were narrowed down into two or three themes by identifying the codes that the participants discussed most frequently, were unique or surprising, had the most supporting evidence, or were expected to be found in this study (Creswell, 2012). These themes will be discussed in detail below.

Additionally, the pre-survey results were compared to the post-survey survey by performing a paired-sample T-Test with a 90% confidence interval on items with more than 0.20 unit of change from pre-survey to post-survey to determine the statistical significance of the results. A 90% confidence interval was used since the proposed intervention may or may not impact the perspective and use of textbook within the relatively small sample population. Also, items with smaller than 0.20 of a change were unlikely to result with statistically significant results and thus were not analyzed. The post-interview responses were compared to the pre-interview responses to identify any change in perspective or behaviors. Additionally, the post-interview qualitative analysis was used to explain some aspects of the quantitative data, which allowed for a discussion on the effectiveness of the intervention.

Results

Quantitative Results

The results of the Pre-Survey are reported in Table 2 below indicating the mean and standard deviation for each response.

Table 2

Pre-Survey Results

Pre-Survey Questions	Mean	Standard Deviation
1. I always read my assigned reading for my mathematics textbook	3.67	0.84
2. I feel comfortable and confident while reading my mathematics textbook	3.44	1.04
3. I feel comfortable and confident when asked to take notes while reading my mathematics textbook	3.67	1.14
4. I view my mathematics textbook as a resource to understand the concepts we discuss in class	3.72	1.18
5. I try to look up the answer in my mathematics textbook when I have a question	3.33	1.03
6. I like my mathematics textbook	3.17	1.10
7. I find my mathematics textbook useful	4.00	0.97
8. I used resources other than my mathematics textbook to assist with understanding concepts from class	4.56	0.70
9. I ask questions in class if I cannot find the answer in the mathematics textbook	3.83	1.10
10. I have read my mathematics textbooks in previous classes.	3.17	1.38

The results of the pre-survey indicated a wide variety of uses and perspectives towards participants' mathematics textbook. Questions one through four directly addressed the purpose of this research project, which was to determine if the intervention caused positive change in participant use and perspective towards using their mathematical textbook as a resource to learning. The mean responses to the questions one through four were 3.67, 3.44, 3.67, and 3.72 respectively, which translated to being a descriptor between neutral and agree. This indicated participants sometimes read their mathematics textbook, felt somewhat comfortable and confident when asked to read and when asked to take notes, and somewhat viewed their textbook as a resource. While questions one through four directly addressed the purpose of this research, questions six, seven, and eight impacted the way participants responded to questions one through four.

The mean responses to questions six and seven were 3.17 and 4.00, respectively. This indicated participants only somewhat liked their textbook even though they found it useful. As a result, the mean response to question eight was 4.56 with the lowest standard deviation of 0.70. The results to question eight suggested that most of the participants were frequently utilizing outside resources (other than their textbook) to aid in understanding classroom concepts. The results of the pre-survey were then compared to those of the post-survey in order to identify the change in perspective and use of the textbook after the intervention.

The post-survey contained the same first nine questions, omitting the last question from the pre-survey for redundancy. The post-survey used the same rating system and weighted point value as the pre-survey. The results for the post-survey are in Table 3 below.

Table 3

Post-Survey Results

Post-Survey Questions	Mean	Standard Deviation
1. I always read my assigned reading for my mathematics textbook	3.83*	0.74*
2. I feel comfortable and confident while reading my mathematics textbook	3.78*	0.81*
3. I feel comfortable and confident when asked to take notes while reading my mathematics textbook	4.06*	0.74*
4. I view my mathematics textbook as a resource to understand the concepts we discuss in class	4.06*	0.73*
5. I try to look up the answer in my mathematics textbook when I have a question	3.39*	0.92*
6. I like my mathematics textbook	3.28*	1.02*
7. I find my mathematics textbook useful	3.83	0.74
8. I used resources other than my mathematics textbook to assist with understanding concepts from class	4.28	1.02
9. I ask questions in class if I cannot find the answer in the mathematics textbook	3.67*	1.24*

**Results had a higher mean response and a lower standard deviation in the post-survey data than in the pre-survey data.*

The results of the post-survey showed an increase in the mean responses as well as a decrease in the standard deviations for questions one, two, three, four, five, six, and nine. The increase of the mean responses and decrease of standard deviation indicated that participant responses were clustered more tightly around more frequently completing their assigned reading, feeling more comfortable and confident when asked to read and take notes, viewing their textbook as more of a resource, liking their textbook more, and increasing their questioning. On the other hand, the mean for question seven for the pre-survey was 4.00 and dropped to 3.83 for the post-survey, while the standard deviation decreased from 0.97 to 0.74, which indicated participants viewed their textbook as less useful and the participants agreed more with that response in the post-survey than in the pre-survey. The mean score for question eight dropped from 4.56 to 4.28 that indicated participants used outside resources less after the intervention. In order to better understand the change in participant perspective after the intervention, a paired-sample T-Test with 90% confidence interval was performed on items with more than 0.20 unit of a change from pre-survey to post-survey, which includes questions two, three, four, and eight.

The results of the paired-sample T-test with 90% confidence interval are in Table 4.

Table 4

Paired-Sample T-Test with 90% Confidence Interval

Pairs	90% Confidence Interval		t	df	Sig.
	Lower	Upper			(2-tailed)
Question 2	0.36194	0.86028	4.267	17	0.001
Question 3	0.18321	0.04221	3.289	17	0.004
Question 4	0.05206	0.61461	2.062	17	0.055
Question 8	0.04221	0.51334	2.051	17	0.056

Analyzing the results of the paired sample t-test indicated that the intervention had a statistically significant impact on how participants responded to questions two, three, four, and eight. These results suggest participants felt more comfortable and confident when asked to read and when asked to take notes about their mathematics textbook, viewed their textbook as more of a resource to understand concepts, as well as reduced their frequency of use of outside resources. To assist in understanding the differences in the pre-survey and the post-survey, qualitative data analysis was performed on the interview responses.

Qualitative Results

Six participants were interviewed before and after the intervention to provide insight regarding their responses on the survey. Two participants who displayed a high frequency of textbook use, two participants who displayed a medium frequency of textbook use, and two participants who displayed a low frequency of textbook use were asked to interview. After analyzing the pre-interview responses, a general theme emerged that suggests participants who displayed a high frequency of textbook use enjoyed reading and note taking, found the textbook enjoyable and useful, and utilized outside resources only if the textbook did not address their question. Participants who revealed a medium frequency of textbook use sometimes read, found the book difficult to understand, disliked taking notes, and viewed outside resources as more beneficial and useful than the textbook. Participants who revealed a low frequency of textbook use hardly read and disliked their textbook and only utilized outside resources to understand concepts. Broadly speaking, if participants viewed their textbook as a resource and utilized it for learning then they enjoyed it. If participants did not view their book as a resource and did not utilize it for learning, then they did not enjoy it.

The same six participants were interviewed after the intervention to determine any change in their perspective. All six participants showed the same trend: the guided notes increased frequency of reading, increased comfort and confidence when reading and taking notes, viewed the textbook as a better resource and as more useful, while decreasing the use of outside resources due to the increase use of the textbook. The general results of the interviews support the findings of the paired-sample T-Test that showed the study had a statistically significant impact on participants' comfort and confidence when reading and taking notes, perspective towards using their textbook as a resource, and the frequency of use of outside resources. Three main themes emerged from the interviews that helped explain the survey results.

The first theme is that the participants utilized outside resources less because they used their textbook and guided notes more frequently to aid in understanding classroom content. One participant said, "I was using outside resources less because I realized how much stuff was actually in the book since I actually read it. Before I didn't read the book as much so I just assumed it wasn't in there and I looked it up somewhere else." This participant specifically highlighted how the guided notes helped her recognize the important information in the textbook and how to utilize her book to guide her understanding of classroom concepts. Both the survey data and the interviews showed that participants were using their textbook more frequently. The increased use of textbook and guided notes impacted how participants viewed their textbook.

The second main theme is that participants viewed their textbook as more of a resource to aid in learning by recognizing the abundance of information in the textbook, learning how to identify important information, and also making sense of the information. One participant said, "I always used to read but the notes allowed me to go in more depth and find the more important information as well as supporting information." The participant claimed that the guided notes helped him make more meaningful connections with the textbook, therefore improving how useful he found his textbook. Some participants saw the guided notes and textbook as one in the same, which resulted in them claiming the guided notes made them like the textbook more and find it more useful. However, other participants viewed the guided notes and textbook as separate entities, which changed how useful and to what extent the participants liked their textbook.

The last main theme is that participants who viewed the guided notes separately from the textbook found the textbook to be less useful because the guided notes were a more direct, easier-to-understand, and overall better resource than the textbook. According to one participant, "The guided notes are much easier to understand than the textbook. The textbook is okay but the guided notes are better." This impacted how useful she found her textbook, "I found the textbook less useful because the guided notes were more useful." When deciding what makes the textbook useful, participants frequently referred to how well the book directly answered all of the questions in the guided notes. For example, one participant explained why she sometimes viewed the textbook as a good resource: "The textbook didn't always tell me everything so then I didn't see it as that great of a resource; but when it told me everything in the notes, I felt like it was more of a resource." According to this participant, if the book allowed her to answer everything on the notes, then it was a good resource and if it did not, then it was not a good resource. Another participant explains that "[The textbook] gave us broad answers but was not very specific" and therefore the participant said, "I liked the guided notes more because they were easy to look back at when I had a question." The participant claimed to the find the textbook less useful because her guided notes were easier to use as a reference when learning.

The separation of guided notes from the textbook caused some participants to rate the textbook as being less useful, which explains the decrease in mean response from pre-survey to post-survey.

Overall, the results suggested that the guided notes reduced the use of outside resources by increasing textbook use, improved participants' view of the textbook as a resource, and improved how useful participants found their textbook and/or guided notes.

Discussion

The main goal of this action research was to determine if creating a reader-centered learning environment would improve participants' perspective of and frequency of utilizing their mathematics textbook as a resource to learning mathematics. The results of the study indicated that the guided notes were successful at encouraging participants to more frequently complete their assigned reading, improve their view of the textbook as a resource, improve how useful they found their textbook, while decreasing their use of outside resources. It is important to note the curriculum used by the participants was not a "traditional U.S. textbook" as described by Reys, Reys, & Chavez (2004), but instead had many characteristics of the international textbooks used by high mathematics achieving countries. Also, due to the unique classroom environment of a student teacher and a CMT, there was a strict adherence to a high SBLE as mentioned by Tarr et. al (2008). All lessons, guided notes, and assessments were aligned with state learning standards. The guided notes were designed to promote a reader-centered learning environment as proposed by Weinberg and Weisner (2010) by requiring participants to make meaningful connections with the text, explain concepts from their own perspective, and provide unique examples and applications of concepts. Participants were also asked to identify questions they had about the text that were then used as the basis for a class discussion during the lesson. There were also unique characteristics of the study which acted as limitations to the findings of this study.

The largest limitation of this study is that there were only 18 participants from one eighth grade class in one suburban school. The sample population is not a representative sample of the general student population and therefore these results cannot be universally applied to all participants. Additionally, due to the relationship the researcher (classroom student teacher) had with the participants (students) the results of the survey and interview could be skewed. While participants were informed their feedback would in no way impact their classroom grade or studious image, some participants might have responded in a way to which they anticipated the researcher wanted. Participants were also uncomfortable with the idea of recording the interviews so interview notes were taken instead. Another significant limitation was the disposition and motivation participants possessed towards their learning.

As mentioned previously, this study aimed to create a reader-centered learning environment by providing guided notes that required participants to have meaningful interaction with the textbook. Participants were asked to make the mathematics make sense to them in their own way by writing definitions in their words, completing Frayer models, writing down unique examples, and proposing ideas on how to solve relevant but novel situations. Some participants struggled with fully completing the guided notes when the answers were not directly in the textbook. The majority of participants blamed the textbook for not being detailed enough and lacking direct explanations. Many of the participants did not maintain a positive disposition towards mathematics and/or towards their mathematical ability. In order to truly develop a reader-centered learning environment, the participants have to be actively engaged with the text and constantly be questioning, making connections, and rewording ideas from their own perspective. If participants are not motivated to apply this type of energy and work into the reading, guided notes, and class discussions, then a reader-centered learning environment is never established for those participants. This was the largest inhibitor towards the success of this action project and one that should be thoroughly considered for future studies.

If this study was to be replicated, then it is suggested that a larger sample population be used in order to more accurately assess the general student population. Additionally, the data collection should be changed by using a combination of quantitative and qualitative survey items. For each item on the survey that asks the participants to use a rating scale to identify to what degree they agree with the statement, there should then be a short answer question that allows the participants to write in their personal explanation for why they gave that response. This might be more comfortable for the participants instead of performing interviews and would also increase the number of qualitative responses to analyze. The duration of the study should also be reconsidered and perhaps extended so that participants have the opportunity to truly understand the idea of the guided notes and how to use them effectively. Providing more experiences with the guided notes over a longer period of time could allow participants to recognize the benefit of establishing a reader-oriented learning theory and make them proficient users of the guided notes. Increasing the duration of the study would also allow more time for the researcher to positively interact with the participants in a way that encourages a positive growth in their disposition towards mathematics and their mathematical ability. By encouraging participant responses that reflect a personal connection with the concepts, supporting collaborative work revolved around the participants' ideas, as well as engaging in meaningful discussions about their questions may assist in better establishing a reader-centered learning environment. Ultimately, a deep understanding of the sample population would be necessary to anticipate and provide intervention that would positively impact the participants' experience with a reader-centered learning environment.

This action research study notes the important concept that students can more frequently and more purposefully utilize their mathematics textbook in a manner that promotes the learning and understanding of mathematics. With class time never quite long enough or the increased need for using class time to tailor instructional supports, the idea that students can utilize their textbook and become somewhat responsible for their learning is an extremely valuable concept. Participants might need the correct scaffolding and learning environment in order to maximize their independent use of their textbook, but the investment can reap major rewards.

Summary

The purpose of this action research study was to explore participants' use of and perspective towards their mathematical textbook as a resource to learn mathematics. The initial survey was provided to participants to gauge perspective about current use of textbook as a resource and was then followed up with one-on-one interviews of six participants. A reader-centered learning environment was established by encouraging proper reading skills through guided notes. A second survey and set of one-on-one interviews were held to determine if targeted instruction proved influential to the participants' views on and use of textbook. The results indicated that the targeted instruction proved beneficial for all participants by increasing textbook use, improving their comfort and confidence of reading and note taking, improving the perspective of viewing the textbook as a resource, while decreasing the use of outside resources.

References

Creswell, J. (2012*). Educational research: Planning, conducting, and evaluating quantitative and qualitative research.* Boston, MA: Pearson

Helms, J. & Helms, K. (2010). Note launchers: Promoting active reading of mathematics textbooks. *Journal of college reading and learning, 41* (1), 109-119.

Lappan, G., Phillips, E. D., Fey, J.T., & Friel, S. N. (2014). *Looking for Pythagoras: Teacher's Guide.* Boston, MA: Pearson.

National Council Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author.

Post, T., Monson, D., Andersen, E., & Harwell, M. (2012). Integrated curricula and preparation for college mathematics. *Mathematics Teacher, 106,* 138-143.

Reys, B., Reys, R., & Chavez, O. (2004). Why mathematic textbooks matter. *Educational leadership, 61* (5), 61-66.

Tarr, J., Reys, R., Reys, B., Chavez, O., Shih, J., & Osterlind, S. (2008). The impact of middle-grades mathematics curriculum and the classroom learning environment on student achievement. *Journal for Research in Mathematics Education, 39*, 247-280.

Weinberg, A. & Weisner, E. (2010) Understanding mathematical textbooks through reader-oriented theory. *Educational studies in mathematics, 76,* 49-63.

Appendix A

Problem 2.2 Guided Notes

(1) The area of a square is the ___________________________ multiplied by itself.

(2) The formula for the area of the square is ________ or ________,

where *A* is ________ and *s* is ________.

(3) If you know the ________ of a square you can work backward to find the ________________.

(4) Write an example to demonstrate (3) above. What is a term that can be used to describe the answer to this example?

(5) Draw a diagram that goes along with the example provided above.

(6) In general, if ________ then *s* is a ________ of A. Give two examples to prove this statement.

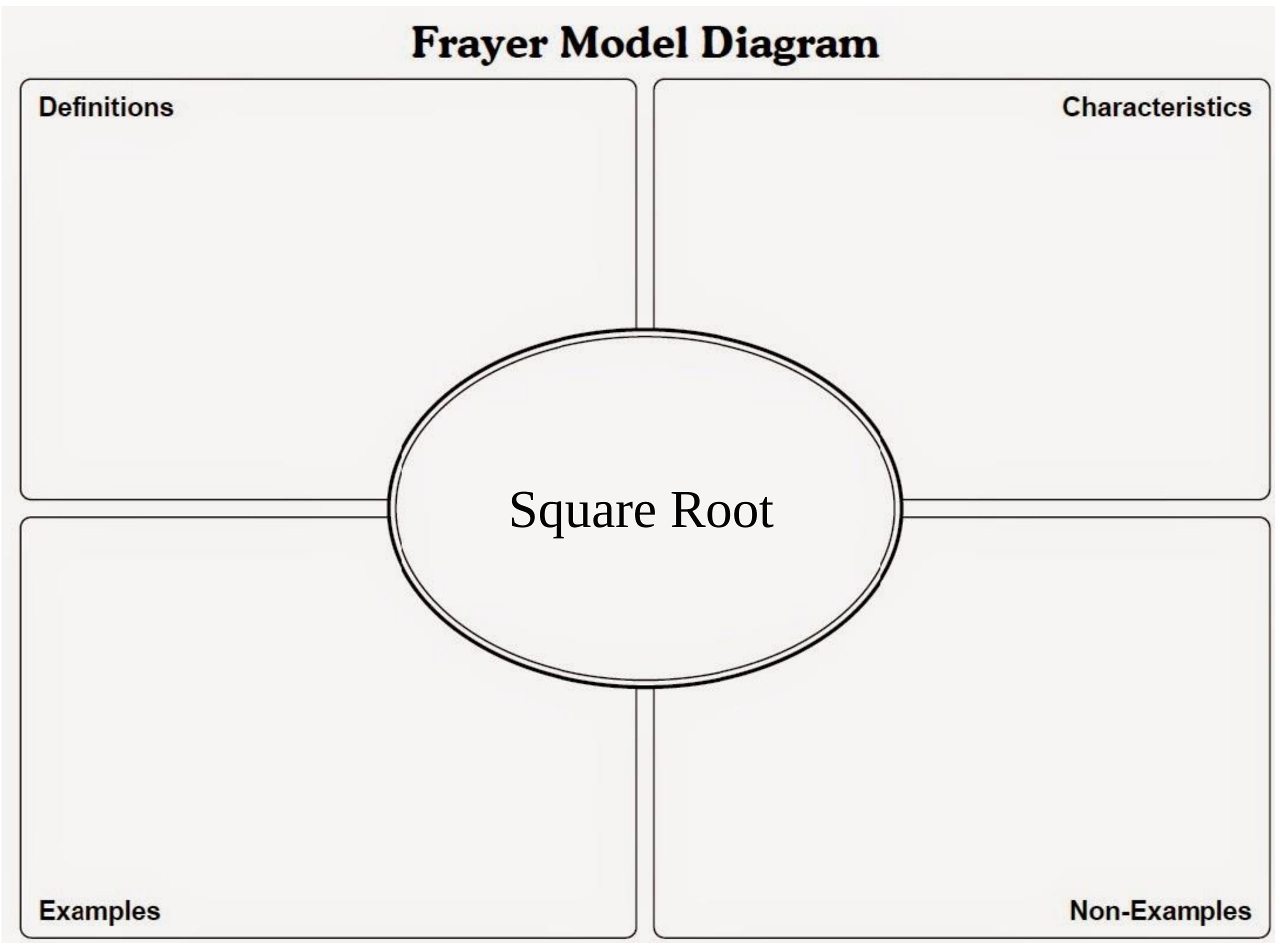
(7) How many square roots does a positive number have?

(8) How many square roots does 0 have?

(9) What symbol represents square root? Write two examples using this symbol.

(10) If you had to explain what "square root" is to a friend in your own words, what would you say?

(11) Complete the Frayer model below for "square root" with the following requirements:
"Definitions" include both the textbook definition and a definition in your own words;
"Characteristics" include as many thing as you can to describe square root;
"Examples" include the use of the square root symbol as well as positive and negative square roots;
"Non-examples" provide at least two and an explanation for why they are non-examples.

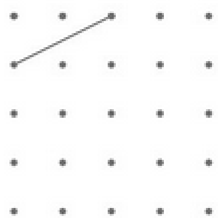


Appendix B

Problem 2.3 Guided Notes

(1) How can you find the length of a segment that is connecting two dots on a grid?

(2) Create a square using the line segment below as one of the sides.



(3) Does this match the square in the book? Should the two squares match? Explain.

(4) The book claims the area of the square is 5 square units. Verify this statement is true.

(5) How does knowing the area of the square help you find the length of the line segment?

(6) Draw your own line segment connecting any two dots on the grid below. Find the length of this line segment (show all your work).

(7) Write down two questions you have about this concept, This could include questions about what the textbook said, about concepts not mentioned by the textbook, or questions raised when solving certain problems.