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Holding Students Accountable

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Abstract

This action research study of approximately 90 high school algebra students investigates how frequent quizzing benefits them during the course of a semester. The intent of the research was to see how well students kept up with the material and if frequent quizzing helped them on the chapter tests. It was also designed to help me gain a better understanding of what students know and how I need to adjust daily routines so that all students stay caught up. I discovered that although frequent quizzes are not the students' favorite activity to take part in, they learn to accept the quizzes and benefit greatly because of the amount of information students learn from them. Holding students accountable with frequent quizzes forces students to stay caught up and pushes them to excel as many found the tests to be much easier because of the practice they received. My research revealed many advantages to holding students accountable through frequent quizzes and although it can be somewhat time consuming, it is definitely a practice that will be continued in my classroom for years to come.

Entering my fourth year in the profession, I continue to look for ways to improve my teaching. There are certain things I wish to fix because of dilemmas I currently face or things that I have witnessed in the past. One of the most frustrating parts of teaching is having students who lack the motivation to do the minimal amount of work required in order to pass a class. This phenomenon has intrigued me since my first year of teaching. During the spring of 2008, I designed my first graduate research project around strategies to help motivate students in my classroom (Fries, 2008). That research led me to start questioning my teaching practices and thinking about how or in what ways my students learn best. While my motivational research was very informative, I found that different people are motivated for different reasons. I found that my students were not motivated by some of the things I did as a classroom teacher. My first study led me to think of another possible way to motivate students to do well and that is through frequent quizzes.

Looking back through previous experiences, I found that if students are allowed to go at their own pace, they definitely will. I need to hold them accountable on a daily basis or many of them will only do enough to get by. Since I began teaching I have always weighted students grades based on categories and had quizzes count as 5% of their final grade, while tests made up 50%, homework 40%, and participation the remaining 5%. Through this system I have found that many students would put in minimal effort during much of the chapter and then put in a much stronger effort the day or two before the test. Those particular students maintained an acceptable grade, but how much were they actually remembering? I have never been a fan of graded pop quizzes and vowed to never give them. I have, however, given *practice* pop quizzes on occasion as a way to review material from the previous day. I like to think of my quizzes as a *practice* test before I give the actual test. I have always stressed this point to my students. Students should take the quiz and learn from it so they can do better on the actual test. I only

give one or two quizzes per chapter; this normally occurs about halfway through and at the end of the chapter.

This year, before beginning my action research project, I decided to change the test percentage from 50% to 40% and adjust the quiz percentage from 5% to 15%. I have already found this year that students are more prepared for the quizzes because of the added emphasis on the total grade. My overall goal is to improve the student retention rate of material because I think in the long run it will make my students better math students and improve their performance on state assessments.

In deciding upon a topic for this action research project, I spent time reflecting on my past experiences as a learner. I learned best when I was challenged and not allowed to just get by on a daily basis. I think this may be true for many learners as we have a tendency to put in a better effort, and in the long run remember more, if we are told we will be quizzed on the material. Reflecting on my learning experiences in high school or college, I recognized the teachers who quizzed or tested me frequently helped me to learn the material better because it was expected that I work hard to learn the material. I knew learning was something I was going to be held accountable for and so I did the work. Thus, I decided to focus this action research project on holding students accountable using daily quizzes.

My research took place in a Nebraska public school with approximately 500 students in grades nine through twelve. Fifty-five percent of the students were white and 40% were Hispanic. The classes used in my research included two periods of Algebra B and three periods of Algebra A. Algebra A and B are basic Algebra classes that are designed to take two years to complete instead of one. Algebra A is taken the first year and Algebra B is taken the second year. Thus, these classes go at a slower pace and cover the entire curriculum in two years rather than just one. The gender breakdown for the study used 50 males and 39 females. Forty-seven of the students were classified as being white, 37 as Hispanic, and five as other. Most of the

students were in the ninth or tenth grade. The students' overall GPA was 2.01 (C average) prior to the start of my study.

Problem Statement

I decided to research how frequent quizzing would change students because I thought it would help students retain information and play a significant role in helping me formatively assess where each student was in the learning process. As I began to investigate this topic last spring, I realized this research could have important implications on my teaching as well as my students' performance in my class. There are many benefits of frequent quizzing that go beyond just the formative assessment piece. Frequent quizzes can be used as an instructional tool and one way of doing that is giving a quiz at the beginning of the day to lead into the next topic or for a quick review of previous material. Frequent quizzes help to inform the teacher if topics need to be recovered or not. One can use frequent quizzes as a motivator for students to study and hold students more accountable for their learning. Frequent quizzes also can be used as a way for students to retain knowledge better. I also think it may help many students who do not do well on tests. Using frequent quizzes to put a little pressure on students may help to alleviate some of the panic or test anxiety many students face when they take the actual test. A frequent quiz may make the test more of a normal procedure rather than some big event. I also think this experience may reduce the level of stress my students feel when they take the state standard assessments in the spring.

My biggest concern with doing this project was time. What was going to be the amount of time required of me to successfully create, give, and grade quizzes on a daily basis? Yet, I considered this to only be a minor issue as I was sure I could find a routine to make this very time efficient. I was willing to sacrifice some time commitment to see what the results might show. The other issue that I was concerned about was how the students would respond to having to take frequent quizzes. Would they embrace this classroom routine or find it disturbing and

shut down their learning? Through this project I was confident I could collect enough data and hoped my findings would provide me with a new way to hold students accountable.

Literature Review

Testing has become a routine element in education since the government-mandated policy *No Child Left Behind* (NCLB) came in to place a few years back. It seems that students today must perform well on tests or there will be consequences. With the Nebraska State Legislature pushing for statewide testing, one can only assume that high stakes testing will be around for some time and only continue to grow. So how can teachers become more successful in having students retain information they have learned throughout the course of the year? One of the goals of educators is to prepare students well enough so that they may excel in the next class as well as on standardized tests. Educators want students to leave the classroom with a rich understanding of the topics encountered during the year. I believe many students simply just try to get by chapter to chapter and do not really see the big picture that teachers try to paint. This may explain why many students struggle with studying or taking semester exams. Many students cram and may not see future benefits of learning the material well. Since becoming a teacher I have contemplated implementing daily quizzes. I have not always been a fan of quizzes or tests, but the benefits of quizzing daily may have dramatic effects on the amount of information students will retain during the course of a year. With current research and the implementation of my own research plan, I think I can help others see a new perspective on classroom procedures that could help with student participation and performance.

In recent years, I and other teachers at my school have been reluctant to quiz too often because of students' dislike of such practices. As I read books and articles related to this theme, I tried to understand how these researchers conducted their study and how I could implement parts or generate my own plan for how this would fit in my classroom. I was excited to research frequent quizzing because it could be very promising in helping teachers change their daily

routine to model NCLB government legislation of students performing better in the classroom. Daily quizzes are most notably used to assess students; however, some research suggests quizzes can be used as an instructional tool (Azorlosa & Renner, 2006), a student motivator to study (Tuckman, 1998), a way for students to retain knowledge better (Karpicke & Roediger, 2007b), and to help reduce test anxiety (Connor-Greene, 2000).

Using frequent quizzes as an instructional tool

Merriam-Webster's online dictionary (2009) defines a quiz as a short oral or written test and the word frequent as resorting to often or habitually. Thus, for research purposes, I define frequent quizzes as short written tests that are taken often. Teachers may or may not choose to use frequent quizzes in their classroom, but some of the findings suggest there may be benefits to their instructional practices. Azorlosa and Renner (2006), who researched how announced quizzes can have an impact on exam performance, claimed that brief, frequently administered exams, or quizzes, serve many instructional purposes. Their study took place at West Chester University using four sections of Psychology of Learning classes. Azorlosa and Renner suggested announcing quizzes so students have an opportunity to study and learn more in the long run. Their quantitative study provided statistical results on attendance, hours studied, and percentages for questions asked on a questionnaire. Although it provided some good desirable effects on learning, the study did not, however, prove that using quizzes improved exam performance.

Starting the day off with a quiz also can pull students into the topic and get them connected to the day's lesson. The ease with which a teacher could incorporate quizzes into a course and the increased efficiency of students' time makes frequent quizzes an attractive tool for increasing students' learning (Narloch, Garbin, & Turnage, 2006). Narloch et al.'s (2006) experimental study used a control group. The study was performed using 162 students at a Midwest State University in which they were given a quiz as a way to promote initial

understanding of course material before it would be covered in class. The results showed that pre-lecture quizzes may be useful in improving students' performance and satisfaction.

Using quizzes at the beginning of a lesson can play two important roles, an introduction to new material, as just mentioned, or a review of previously learned material. Quizzes to introduce new material can be over an assigned reading given the previous day. This may help lead to a better understanding of the material after the lesson because students had an idea of what they would be learning that day. Quizzing at the beginning of the period also can take place over previously learned material. In a comparison to those findings from Azorlosa and Narloch, Connor-Greene (2000) reports that

> In using daily quizzes as the catalyst for class discussion, testing becomes a dynamic process rather than a statistical measure of student knowledge, and teaching and testing are no longer distinct entities. Assessment is an integral part of every class session, a central component of teaching rather than simply an evaluation of what has been learned. (p. 88)

Connor-Greene, a professor at Clemson University, looked at the blurring lines between teaching and testing. The study used both qualitative and quantitative methods, and comments were recorded once the study had been completed. Statistical measures were shown for various topics. Connor-Greene found student study behavior was strongly influenced by tests. She also commented that many teachers have always thought of teaching and testing as separate pieces to the education puzzle, but she suggested that they should not be distinct components. One of the final questions she posed in her conclusion was "Do our methods fit our goals?" (p.88). In terms of my own teaching, I expect students to leave my classroom having learned a lot, but if I only quiz and test them occasionally, my methods do not ensure me that they are obtaining the goals I have set for them. I can expect my students to study and learn the information, but until I know they are being held accountable, I am not sure that I am accomplishing my goals as a teacher.

Many teachers use quizzes and tests as a way to specifically assess learning, but research has shown that quizzes may produce learning also. Karpicke and Roediger (2007a) studied the effects on repeated trials of studying and testing in different series. Their research found that a test trial has much more impact on long-term retention than does a study trial. In their research Karpicke and Roediger carried out an experiment to test a previous hypothesis by E. Tulving in 1968 in which he stated that as much learning takes place from a test trial as it does from a study trial. Karpicke and Roediger found that most recent research suggests that test trials may actually create greater learning because of the familiarity with material and questions. In the experiment, they used 60 students divided into three groups and tested them on repeated trials. One group was a SSST trial (S for study and T for test), one group was a STST trial, and the last group was a STTT trial. This process was repeated for five cycles. Results from experiment one showed that the STTT group had better long-term retention at the end of the experiment, although alternating study and test trials may represent the optimal condition to enhance learning because of the feedback gained.

Most researchers agree that feedback is a must if quizzes are used as a tool for learning. Feedback in this case means either going over the quiz in class or giving students enough time to review their answers to the graded quiz. Another study by Karpicke and Roediger (2007b) related to expanding retrieval practices revealed that when tests are equally spaced out, providing feedback after each test counteracted the forgetting that occurred in the equally-spaced conditions and this allowed subjects to correct errors and learn from their mistakes. Klionsky (2008) commented in a letter to the editor in Life Sciences Education magazine that since he began using a quiz format, he has seen improvement in students' performance. He observed many students pull out their notes to see what they couldn't remember or to verify that their answers were correct once he had collected the quizzes. Klionsky now considers quizzing as one of the most important learning times for his students. He acknowledges that giving students a

few minutes for discussion about the problems with classmates after going over the quiz leads to a better understanding on their part. Sporer (2001), whose comments are in the quick fix section of College Teaching magazine, comments that feedback redirects her teaching efforts. She states, "Question review creates an ideal opportunity for students to teach one another. Peer tutoring increases student motivation, time on task, and active involvement" (p. 61). This makes one question how many teachers are missing out on the benefits of the peer tutoring that takes place as a result of going over the daily quizzes. McDaniel, Roediger, and McDermott (2007) researched ideas related to the testing effect and memory of certain literature pieces. Their intent was to experiment further with memory, learning, and retention. The results of their study suggest that it is important that initial tests include feedback. Even more important, their results suggest that testing in education should not be limited to an assessment role.

Many of the studies that involved using quizzes as an instructional tool were based on the same general idea that quizzes should not be used solely for determining how much one knows. The studies above had no intent of the quiz being used an assessing device. Instead, the approach looked at quizzes from an instructional stand point and that made these studies unique from the others. There were some differences in the studies based on what was actually researched. Some researchers looked specifically at attendance or engagement in the class because of the quizzes, while others focused on things like feedback from the quizzes. Overall, many of the aforementioned studies were performed on college students and it makes one question how this could change one's teaching practices and what the results would look like if frequent quizzes were implemented for high school students.

Using frequent quizzes as a motivational device

Using quizzes to hold students accountable for their learning was another idea that surfaced in the literature. Connor-Greene (2000), mentioned earlier regarding her study on blurring the line between teaching and testing which took place at Clemson University, stated

that “Students develop the study patterns in response to the demands of their classes” (p.84). Connor-Greene also stated that it may be necessary to modify one’s class structure to encourage students to develop the skills and habits necessary to learn the material. Results from questionnaires about student study behaviors and student perceptions showed that students tended to keep up because of the implementation of the quizzes. In fact, one student in the survey responded by saying:

> At first I almost dropped the class because the quiz idea did not sound good to me. I always procrastinate for everything so I thought this way of testing would hurt me. But it really helped me to stay up with the class and understand more. Keep it this way. (p. 87)

Other research cited that students kept up with course material because they were frequently quizzed. A study conducted by Wilder, Flood, and Stromness (2001), looked at how random extra-credit quizzes would lead to an increase in student attendance in an undergraduate setting. Each once-a-week random quiz was only worth two points and did not affect students’ final grades much, but results showed that 94% of students favored the extra-credit system. More significantly, 69% said they attended class more often because of the chance to obtain free points. Similarly, 53% of students reported they kept up with course readings because of the random-quiz implementation.

Results from Azorlosa and Renner (2006) showed that one of the primary reasons for frequent testing was to motivate students to study more on a regular basis. Results and surveys showed that students tended to study more if they knew about the quiz ahead of time. In fact, the percent of those who reported studying at least three hours or more per week was 80% for those who knew they would have a quiz, while it was only 38.9% for the group who did not expect a quiz. Student opinions showed that the quizzes helped them on exams; however, data showed no effect on exam performance between the two groups.

Research has shown a quiz can be used as a strategy to motivate students who procrastinate to study. Tuckman (1998) studied how to use quizzes as an incentive to motivate procrastinators to study. His research used 82 pre-service teachers in two sections during a six-week summer course. He implemented spot quizzes for readings that students were to have read over for the previous week for one group and designed homework outlines for the other group in which they were to extract meanings from the text. Students also completed a procrastination scale. Tuckman concluded:

> Spot quizzes, as an instruction intervention, motivated procrastinators to study continually over the entire course. They induced students to study on a daily or weekly basis, rather than postponing studying until the middle or end of the course. Moreover, completing homework assignments did not have the same impact on procrastinators as weekly spot quizzes did. (p. 145)

Research also suggests that procrastination is higher for students at younger age levels, where habits may be developing, and may be a critical developmental period for assessment and early intervention (DeRoma, Young, Mabrouk, Brannan, Hilleke, & Johnson, 2003). DeRoma et. al's study, titled Procrastination and Performance on Immediate and Delayed Quizzes, took place at a four-year military college and used 183 undergraduates in five introductory courses. The researchers not only examined student results on quizzes, but also reported students' on-and-off task behaviors and their responses to a procrastination survey. The on-and-off task behaviors were recorded by observers who randomly selected seats before class began. The observers recorded the student's behavior every 10 seconds with the cues being as on- or off-task. The research suggested that although an immediate quiz might promote active engagement in the lecture, no significance difference was found in the study.

Many of the studies that involved using quizzes as a motivational device revolved around the same basic principles. Researchers thought if they put the pressure on students to perform

well on quizzes, that this would hold them accountable for their learning and force them to spend more time with the material. For the most part, all of the studies were centered on this key idea, but different data was collected and each had its own way of determining how the quizzes were important for its participants. Once again, all of the studies were performed on college students and no high school or middle school students were studied, but one study did state that research on this topic would probably be better performed at younger ages because it is critical to mold younger students into good habits. The main differences between the studies were the ways in which they were conducted. One study looked at on- and off-task behaviors, wanting to know if a quiz would make students be more focused on the lecture, while others concentrated efforts on number of hours studied and comments from students on how well they kept up with the material because of the quizzes. Motivation has certainly become a road block for many teachers today, and it seems that daily quizzes may be a key factor to getting students headed down the right path.

Using frequent quizzes to help with retrieval process and increase retention rates

One of the biggest concerns for teachers is how to get students to become better students and build up a wealth of knowledge. Karpicke and Roediger (2007a) are two researchers who have studied extensively on repeated retrieval and retention rates. Together they likely carried out more research on this topic than most others. With each study, they collect better data and report more accurate results. They suggest,“Tests not only measure the contents of memory, they can also enhance learning and long-term retention” (p. 151). Their testing results showed that conditions with more frequent testing led to better long-term retention. This led to a conclusion that repeated retrieval of information is the key to enhancing later retention. They noted that repeated testing required subjects to practice retrieval, and thus practicing the skills necessary to recall items.

Much of Karpicke and Roediger's (2006) most recent focus have been on the so-called "testing effect." The testing effect is the phenomenon that if students are tested on material and successfully recall or recognize it, they will remember it better in the future than if they had not been tested. To put it more simply, the testing effect is basically learning by taking the test. McDaniel, Roediger, and McDermott (2007) have identified it by another name as well. They call it test-enhanced learning and their results showed that quizzes helped students to learn integrated concepts better. Much of the testing on retention leads to an understanding that repeated retrieval improves retention rates, but it seems there is still much more research to be done before all claims can be pinpointed.

It appears that repeated retrieval practices would have an impact on the retention rates of information, although much more work in this area is needed. Karpicke and Roediger seem to be two of the most recognizable researchers on this topic. When the effects of repeated retrieval on retention are fully explored, the results will provide excellent data for teachers and professors. Much of the current research found comes from Karpicke and Roediger, and thus most of the studies are similar in many ways. They have learned from previous studies to develop further studies that will hopefully shed new light on this topic in years to come. Teachers should focus some attention to the topic of repeated retrieval to help with retention as it may be the driving force behind learning in the years to come.

Using frequent quizzes to help reduce test anxiety

Daily quizzes may produce anxiety about a class in the beginning, but finding ways to alleviate the stress may be the key. Many researchers have noted that although there was much resistance and anxiety in the beginning, several of the students greatly appreciated what the quizzes did for their learning. Waite (2007) found many benefits to changing the way he teaches his classes. An associate professor at the University of Houston, Waite, uses online weekly quizzing to help assess and motivate his classes. His research, which provided both student

reactions to weekly online quizzes and student quiz data, offered some insights into how quizzing can be done online and noted the benefits it has provided him in his teaching:

> At first, students were less ecstatic about taking so many quizzes. However, those who had previous experience in my classes immediately saw the benefit and were ready for their exams. Within a semester, my students in other classes were clamoring for weekly online quizzes. Students even complained that other technology professors did not test weekly! (p. 18)

Connor-Greene's (2000) research echoed those same ideas:

> When I began using daily quizzes, students were initially resistant; several dropped the class because of the quizzes. However, the class appeared to adapt quickly, and both the quality and quantity of discussion seemed better than in any previous class I had taught. (p. 85)

It seems as though the more times students are tested over material, the more comfortable students become with it. Teachers who quiz on a daily routine help students alleviate some of the test anxiety they deal with as Sporer (2001) concludes:

> On the day of the real test, the no-fault quizzes have reduced students' anxiety because they have been studying regularly, they know the types of questions they will be asked, and they have learned from their mistakes. (p. 61)

It only appears that this would be the initial reaction as to why students might be able to combat test anxiety. The research mentioned previously represents just a few examples of how quizzes may help to alleviate test anxiety. In contrast to these ideas, Karpicke and Roediger (2006) commented that repeated studying and not repeated testing inflates students' confidence in their ability to remember things for future reference. However, they also noted that this was a self perceived prophesy because that type of studying did not actually prepare them for the test.

There is still much research to do on whether daily quizzes reduce test anxiety. One will probably never be able to eliminate test anxiety because of the nature of being human; yet by helping students becoming better prepared, teachers can help students increase their confidence going into the test, helping to reduce test anxiety. The research provided has suggested that students in each study were very hesitant to be in a class where daily or weekly quizzes were used, but once the studies were completed, it seemed apparent that students felt glad they were put through such a practice.

Literature Review Summary

I believe I obtained some valuable ideas from previous researchers that could lead me in my project. I really wanted to be able to just witness what students say, think, or feel about this new classroom procedure. I believe this was something that would reshape my teaching philosophy altogether and change the way I do things in my classroom. I personally liked the idea that using daily quizzes could help assist me in teaching new concepts and reviewing concepts from the previous day. I believe the more times teachers ask students to recall information, the more likely they will convert it to memory. Today, teachers need to hold students more accountable for their learning and accountability may come in the form of frequent quizzes because it will not allow students to procrastinate and put off studying.

I believe there are many positive results that came about by my review of relevant research. I am extremely excited to see how my project will change my classroom routine for the years to come. I think my research will offer some significant insights and lead to future studies in this area.

Purpose Statement

The purpose of this research project was to see if frequent quizzes helped students learn mathematics better and if it held them accountable for learning on a daily basis. In the past, I have had numerous students slide by on a daily basis and I thought that implementing frequent

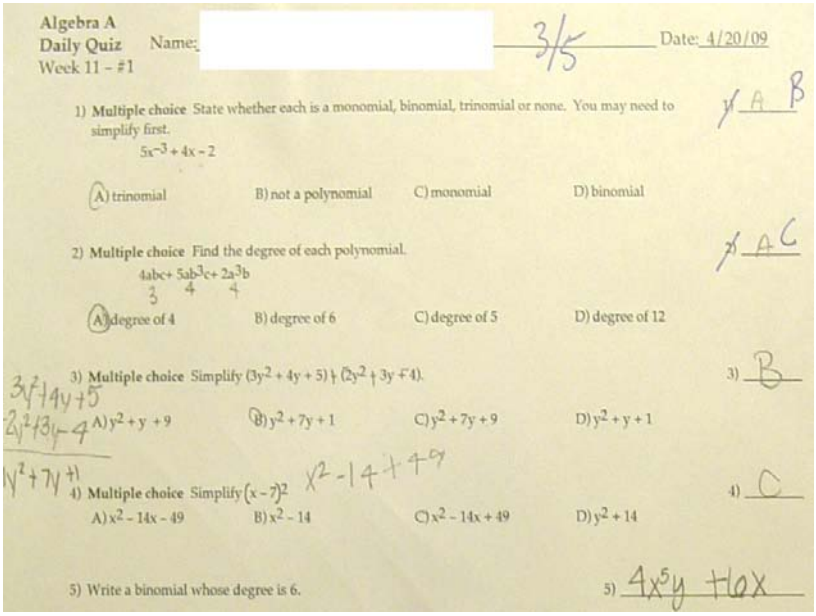
quizzes could help my teaching and students learning in many ways. An additional goal of the project was to help me as a teacher understand where the students were at in their learning and what things I needed to focus attention on during the teaching and learning process.

Through this research, I desire to better understand how students react to taking frequent quizzes, how they grow in their learning by taking frequent quizzes, and how I as a teacher benefit from giving and checking the frequent quizzes. The research questions I investigated are:

- What are the thoughts of students on frequent quizzes and do they think it better prepares them for chapter quizzes or tests?
- What happens to students' studying habits when they know they will be quizzed frequently?
- What happens to my mathematics teaching when I implement frequent quizzes as part of our daily routine and how does this help drive my instruction in the classroom?

Method

I used a number of different instruments to collect data during the second semester of the 2008-2009 school year consisted of a number of different instruments. To begin the research, I had to devise a plan for giving frequent quizzes. I decided to do this by creating all of the frequent quizzes using a test program called TestWorks on my computer. This allowed me to create a digital file of all the quizzes that I gave throughout the semester. A student example is shown to the right. The quizzes were given to students in two different courses, Algebra A and



Algebra A
Daily Quiz Name: 3/5 Date: 4/20/09
Week 11 – #1

1) **Multiple choice** State whether each is a monomial, binomial, trinomial or none. You may need to simplify first. A B
$5x^{-3} + 4x - 2$

(A) trinomial B) not a polynomial C) monomial D) binomial

2) **Multiple choice** Find the degree of each polynomial. A C
$4abc + 5ab^3c + 2a^3b$
3 4 4

(A) degree of 4 B) degree of 6 C) degree of 5 D) degree of 12

3) **Multiple choice** Simplify $(3y^2 + 4y + 5) + (2y^2 + 3y + 4)$. 3) B

A) $y^2 + y + 9$ B) $y^2 + 7y + 1$ C) $y^2 + 7y + 9$ D) $y^2 + y + 1$

4) **Multiple choice** Simplify $(x - 7)^2$ 4) C

A) $x^2 - 14x - 49$ B) $x^2 - 14$ C) $x^2 - 14x + 49$ D) $y^2 + 14$

5) Write a binomial whose degree is 6. 5) $4x^5y + 6x$

Algebra B. The Algebra A course consisted of three classes of approximately 55 total students, whereas the Algebra B course consisted of two classes of approximately 40 total students. All of the quizzes contained five questions that were printed from the test program and given to the students in a paper copy (Appendix A). I personally graded all of the quizzes and entered the daily results in a spreadsheet (see example below). I then entered the scores into the school grading program at the end of the week.

March 23 - 27th	Quiz 1	Quiz 2	Quiz 3	Week 2 Total
Period 1				
Student 1	4	2	4	10
Student 2	4	3	2	9
Student 3	3	x	x	3
Student 4	4	1	1	6
Student 5	5	4	5	14
Student 6	4	4	4	12
Student 7	5	x	x	5
Student 8	x	x	x	0
Student 9	4	2	2	8
Student 10	4	4	1	9
Student 11	3	3	5	11
Student 12	4	2	3	9
Student 13	4	3	3	10
Student 14	2	2	1.5	5.5
Student 15	5	6	3	14
Student 16	x	x	x	0
Student 17	5	4	5	14
Student 18	2	x	x	2

I intended to implement the quizzes for this research daily. I found this task much too difficult after the first few weeks because there was just too much to do. It took a great deal of time to create, grade, and find adequate time to fit 10 minutes into the agenda on a daily basis. Students were often rushed on a daily basis; a change was needed. Therefore, after the first few weeks the goal was to give at least three quizzes per week and thus the daily term has been used interchangeably with frequent in this research. This method of giving quizzes frequently and not daily seemed to fit well with the pace of this class because there was adequate time on days when two days were used to cover a lesson.

Chapter test scores were the second piece of data I collected (Appendix B). The Algebra A and Algebra B classes each took four chapter tests during the research time period which ran from February 2 to May 1. I used these scores solely for analyzing purposes to see if a student improved his or her scores after the frequent quizzes were implemented up until April 14. I also analyzed these after each group took the last chapter after the frequent quizzes were removed from the classroom routine. The test scores were used in conjunction with and to help triangulate other data including student comments made in student journals. I also used the test scores for instructional purposes because I wanted to see where students were at in their understanding. Since I thought daily quizzes benefited me in knowing where students were at, I decided to see if I could use quiz scores to predict what students would score on a chapter test (Appendix D).

I asked my students to write journals and self reflections following chapter tests (Appendix E). This constituted the third piece of data I collected during my study. Much of this data consisted of comments students made about questions regarding the daily quizzes and how those quizzes may have helped them on the test. Students also were encouraged to share concerns they faced or triumphs they had since the frequent quizzes were implemented. I stored these reflections in a binder and used them to triangulate data from the other sources.

The fourth piece of data collected included a pre- and post-survey that was given through an online feature with the use of Google docs. Students addressed questions on the pre-survey related to their thoughts and ideas about school in general as well as their initial thoughts of having to take frequent quizzes. This survey was given before the first daily quiz was ever assigned. On the post-survey, I include many of the same questions in addition to a few more that dealt with particular details regarding the frequent quizzes they had taken during the course of the semester. I again used student comments to triangulate other data I had collected. The pre- and post-surveys became a very important part of my research project as these surveys helped me see ideas and concerns from the beginning, as well as thoughts and comments at the end of

the research period. This particular piece of data offered a more personal level with data from everyone.

A fifth source of data consisted of student interviews that were conducted at the conclusion of the research project. I conducted interviews with four people who were randomly chosen by a fellow colleague who collected the consent forms from students. I gave the students a sheet to look over that included the questions I was going to ask them and had them make notes about these questions before we actually began the audio recording (Appendix F). This format allowed my students to know the questions I would be asking. I also was able to build off what they told me or what I heard to allow the interviews to flow smoothly.

The sixth and last data I collected were journals that I wrote on a weekly basis. I jotted brief notes when questions or concerns arose and used these to answer my predetermined weekly questions (Appendix G). I found much growth in these because I was able to analyze comments on a weekly basis and this allowed me to see the changes or growth that was taking place in my classes. Some of these journals included comments made by students that I remembered or comments made by a student aid from a local college who helped in my classroom. I also had a para-educator in one of my classes and a few of my journals included comments she made. The weekly journal proved to be another invaluable source of data because it helped spell out the storyline of what occurred over the semester.

Typical Day

During my action research project, the students in my class had a heightened awareness of what was taking place and I seemed to be better prepared because of the activities I had to get covered. Each class period lasted 50 minutes on a normal day in my school. I made a conscious effort to lay out my daily plan in a time schedule format because I knew I would need 10 minutes at the end of the period to administer the daily quizzes. The pace for the Algebra A and Algebra B classes used in this research project was slower than a normal Algebra class. A normal

Algebra class covers most of the material in a full school year. Students who follow the Algebra A and Algebra B path take two years to complete the one course and gain 20 high school credits towards their required 30 for graduation. Due to the slower pace, one section was usually covered in two days unless the section was fairly straightforward or has only a few concepts to master. If there are a number of different concepts in the section, two days were usually taken to cover it.

I have always tried to motivate the Algebra A and Algebra B classes more than my other classes. This has been a common practice in my young career, and I try to do this in a number of ways. A typical day does not always start the same way. On some days, I began a class period by offering up a story or advice on a topic that may be of interest to my students. This is usually math-related, but not always. A math example used this semester on March 14 was informing my students that it was "Pi" day and showing them an article about the significance of the day. A non-math example to begin the period may include something out of the bulletin I want to draw to their attention to or something I came across as interesting and want to share with them. A second way I began a class period was by telling my students to take out their previous day's assignment and answering a few questions they may have had. Sometimes this turned into working through a few problems together so everyone has a good understanding of what we did the previous day. The third and final way I usually began a typical day was by offering up a mind-trap question or brain teaser. Mind trap is a game that I use to get my students thinking for the day. Each question comes on its own card and an example would be something like "Find the multiplication of the following: $(X - A)\bullet(X - B)\bullet(X - C)\ldots..(X - Z)$". The answer is zero because there will be a term in there that is $(X - X)$, and zero times any number gives an answer of zero. The range of difficulty of these types of questions varied. Sometimes I used them to serve as our warm-up to begin the day.

Following the warm-up, I had a few options of how the class was to proceed. If we began

with a story or mind-trap question, I may have moved right into taking questions from the previous day's assignment or moving into the next lesson. If we just completed going over the previous assignment in the opening, I probably collected homework and graded on my own or we checked in class. I checked many papers on my own this semester to save us time for the frequent quizzes. If I decided to give students an extra day to complete the homework, we usually moved right into the next lesson. Once the lesson was complete, students were given time to work on their assignment until there were approximately 10 minutes left. The final 10 minutes were set aside for students to take the frequent quizzes and for us to go over them together in class before they left my room. The key and vital part to doing frequent quizzes was the immediate feedback students received after taking them. Since all the quizzes were made on a computer document, the quiz was displayed on the Smartboard so we could go over it when everyone was finished.

On a non-typical day, things likely would follow a different plan of action than the plan outlined previously. Non-typical days consisted of chapter quizzes, chapter reviews, or chapter tests. On chapter-quiz days, we usually went over the previous day's homework and then spent a short time reviewing as a class. I made sure to provide at least 30 minutes for students to complete the chapter quiz. The chapter quizzes were usually given about halfway through a chapter. Chapter-review days consisted of reviewing in some form, ranging from a whole-class powerpoint review to small groups of students working review problems at the dry erase marker boards. Chapter-test days consisted of asking students any last minute questions they had and then allowing them the remaining time to take the test.

The last key piece of information on a typical day was how the lessons were taught. I usually had three teaching methods or tools to present information to my students. The first method of presentation that I used with my students was through the notebook software that came with my Smartboard. I got my Smartboard at the beginning of the school year and had one

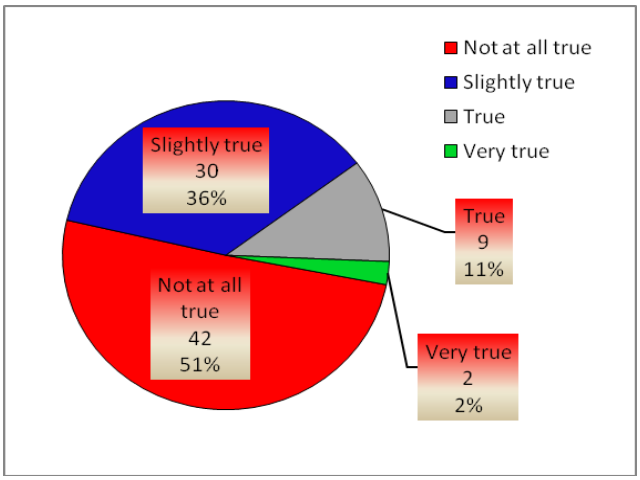
semester to learn and train myself with it before my research project began. The notebook software was very user-friendly and allowed me to display notes and examples to students. A lesson enhanced through the use of the notebook software was very captivating and usually caught a student's attention. My second method of presentation was through the use of a powerpoint. Students took notes about the key ideas that were presented in the beginning slides and then were able to write down some examples in the proceeding slides. Toward the end of the powerpoint, students had the opportunity to practice on their own and I sometimes had students come up to the Smartboard and do the practice problems. The other times we compared with neighbors or I went around and checked student work to make sure they were doing the problems correctly. The final method I used to present a lesson was by utilizing my dry erase marker boards in the front of my room. I used this method mostly if the material for the day was pretty straightforward, and I did not need the animation or graphics the other two methods provided. In this method, I wrote the notes and example problems on the board for students to write down before I allowed them to attempt problems on their own. I have found that these three methods allow for differentiated delivery of material and keep students focused better than doing the same routine daily.

Students dislike quizzes in the beginning

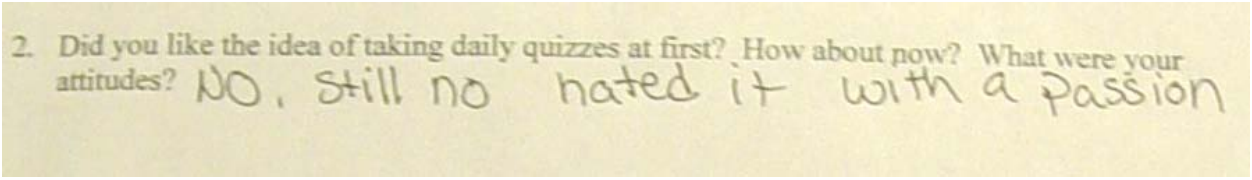
My first research question addressed the thoughts my students had about the frequent quizzes. *Do the quizzes help students or are they more or a hindrance?* I spent much of the semester collecting data from students to tap into their thoughts and ideas. The first and most overwhelming consensus I found was that students will resist the quizzes with a passion in the beginning. Anytime a routine is changed on students and the teacher tells students they are going to implement something different, there is nervousness. In this case, one can image the uproar that was created with the implementation of a stressful event like frequent quizzes. Pseudonyms will be used throughout the paper to conceal the identity of all students used in the research.

On a number of the pre-surveys, I got a response of “this is dumb” or “why do you want me to fail” and 87% of the students marked *not at all true* or *slightly true* when asked if they were glad they would be having daily quizzes.

I am glad that we will be having daily quizzes!



This means that only the remaining 13% marked *true* or *very true*. Given this data, it was expected that quizzes would not be a popular feature with this group. Some students were very adamant with their disgust that they often complained in the beginning. Beth commented in her student interview that she did not like the quizzes in the beginning or at the end because she wrote:


2. Did you like the idea of taking daily quizzes at first? How about now? What were your attitudes? NO, still no hated it with a passion

In a journal comment on February 13, in witnessing the anguish of students having to take daily quizzes I wrote:

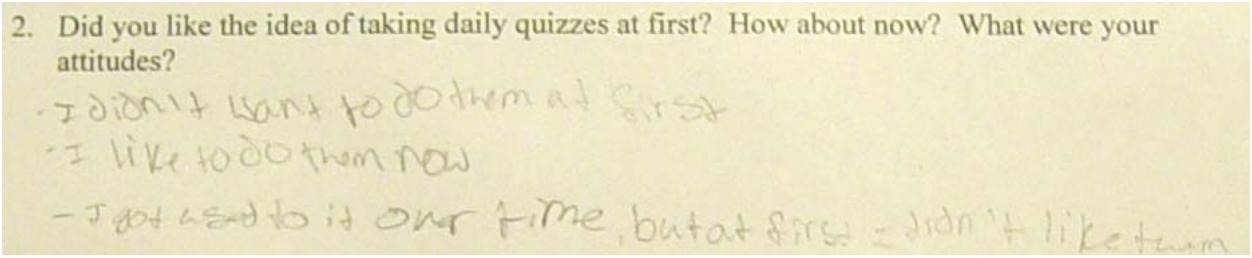
> Since implementing the quizzes two weeks ago, students have decided unanimously that the quiz idea is a big mistake. Many wonder if I have gone insane and want to know why I would implement such a thing. I have been trying to convince them that they will benefit from the quizzes and many totally disagree

> with me because they think the only thing the quizzes are doing is pulling their grade down (Feb. 13th).

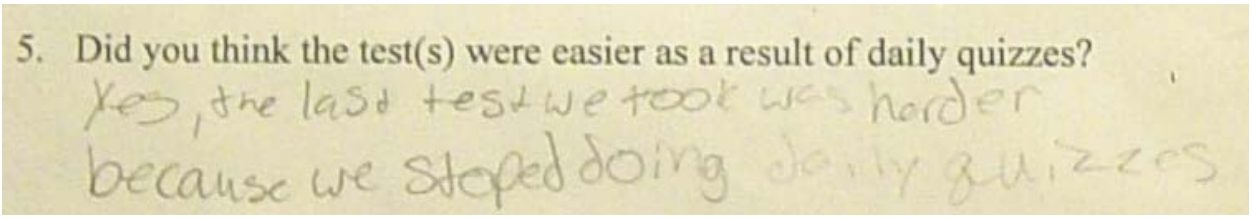
My frustration with my students in the beginning seemed to be quite overwhelming. I did not know how to proceed with the research knowing that I may be heading down a dead-end road. I remembered that some of the research I reviewed stated that students thought this was a bad idea in the beginning as well, so I decided to push forth with the daily quizzing in the hopes that students would eventually change their minds about the quizzes and learn to accept them.

Students learn to accept the quizzes for various reasons

During one of the student interviews, Emily wrote down the following comment about the idea of taking daily quizzes:

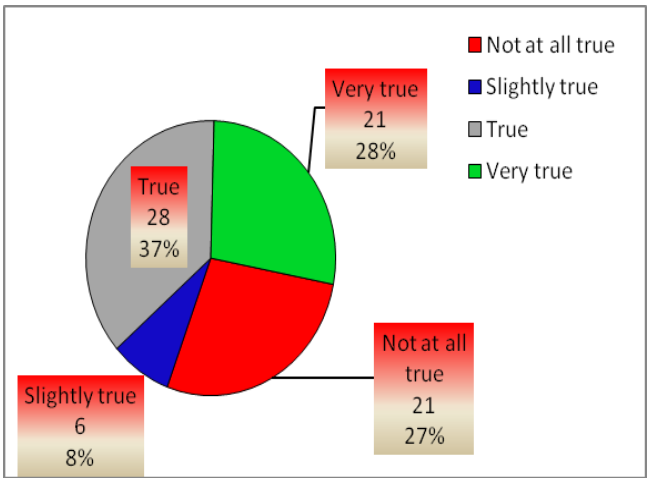

2. Did you like the idea of taking daily quizzes at first? How about now? What were your attitudes?
- I didn't want to do them at first
- I like to do them now
- I got used to it over time, but at first I didn't like them

Emily happened to a student who felt a great benefit to the quizzes because they helped her tremendously, even though she did not like the idea of taking quizzes in the beginning. She later went on to state the reason why she changed her mind about the quizzes becoming a positive thing for her with the following response:


5. Did you think the test(s) were easier as a result of daily quizzes?
Yes, the last test we took was harder because we stoped doing daily quizzes

Emily's response helped to see the benefits of the quizzes, and many students commented that they felt the quizzes helped them learn the material better and do better on the tests on the post-test. When given the post-survey, the 87% group who disliked quizzes in the pre-survey was reduced to 65%.

Math class was better when we didn't have to take a daily quiz.



Having a decrease in the number of people who disliked the quizzes is not surprising because there were more students who agreed with Emily. Julia felt a great benefit from the quizzes and also thought the quizzes played an important role in making the tests easier for her as she states on her chapter self evaluation on March 19:

4. Do you think daily quizzes helped you understand the chapter better? Explain why you think that.

[redacted] Yes, b/c I have got good grades on these so it makes the test feel [redacted] really easy.

5. Do you think the Daily Quizzes helped you on the test? If so, in what way. If not, why do you think it didn't.

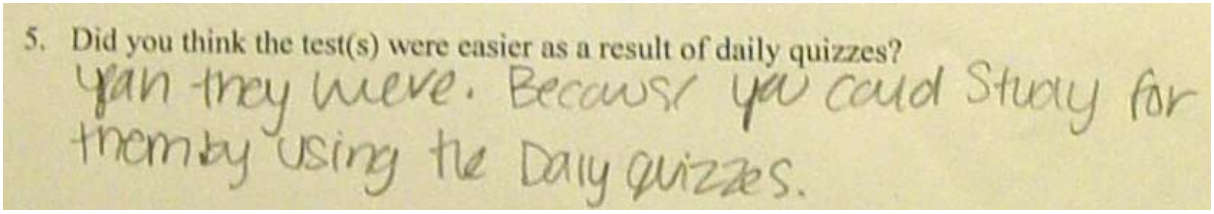
Yes, b/c on the things I didn't know were on the quizzes.

When asked if Julia would like to see the quizzes continued, Julia wrote:

6. Would you like to see the daily quizzes continued? Explain why you think that.

Yes, b/c I like getting good grades on them. They help out in the long [redacted] run.

All students with an A in my class commented that they liked the quizzes because the quizzes made the test easier for them. One student who did not have an A in my class, Jessica, wrote the following comment during her student interview:


5. Did you think the test(s) were easier as a result of daily quizzes?
Yan they were. Because you could study for them by using the Daily quizzes.

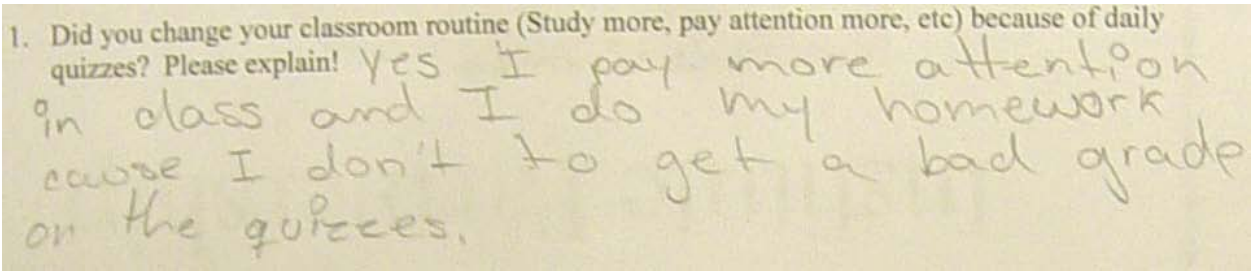
Thus, it appears that some students like the quizzes because it helped them prepare and do better on the chapter tests. In my weekly journal writing on March 13, in which I answered my question on what were the student attitudes for the week, I wrote:

> Many were excited after they found out their test score! Again those who put forth the effort and do the work absolutely enjoy the quizzes because they see a huge benefit from them. Others who seem to care less about their grade still hate the quizzes because they see it as a way to pull them down (March 13).

Some students liked the quizzes because it made them pay attention more. In one of my journals from April 19 I wrote:

> I've seen a number of students this semester who continue to get things done on time because they know they will be quizzed. In the last couple of weeks, I have made a concentrated effort to focus on students in general and have found that when I remind students of the daily quizzes that we will be taking, students tend to focus in more of the days lesson and ask questions about things because they want to make sure they are doing things correctly (April 19).

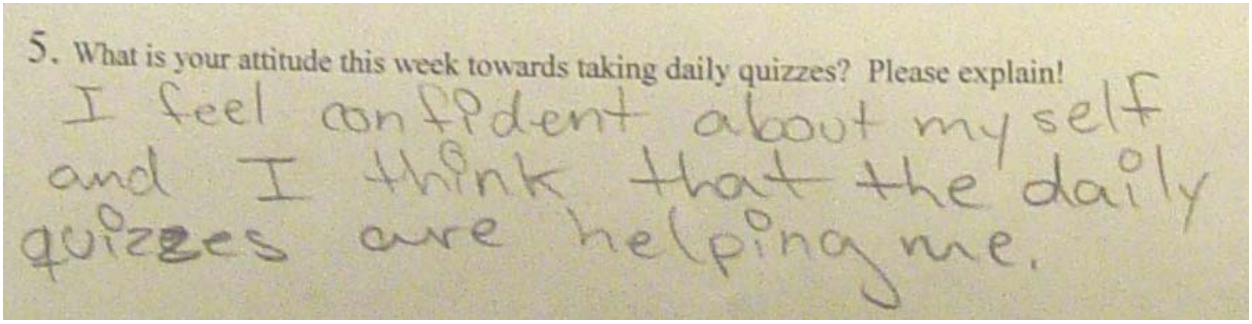
Some of the student journals back up this very idea as Amanda states in her student journal on April 17:


1. Did you change your classroom routine (Study more, pay attention more, etc) because of daily quizzes? Please explain! Yes I pay more attention in class and I do my homework cause I don't to get a bad grade on the quizzes.

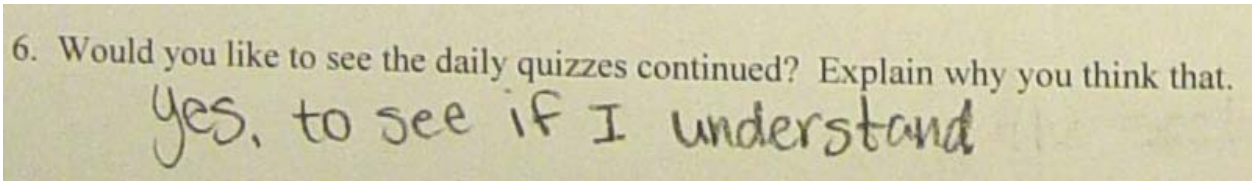
Many students commented that they liked doing the quizzes because it provided another way to know if they were doing things correctly. In one of my journals from April 3 I commented about how the students were performing:

> Students seem to be very open to the quizzes because of the fact they are getting tested at the end of the week. I think many felt the daily quizzes were a way to see how prepared they were for the test and they seemed to enjoy the extra review. Going over the quizzes in class I remember hearing a few remark "yes I got them all right" or "I still struggled with that type of problem" (April 3).

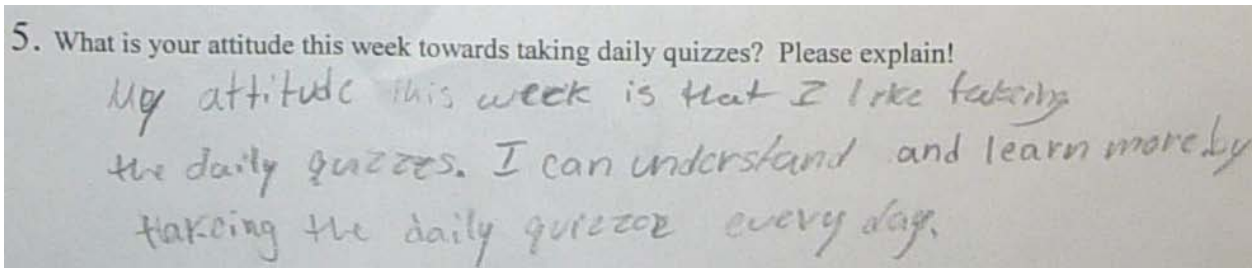
Amanda also commented in that same journal how the quizzes have made her more confident by stating:


5. What is your attitude this week towards taking daily quizzes? Please explain! I feel confident about myself and I think that the daily quizzes are helping me.

Pam was another student who echoed these same ideas in her student journal on April 17 when asked if she would like to see the daily quizzed continued:


6. Would you like to see the daily quizzes continued? Explain why you think that. yes, to see if I understand

Morgan followed Pam's response with a different question on the same student journal on April 17 with:


5. What is your attitude this week towards taking daily quizzes? Please explain!
My attitude this week is that I like taking the daily quizzes. I can understand and learn more by taking the daily quizzes every day.

Therefore, it appears that a number of students were using the frequent quizzes as their gauge to see what they knew well and what they needed to work on. This ultimately led them to knowing the chapter more and becoming better prepared for the chapter test. I made a note in my journal on March 13 with the following about how students were performing in class:

> When we reviewed for the last test I felt really good in one class because I felt the review was pointless. Most were bored because they already understood everything we were doing and so I think this was in part because of the daily quizzes allowing everyone to have a good understanding of the material (March 13).

I even had of a few students who actually asked if they could take the test the day after we took the chapter quiz because they felt they would be bored by reviewing. My journal comment from April 19 states:

> We took the quiz over section 9.1 – 9.5 and will spend a few days reviewing before taking the test and I actually had a few students ask if they could take the test today after the quiz. This tells me they feel they understand the material well because they've seen numerous examples of how they will be tested. This has occurred on more than one occasion this year and something I've never had in my four years of teaching. I guess the daily quizzing allows many of them to determine how prepared they are for the test (April 19).

The results were not the same for everyone as some students still continued to dislike the frequent quiz practice, but more students were seeing the benefits of the quizzes.

Throughout the research I had found that a number of students were using the quizzes as a way to build confidence and know if they were doing things correctly. I felt much of my research and final comments from students would be amplified if students had to go back to the old way of doing things in my class without the quizzes. I really did not want to go back and not give quizzes because I knew many were benefiting from them, but I wanted to see how students adjusted. Therefore, the last administered frequent quiz was on April 24 and all the classes had a test approximately two weeks later. The test scores and dates for all classes are listed in Appendix B. For analysis reasons here, I chose to just use the first period. The other classes seem to follow the same general characteristics. An examination of the table shows that the daily quizzes may have played a role in test scores because the scores for most students seemed to improve over time since the quizzes were first implemented. The characteristic that stands out the most is how student's test scores seemed to drop the most on the last test and this may be due to the fact that the quizzes were not given the last two weeks prior to the test. This seems to back Emily's earlier response of how the test seemed harder because she felt like she got behind or lost confidence that the quizzes provided. This argument of comparing test scores is only a generalization and a better study would be needed because

Period 1 – Algebra B Test Scores					
Test #	**1**	**2**	**3**	**4**	**5**
Date	**2/4/09**	**3/5/09**	**3/18/09**	**4/3/09**	**5/6/09**
Student 1	64	85	84	82.5	75.5
Student 2	68	88	82	62.5	64
Student 3	68	89	x	x	x
Student 4	73	95	76	91	40
Student 5	82	100	78	99	91
Student 6	92	99	98	95	98.5
Student 7	74	91	x	85	84.5
Student 8	64	84	76	91	87
Student 9	82	100	80	86	69.5
Student 10	70	83	80	75	69
Student 11	93.5	92	92	92.5	88
Student 12	89.5	92	92	91	74.5
Student 13	89.5	99	98	92.5	95
Student 14	89.5	96	92	94	92
Student 15	82	95	94	95	87
Student 16	86	97	92	89	75.5
Student 17	96	100	100	102	100
Student 18	82	81	80	85	65.5

each test was different and so the chapters could have been easier or harder. But the generalization that the quizzes had an effect probably is a good assumption here because of the comments made by students. In my journal on May 1 when I responded to a question on what I learned for the week, I wrote:

> I think the biggest thing I learned this week is that more students were using the quizzes to help them keep up than I thought. I was surprised by the number of people who mentioned "How am I supposed to know if I am doing things correctly" or "What am I supposed to use to study" in which I had to elaborate on all of the other things we do that they can use to make sure they are doing things correctly or to help them study for the test (May 1).

About 30 students, a group primarily composed of higher achieving students, answered the post-survey questions with *true* or *very true* for the following questions:

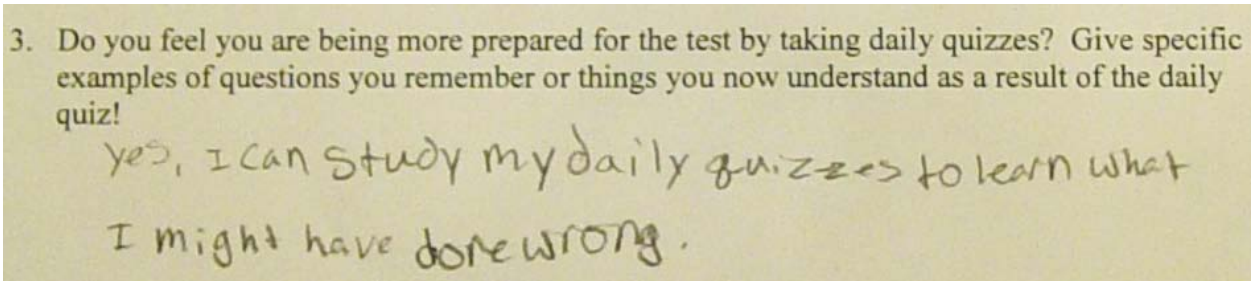
- Taking the daily quizzes made me a better test taker.
- I feel I did better in class because I was quizzed daily and was held accountable for doing the work.
- I thought the daily quizzes helped me to correct mistakes I made.
- I feel I understood the material better because of the daily quizzes.
- I felt better prepared for tests because I was quizzed daily.
- I did better on tests because we were taking daily quizzes.
- I would recommend having daily quizzes in other subjects as well.

It is not surprising that the students who answered this way are the stronger students. The students who were doing better in school overall thought the frequent quizzes were very helpful to their learning in a number of ways. They went against their initial idea about quizzes being a bad thing and concluded that the quizzes turned out to be a great benefit.

In conclusion, I found that almost all of the students thought daily quizzes were a bad idea at first. But through the project I carried out, I learned that if I develop the quiz questions around homework questions and like the test questions, many students will see positive benefits to having the extra practice. Undoubtedly, some students will continue to not like the quizzes and think of them as a type of punishment and a way to pull their grade down. The other students who took the class and their grade seriously found a major benefit to the quizzes as outlined earlier. I liked the daily quizzes because it accomplishes many things that we as teachers try to do. It pushes students to work a little harder and make the most of the learning opportunities they have. The quizzes also help to hold students accountable and may help them to retain more information for future use. The students who want to learn and become better students will appreciate them because the quizzes seemed to make tests and homework easier for them.

Student studying habits change little

One of my goals of using frequent quizzes was to see if students would study more because of the implementation of quizzes. Through my research I found only a few students who changed their study habits. I believe there were two reasons for seeing no change in student study habits. The first reason was that most of the students just took the quizzes and used that to determine how well they knew the chapter we were working on. They considered the frequent quizzes as another way of practicing problems and felt it was enough for them to know if they were doing things well or not. Thus, no other studying was needed if they were doing things correctly. The other reason was because some students just did not seem to care that much and did not choose to start studying just because I implemented frequent quizzes. The few students who changed their study habits did so because of a comment like Ann's in which she says:


3. Do you feel you are being more prepared for the test by taking daily quizzes? Give specific examples of questions you remember or things you now understand as a result of the daily quiz!

yes, I can study my daily quizzes to learn what I might have done wrong.

The few students like Ann realized how the frequent quizzes and test questions kind of related and how the frequent quizzes were a nice complement to the other review material they had. Overall, there was not enough evidence to prove that implementing frequent quizzes caused students to study more.

I have a better understanding of student's ability

The last research question I hoped to answer was how implementing frequent quizzes changed me as a teacher. This semester supplied me with a remarkable insight on how to improve my teaching for my students. There were two big ideas that developed from the research I performed. The first and most helpful tool the frequent quizzes provided was that it allowed me to better understand the ability of my students. I saw much growth throughout the semester by both my students and myself. I learned more about my teaching this quarter than I probably ever have in my first four years because the focus was definitely on what the students knew and what they did not know. Giving and checking students' quizzes on a frequent basis allowed me to understand where each student truly was at with the topics they had learned. I stated in my journal on April 19:

> My teaching has taken great strides because I feel more knowledgeable about my students. It is weird because checking the quizzes on my own has allowed me to pinpoint the students who know what they are doing and those who need help. I get to see how students are thinking on a daily basis now, when before I could be clueless on some of them because they could get by on homework assignments. It

> is now like I check each student daily and know exactly where they are at in understanding the chapter (April 19).

Throughout this semester I slowly began to understand what I knew about each student's ability and how this changed me as a teacher. In the past I would try to judge what a student knew through homework assignments and daily practice we did in class. I now realize this provided very little insight into how much I knew about a student's ability. Before the research began, the only checking I did with students was the brief understanding of the lesson we were covering that day. Some students could inevitably get by on homework assignments and make me think they understood the chapter material, but the frequent quizzes helped me to see what the students actually knew and why frequent quizzes need to be implemented and hold students accountable.

On one of the last chapter tests the students took, I was feeling pretty confident of knowing their ability that I decided that I would try to predict what they would score on the test (Appendix C). Therefore, I predicted a score for each student and it turns out that I was able to predict 2 of the 80 test scores exactly and I was within 2 percent on 22 out of the 80 students. I was also within 5 percent of the test scores 40 out of 80 or half the time. The results did not show great numbers, but my ability to even think I could predict test scores stemmed from giving frequent quizzes and being more knowledgeable about what each student knew heading into the chapter test. More research is needed to say if frequent quizzes help teachers predict student test scores, but the idea in this research was that I tried it because I felt much more knowledgeable about my students because of the implementation of the frequent quizzes. A study directly on this topic would have to be implemented to tell how much more knowledgeable of students teachers are based on the idea of giving frequent quizzes.

I can catch mistakes and change lesson plans

Another major advantage I learned from the research project besides being able to better understand my students abilities was the fact that I was able to catch and fix many mistakes that

students made. Checking the quizzes myself allowed me the opportunity to see what concepts students struggled with the most and provided me with the feedback I needed to take action on correcting the mistakes. In my journal on April 19 I comment with:

> Looking at my notes and comments, I feel I know much more about where each student is at in terms of their learning. By giving them a daily quiz and checking these myself, I know the students who are struggling and those who are not. This allows me to focus attention on those that need it and try to get them to understanding the material. Doing this on a daily basis has really given me a better understanding of how everyone learns at a different pace and how some may need a little more time on different topics (April 19).

If a concept was missed repeatedly, I made sure to revisit it the next day and clarify the confusion or mistakes that were made. Sometimes I built the next quiz around the missed concept so students had a chance to work on things they had problems with. An example of a problem I encountered this semester was the topic of subtracting polynomials and an example of a quiz question is below.

3) **Multiple choice** Simplify $(3y^2 + 4y + 5) - (2y^2 - 3y + 4)$.

A) $y^2 + y + 9$ B) $y^2 + 7y + 1$ C) $y^2 + 7y + 9$ D) $y^2 + y + 1$

My notes in my journal about fixing misunderstandings like this one contained the following:

> A few students kept getting the subtraction of polynomial problems wrong, so I revisited the topic on a couple of occasions. I made sure to implement at least one of these types of problems on the proceeding quizzes so students had a chance to work on their misunderstandings. Most of the students who did not distribute the negative sign have finally made the adjustment (April 19).

Almost all of the students corrected this mistake and got this type of problem right on the next quiz. This type of identifying and correcting from a teachers standpoint is very powerful and helps students tremendously because it allows them to learn correctly and not be confused.

Using an electronic document and Smartboard helped to correct many of the mistakes students made and is one of the key components to the research. After students were done taking their quiz, I displayed the quiz on my Smartboard and we would go over the answers. This immediate feedback is a vital part of the research and allows students to correct any misunderstandings minutes after they were quizzed. Too often students turn in homework or take quizzes or test with the intent that they did everything correctly and so if these answers are not provided right away, the student will not know they actually did the problems wrong.

Conclusions

My research is consistent with the research I reviewed in that frequent quizzes, when implemented with a goal, can serve many purposes. The first purpose is that it allows students and teachers to correct mistakes. Immediate feedback is a must if students are to learn from their mistakes just as Klionsky (2008), Sporer (2001), and McDaniel, et al. (2007) have stated in their work. Another purpose of quizzes is to motivate students to study and do better and Connor-Greene (2000), Wilder, et al. (2001), Azorlosa and Renner (2006), and Tuckman (2008) have stated that quizzes can be an effective tool to motivate students. I did not find this very convincing in my research as part of the contradiction here is that many of these researchers are working with college students who have a desire to succeed because they are paying for the class and my research includes high school freshman and sophomores who sometimes could care less about their grades. For some of my students an alternate method of motivation would need to be put in place because frequent quizzes did not do the trick.

A third purpose of quizzes was to increase the retention rate of material and I would say Karpicke and Roediger (2006) have their research headed down the right path. Many of my

students became more efficient at recalling information on a daily basis. Students commented that tests became easier because they were familiar with the types of questions they were going to be asked. Karpicke and Roediger should continue their efforts on the retention of material and implement their studies at lower levels instead of at the college level only.

A fourth and final purpose I would agree with is the idea that students will oppose taking daily quizzes in the beginning, but eventually think it helps them reduce some test anxiety. Waite (2007), Connor-Greene (2000), and Sporer (2001) all noted that students showed strong opposition to the quizzes in the beginning, but really embraced the idea at the end of the semester. I found this true with many of my students who wanted to do well in my class. Connor-Greene mentioned how the quality and quantity of discussion seemed better and I agree that students took a more active approach to their learning and the classroom seemed more of a learning environment this semester.

The research I carried out convinces me that I need to continue trying to hold students accountable in some form. Providing immediate feedback and understanding what students actually know can be valuable tools in the education process. Having students recall information on an almost daily basis helps many students convert this to memory. My students had the opportunity to earn extra credit at the end of my year in my class by typing a paper summarizing things they learned, what they like or disliked about the class, what they will remember the most, or another topic they would like to share with me about the year. One of the students I interviewed decided to write a paragraph on the frequent quizzes and she states:

> Daily quizzes were a great idea. I have to admit that I really did not like the idea whatsoever. The thought of having a quiz every day was crazy, but after I got used to taking them they were not that bad as I thought they were going to be. Actually we noticed when we would not have a daily quiz it was weird for us. We were expecting to have one every day. The daily quizzes help me with studying

> for quizzes and tests. It is a good thing that we got to go over what we learned every day. It was just like a review, a daily review basically. The quizzes have made me pay more attention in class than I used to before we started taking them. Before the quizzes, I would talk to my friends and pretend like I was paying attention. Now that we have been taking quizzes more often, I do not talk as much and pay attention when you are teaching. From taking the quizzes it has helped me with my test anxiety. I do not have it any more in Algebra, but I still do have it in the rest of my classes. I do not have the anxiety anymore because I know what I am doing and we go over it every day in class so it is just like stuck in my head. You can also study from the daily quizzes which are basically like questions on the test (May 15).

The research has reminded me that every student who enters my classroom is important and I need to make sure they are making the most of their opportunities. I had a more heightened concern this semester on whether I thought someone would be able to pass the next class because I truly understood each one's ability more than I ever have. In the past it seems that I looked at my classes from a big picture perspective and this semester the frequent quizzes have forced me to look at each student's individual picture. This focus will help me to make more students successful in my classes in the years to come.

Implications

As a result of this study, I can definitely tell that frequent quizzes will be used in my classroom for some time to come. I learned so much as a teacher by administering frequent quizzes that I will have to find a way to keep them implemented. I need to make sure I tie the quizzes into a students' grade somehow, but I also need to find a more efficient method of doing this. Grading on a daily basis can become a daunting task, so I will need to experiment with alternate methods. A few ideas I came up with and will look into for next year include using

classroom clickers or administering the quizzes on an online Web site. The classroom clickers came out a few years ago and allow for a quick assessment of information with a touch of a button by a student. Quizzes could be administered quickly and effectively with devices like these. The online quizzes offer another accessible method of quizzing my students frequently. I need to find a software program that allows for the creation of quizzes that can be uploaded to a Web site and where results can be sent to me as soon as a student completes the quiz. These two types of quizzing methods will help my classroom procedures continue smoothly and still hold students accountable on a daily basis.

Another teaching practice that I changed during the research and will continue to do is assign less homework. The benefits of frequent quizzes and knowing what students knew allowed me to assign less homework. Frequent quizzes provided students with extra practice and since students were getting the extra practice on an almost daily basis, I decided that I could assign less homework. In my journal on February 22 I wrote:

> I have started assigning less homework because students get about five minutes less time in class to work (which they would not use anyway) because of the daily quizzes. I assign less homework because I feel the daily quizzes have been instrumental in providing the cementing of concepts that more homework cannot do (February 22).

Many of the students did not know I cut down on the number of problems assigned until later in the research process. When I finally broke the news to them, many finally realized it and said thank you while others stated let's keep doing the quizzes and have less homework. Many agreed with my reasoning that the extra problems on the quiz helped them and that more homework was not needed. Another reason I decided to reduce the amount of homework was because giving and going over the frequent quizzes in class cut out some of the class time I usually gave them to work on their assignments. Therefore, I thought a compromise was needed and the students

really bought into this idea of trading some homework problems for having to take the frequent quizzes.

I plan to share my results with teachers in my building at the beginning of the next school year through the use of a powerpoint in our initial teacher meetings. I also plan to post my research on my school Web site for teachers and others to read. I will encourage my ninth grade team members to implement a similar practice so that it becomes a common practice for the freshmen in my school and maybe we will see positive results on criterion and norm referenced tests students take. Even if it is not a graded daily quiz, I will encourage them to do a five minute review on a daily basis with their students so students are held accountable on daily basis. Hopefully my school will continue to increase our technology capacity that many teachers can take advantage of this to implement some type of frequent quizzes.

This next school year I will now be the head of student council and as I continue to take a more active role in my school, I hope to share the information I have learned with my colleagues at new levels. I know the research has already had a positive impact on my teaching and I am excited to see what I can learn by taking this idea to the next level. Last year we tried to help freshmen by issuing student planners and tried to get all teachers to have students write down assignments in their planner. Can we possibly take frequent quizzes to this type of level? Can I get some of the teachers to jump on board and can we see as a staff how the frequent quizzes affect our students? Hopefully the hard work from this research will lead to some advancement in the years to come and be a beneficial thing for our school district.

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Appendix A

A Few Example Quizzes

Algebra A
Daily Quiz Name:_____ Date: 1/30/09
Week 2 – #2

1) Solve the following functional notation problem if $f(x) = 3x + 4$ and $g(x) = 5x$ 1) a. _____

a. $f(-3)$ **b.** $f(g(2))$ b. _____

2) Put the following equation in standard form if it is not already and then identify A, B, and C.

$5x = 7y + 9$

_____ A = _____ B = _____ C = _____

3) Determine if the following equation is linear. Answer with yes or no. 3) _____

$2x + 4xy = 5$

4) Assume y varies directly as x. Solve for y when $x = 4$ if $y = 20$ when $x = 5$. 4) _____

Algebra A
Daily Quiz Name:_____ Date: 4/20/09
Week 5 – #1

1) **Multiple choice** State whether each is a monomial, binomial, trinomial or none. You may need to simplify first. 1) _____

$5x^{-3} + 4x - 2$

A) binomial B) not a polynomial C) trinomial D) monomial

2) **Multiple choice** Find the degree of each polynomial. 2) _____

$4abc + 5ab^3c + 2a^3b$

A) degree of 6 B) degree of 4 C) degree of 5 D) degree of 12

3) **Multiple choice** Simplify $(3y^2 + 4y + 5) - (2y^2 - 3y + 4)$. 3) _____

A) $y^2 + 7y + 9$ B) $y^2 + y + 1$ C) $y^2 + 7y + 1$ D) $y^2 + y + 9$

4) **Multiple choice** Simplify $(x - 7)^2$ 4) _____

A) $x^2 - 14$ B) $x^2 - 14x - 49$ C) $y^2 + 14$ D) $x^2 - 14x + 49$

5) Write a binomial whose degree is 6. 5) _____

Appendix B

Test scores recorded for the duration of the study

Names of students were changed to remain anonymous

Period 1 - Algebra B Test Scores					
Test #	**1**	**2**	**3**	**4**	**5**
Date	**2/4/09**	**3/5/09**	**3/18/09**	**4/3/09**	**5/6/09**
Student 1	64	85	84	82.5	75.5
Student 2	68	88	82	62.5	64
Student 3	68	89	x	x	x
Student 4	73	95	76	91	40
Student 5	82	100	78	99	91
Student 6	92	99	98	95	98.5
Student 7	74	91	x	85	84.5
Student 8	64	84	76	91	87
Student 9	82	100	80	86	69.5
Student 10	70	83	80	75	69
Student 11	93.5	92	92	92.5	88
Student 12	89.5	92	92	91	74.5
Student 13	89.5	99	98	92.5	95
Student 14	89.5	96	92	94	92
Student 15	82	95	94	95	87
Student 16	86	97	92	89	75.5
Student 17	96	100	100	102	100
Student 18	82	81	80	85	65.5

Period 4 - Alg B Test Scores					
Test #	**1**	**2**	**3**	**4**	**5**
Date	**2/4/09**	**3/5/09**	**3/18/09**	**4/3/09**	**5/6/09**
Student 1	70	59	60	61	49
Student 2	86	85	70	85	69
Student 3	88	88	94	92.5	86
Student 4	82	97	80	95	75.5
Student 5	75.5	51	80	99	91
Student 6	70	88	64	80	75.5
Student 7	80.5	65	70	84	73
Student 8	82	72	58	55	49
Student 9	64	72	80	87.5	79.5
Student 10	77	88	78	72	89.5
Student 11	73	79	80	77.5	55
Student 12	70	79	68	65	78
Student 13	70.5	77	70	62.5	76
Student 14	57.5	75	70	87.5	81
Student 15	80.5	75	59	72.5	68
Student 16	80.5	87	84	86	68
Student 17	82	96	88	90	82
Student 18	80.5	77	80	87.5	68
Student 19	75.5	88	64	82.5	50
Student 20	88	95	96	94	86

Period 2 - Alg A Test Scores				
Test #	**1**	**2**	**3**	**4**
Date	**2/5/09**	**3/10/09**	**4/3/09**	**5/5/09**
Student 1	83	75.5	77	65
Student 2	93	93.5	95	95
Student 3	80.5	92	91	89.5
Student 4	88	87	68	46
Student 5	41	74	74	69
Student 6	91	84.5	87	94
Student 7	96	86	87	46
Student 8	73	89.5	88	89.5
Student 9	93	80.5	78	69
Student 10	44	55	61.5	28
Student 11	102	102	97	101.5
Student 12	92	101	93	87
Student 13	97	92	89.5	89.5
Student 14	41	35	50	45
Student 15	75	80.5	83	54
Student 16	80.5	83	74	74
Student 17	84	79	56.5	68
Student 18	46	30	59	65
Student 19	65	87	75.5	80.5

Period 7 - Alg A Test Scores				
Test #	**1**	**2**	**3**	**4**
Date	**2/5/09**	**3/10/09**	**4/3/09**	**5/5/09**
Student 1	85.5	81	78	74
Student 2	50	66.5	72	30
Student 3	60	84	51	85
Student 4	80.5	84	82	75.5
Student 5	83	93.5	95	83
Student 6	92	93.5	95	97
Student 7	82	72	86	89.5
Student 8	47.5	40	65	54
Student 9	79	63	60	72
Student 10	80.5	54	52.5	64
Student 11	73	72	74	78
Student 12	77	65	78	83
Student 13	83	82	77	69
Student 14	91	89.5	78	75.5
Student 15	89.5	89.5	80.5	77

Period 8 - Alg A Test Scores				
Test #	**1**	**2**	**3**	**4**
Date	**2/5/09**	**3/10/09**	**4/3/09**	**5/5/09**
Student 1	**88**	**84**	**73**	**83**
Student 2	**85.5**	**89.5**	**82**	**89.5**
Student 3	**57.5**	**55**	**63**	**66.5**
Student 4	**87**	**75.5**	**85**	**80**
Student 5	**69**	**72**	**70.5**	**68**
Student 6	**96**	**86**	**86**	**86**
Student 7	**88**	**95**	**93**	**89.5**
Student 8	**89.5**	**98.5**	**88**	**93**
Student 9	**37.5**	**30**	**15**	**29**
Student 10	**67.5**	**78**	**83**	**65**
Student 11	**80.5**	**86**	**92**	**74**
Student 12	**95**	**87**	**81**	**82**
Student 13	**91**	**82**	**99**	**89.5**
Student 14	**74**	**91**	**91**	**96**
Student 15	**102**	**100**	**102**	**102**
Student 16	**56**	**83**	**82**	**60**
Student 17	**76.5**	**73**	**73**	**69**
Student 18				
Student 19				

Appendix C

Test Predictions for one chapter test taken on April 3rd

Algebra B - Period 1	Prediction	Score
Student 1	80	82.5
Student 2	84	62.5
Student 3	65	91
Student 4	88	99
Student 5	94	95
Student 6	75	91
Student 7	75	75
Student 8	90	92.5
Student 9	85	91
Student 10	93	92.5
Student 11	80	94
Student 12	87	95
Student 13	90	89
Student 14	98	102

Algebra B - Period 4	Prediction	Score
Student 1	45	61
Student 2	70	85
Student 3	95	92.5
Student 4	88	95
Student 5	93	99
Student 6	65	84
Student 7	60	55
Student 8	70	54
Student 9	84	77.5
Student 10	75	65
Student 11	70	62.5
Student 12	75	87.5
Student 13	70	72.5
Student 14	86	86
Student 15	88	90
Student 16	72	87.5
Student 17	93	94

Algebra A - Period 2	Prediction	Score
Student 1	60	77
Student 2	94	95
Student 3	92	91
Student 4	72	68
Student 5	92	87
Student 6	86	87
Student 7	84	88
Student 8	84	78
Student 9	80	61.5
Student 10	100	97
Student 11	92	93
Student 12	94	89.5
Student 13	60	50
Student 14	84	83
Student 15	76	74
Student 16	74	56.5
Student 17	62	59
Student 18	82	75.5

Period 7	Prediction	Score
Student 1	72	78
Student 2	76	72
Student 3	68	51
Student 4	80	82
Student 5	94	95
Student 6	96	95
Student 7	90	86
Student 8	60	65
Student 9	78	60
Student 10	65	52.5
Student 11	72	74
Student 12	86	78
Student 13	84	77
Student 14	88	78
Student 15	87	80.5

Period 8	Prediction	Score
Student 1	**84**	**73**
Student 2	**92**	**82**
Student 3	**80**	**63**
Student 4	**66**	**70.5**
Student 5	**86**	**86**
Student 6	**94**	**93**
Student 7	**92**	**88**
Student 8	**60**	**15**
Student 9	**84**	**83**
Student 10	**80**	**92**
Student 11	**88**	**81**
Student 12	**82**	**99**
Student 13	**90**	**91**
Student 14	**100**	**102**
Student 15	**85**	**82**
Student 16	**80**	**73**

Test Prediction Results

Predictions correct = 2 / 80

Predictions within 2% = 22 / 80

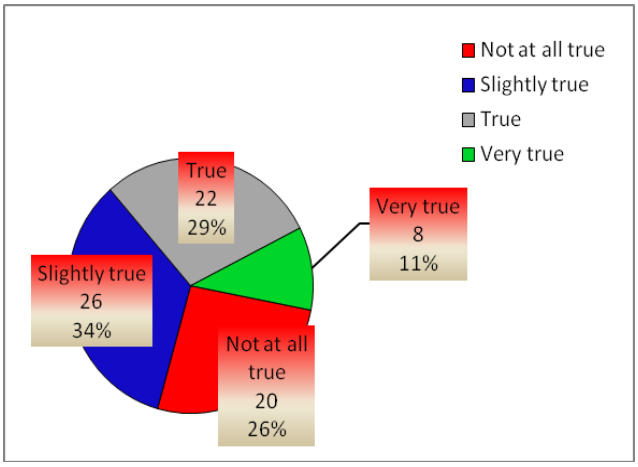
Predictions within 5% = 40 / 80

Predictions within 10% = 58 / 80

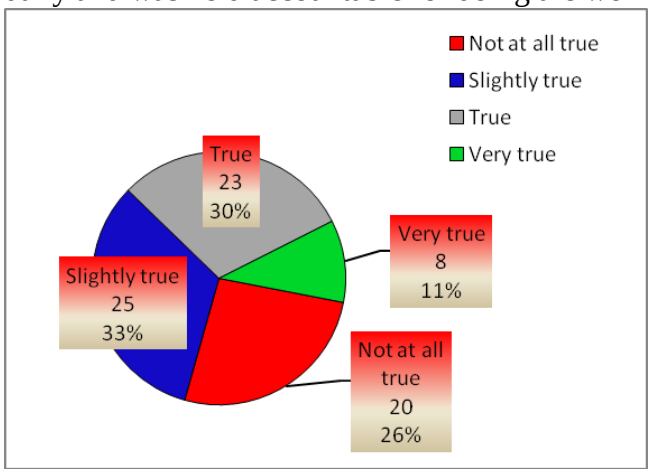
Appendix D

Post-Survey Results Only

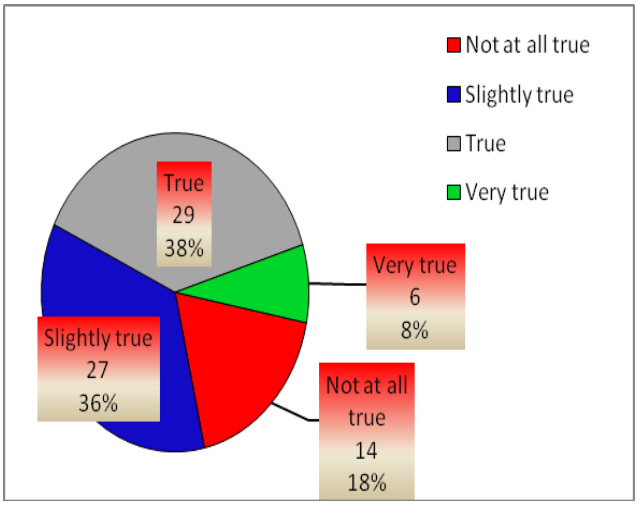
Taking the daily quizzes made me a better test taker.



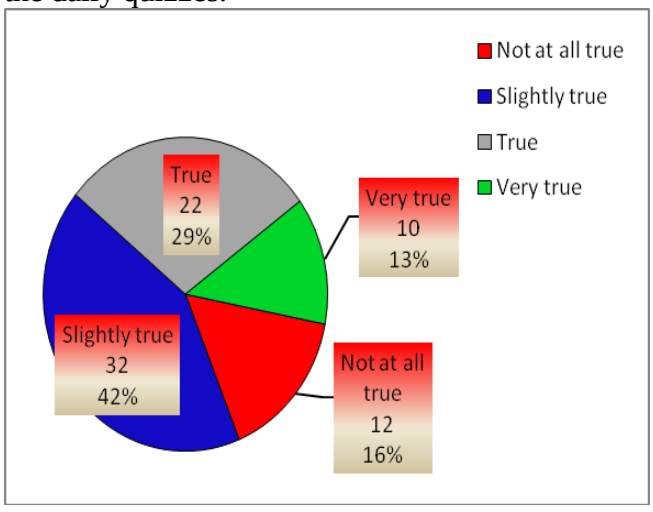
I feel I did better in class because I was quizzed daily and was held accountable for doing the work.



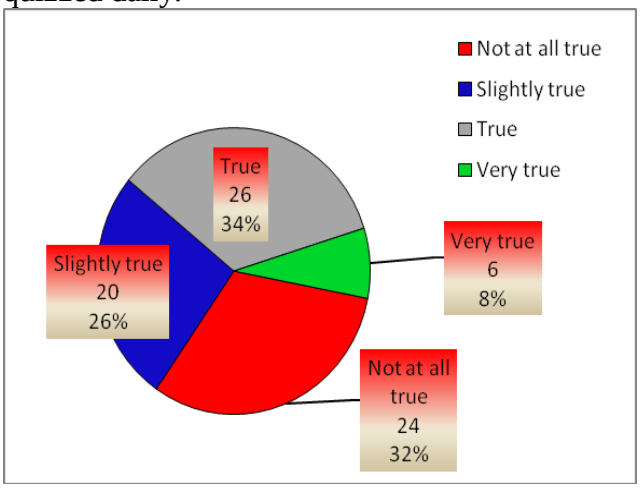
I thought the daily quizzes helped me to correct mistakes I made.



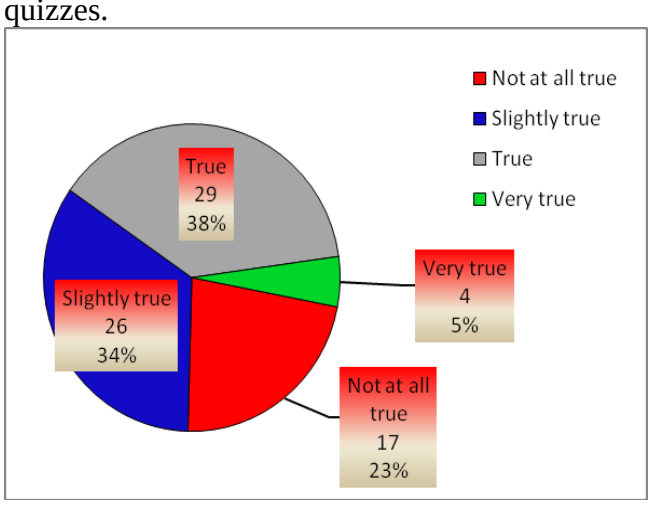
I feel I understood the material better because of the daily quizzes.



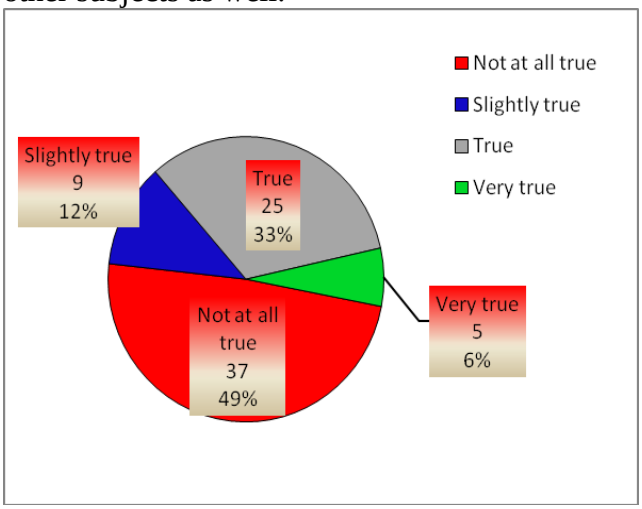
I felt better prepared for tests because I was quizzed daily.



I did better on tests because we were taking daily quizzes.



I would recommend having daily quizzes in other subjects as well.



Appendix E

Student journals and self reflections

Algebra A Chapter 7 Self Evaluation Students Name: _____

1. On a scale of 1-10 (1 poor and 10 excellent), how would you rate your overall effort during this chapter?

2. Did you always have assignments completed on time? If not, why not?

3. When preparing for this chapter test, did you just rely on our in-class review or did you do some extra preparation for the test outside of class? Did you use the practice test? If so, how did you go about studying?

4. Do you think daily quizzes helped you understand the chapter better? Explain why you think that.

5. Do you think the Daily Quizzes helped you on the test? If so, in what way. If not, why do you think it didn't.

6. Would you like to see the daily quizzes continued? Explain why you think that.

Student Journal Students Name: _____ Date: 4/17/09

1. Did you change your classroom routine (Study more, pay attention more, etc) because of daily quizzes? Please explain!

2. Did you learn more this week as a result of daily quizzes? Please explain!

3. Do you feel you are being more prepared for the test by taking daily quizzes? Give specific examples of questions you remember or things you now understand as a result of the daily quiz!

4. Does taking daily quizzes make the class more difficult or easier for you? Please explain!

5. What is your attitude this week towards taking daily quizzes? Please explain!

Appendix F

Student Interview Questions

5/1/2009

1. This semester I changed the way we do things in class, specifically with daily quizzes. Did this have an impact on you and in what ways?

2. Did you like the idea of taking daily quizzes at first? How about now? What were your attitudes?

3. Do you think you learned more in my class as a result of daily quizzes? Remembered more?

4. Did you have test anxiety last semester? If so, has the daily quizzes helped to eliminate this anxiety or do you still have it?

5. Did you think the test(s) were easier as a result of daily quizzes?

6. Do you feel like you understand math better as a result of taking daily quizzes?

7. Do you prefer the daily quizzes to take place at the beginning or end of the period?

8. What suggestions do you have for future class in terms of using daily quizzes? Would you like other teachers to implement this process?

Appendix G
Weekly journal prompts

Personal Journal Prompts - Weekly

February - April 2009

1. What big event(s) did I witness as a result of students taking daily quizzes? (Things said or done)

2. What did I learn this week as a result of implementing daily quizzes?

3. How did students perform in class (taking notes, writing down examples, etc.) knowing they would be quizzed daily?

4. What types of things did I witness in terms of test or quiz anxiety?

5. What were the student(s) attitudes toward taking daily quizzes for the week?