

The Impacts of Technology on Summative and Self-Assessment:

Does more technology in a secondary math classroom increase students' test scores?

By

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Abstract

This study examines the effects on students when the instructor is introducing technology in the math classroom, by taking advantage of a favorable opportunity to study two populations with highly contrasted levels of access to technology. White Bear Lake High School went from minimal technology in 2010 to a school infused with technology by 2013. The instructor applied for a grant to receive a smartboard which was approved. Also, the instructor received a classroom set of graphing calculators that students could use in class and check out to bring home. Students' achievement on a unit test in Algebra 2 and their overall attitude towards the technology were analyzed for two populations. A control group of 63 students from an Algebra 2 class in 2010 had minimal technology available. These students did not have access to graphing calculators and the instructor taught on an overhead projector. A treatment group from 2013 of Algebra 2 students had significantly increased access to technology. This treatment group had a class website with math resources tailored to each class, a set of graphing calculators, an interactive whiteboard and the use of smartphones. The mean score on the unit tests was 32 for both populations and the treatment group had a median of one point higher than the control group. The students in this study who had access to technology self-reported a high level of enjoyment using that technology to solve problems. The instructor reported that students complained less about doing longer math problems when they had access to technology.

Introduction

This is a project to study what impact technology has on student achievement in Algebra 2. This idea came from the large push of technology from the researcher's school district that significantly changed the level of access for students and teachers to technology. In 2010, the researcher taught in a classroom with only an overhead projector and no access to graphing calculators for all students. At the time, White Bear Lake High School had very little access to technology for teachers and students. Over the next 3 years, the district put in place grant money, technology support staff and after school classes to help teachers integrate technology into their classrooms. The researcher requested and was granted a smartboard and a classroom set of graphing calculators which were in place before this study was done. Part of the grant for the smartboard required forty hours of technology training to be done over the course of 2 years. All teachers in the White Bear Lake School District are now required to have a class website update biweekly for students to access, as well as other technology goals. This study investigated the impact of technology on student learning. The technology now in place at White Bear Lake allows students and teachers to have access to much more than before. At White Bear Lake, students are able to follow a website created by the teacher with extra help videos, supplemental applets, or simply a calendar with the daily homework. In class, students are able to visually see math on a Smartboard or a graphing calculator. Teachers are now able to poll their students' understanding with websites such as Poll Everywhere. This allows students to text in the answer from their phone and the data forms in a graph on the Smartboard for the class and teacher to see. With this increase in technology the researcher looked at a three week unit in Algebra 2 from 2010, with little access to technology, and compared it to the unit test scores in 2013 with

infused technology. The students in 2013 were also given an anonymous survey after the unit was complete on their attitudes towards technology in that unit.

Literature Review

It can seem like the average young American now spends practically every waking minute, except for the time in school, using a smart phone, computer, television or other electronic device. As technology advances have been made; and video, online, and cell phone resources have become increasingly available, the use of instructional technology has increased. The number of U.S.-educated people prepared to take on technologically challenging jobs is dwindling due to our education system, but it may be that technology tools are just what we need to help turn things around (Kastber 25).

Having access to technology would appear to be a key part in education. One of the biggest challenges though, is to provide adequate, ongoing, and professional development on the use of the new instructional tools to accompany the infusion of technology. Studies have shown that teachers who use technology in their personal lives are more comfortable implementing it in their classrooms (Lee 869). Technology becomes an effective learning tool when the teacher is knowledgeable on how to use it and how to teach his/her students to use it. Moreover, if a teacher grew up learning mathematics with a graphing calculator, studies show his/her classroom will use graphing calculators in an effective and efficient manner (Kastberg 32).

According to a study by Close, a factor of student success with technology is their level of proficiency with it. Students who come into a secondary mathematics classroom already proficient with technology will thrive in a setting where technology is used as an instructional tool. Others who are not must be taught how to use technology and may not be as likely to do well in units with a high demand for technology use (Close 378).

Technology proponents respond that these tools can be more than a crutch. They can turn the abstract into something more concrete, helping students understand concepts, like those in

algebra, that are far removed from the physical world. (Leavitt, 20) Also, technology motivates students to learn. Studies show that using an interactive whiteboard increased students' interest and motivation and drew their attention. Students even said that using the interactive whiteboard seemed to speed up the lesson. Students begin to complete tasks that might bore them with pencil and paper. Graphing calculators enable multiple ways to solve problems, which provides students to be more creative in mathematics classes. Also, graphing calculators often offer a risk free learning environment for students to explore the world of mathematics. Students are able to quickly correct mistakes before classmates know they made them (Tataroglu 2537).

A study by Lee reports that technology has the potential to give students in the mathematics classroom concrete ways to explore abstract concepts, enhance success for visual learners, promote higher-order thinking skills and deepen understanding. Technology encourages students to become active learners and to assume responsibility for their own learning. Also, technology enables students to use a variety of media and formats to apply, evaluate, synthesize and communicate information and ideas effectively to multiple audiences. By using calculators as a tool, more students no longer have to spend time doing tedious calculations when a machine can do them efficiently and effectively (Lee 869).

Graphing calculators are an especially critical component of classroom technology. A study by Horton on the use of graphing calculators, however, shows that just putting a graphing calculator into a student's hand will not cause him/her to score better on a test. Horton observed that when graphing calculators were simply added to a traditional curriculum, students were no better off than their peers who didn't have access to a graphing calculator. For one thing, students did not know how to use all of the extra features that a graphing calculator provides. However, when a curriculum was developed to use a graphing calculator in problem solving

investigations, students then outperformed their peers. This means that if students are taught how to use graphing calculators, their test scores will increase (Horton 156).

Another study by Williams was done which considered students who had never used a graphing calculator before middle school. In Williams' study, students used their graphing calculators with a partner to explore linear equations. The author gave pre and post tests to the students in a traditional class and the intervention class (using graphing calculators). The students in the intervention class gained an average of 19.7 points while the traditional class only gained 7.41 points. The author did describe initial frustrations of students having to learn how to use a graphing calculator. Although students scored higher in the end, the initial use of graphing calculators was frustrating for them. This study by Williams also found that students who scored higher on the pretest tended to use their calculators to check their work. The overall conclusion of this study was that the use of graphing calculators as an instructional aid does help students increase their knowledge of graphing concepts (Williams 4).

The National Council of Teachers of Mathematics has published many articles on various topics of technology use in the classroom. An article by Browning on graphing calculators as instructional tools shows many different ways to meet and explore content standards with the use of a graphing calculator. This article specifically looks at the middle school standards. Often middle school math teachers do not familiarize their students with this tool, thus making it harder for students to use them in algebra courses and beyond. The article states that using technology tools requires knowledge of the available technologies and their capabilities as tools for learning for both teachers and students. Teachers need to know how and where to implement technology effectively so students have a positive learning experience (Browning 485).

Moving beyond calculators, one of the strongest forces in the contemporary growth and evolution of mathematics and math teaching is the power of new technologies. (Tataroglu 2533) In math, computers have fostered entirely new fields. In education, they've raised the importance of certain ideas, made some problems and topics more accessible, and provided new ways to represent and handle mathematical information, affording choices about content and pedagogy not available before. Most people agree that learning facts is important, but that higher level thinking is more important. With the use of technology, students are able to think more deep more often than without the use of technology (Goldenburg 1).

In a Harvard study done by Ellen Lunts, attempts to show that using a class website has the potential to benefit student achievement in math. This is done by enhancing the delivery of the math and increasing parental involvement. Although class websites have become increasing popular, no studies previous to Lunts' had been done to show how these websites affect the content or parent involvement. Lunts found that teachers do not deliberately use class websites to stimulate parent involvement. Only 8% of all websites had the option to message parents. Lunts concluded that having a website did in fact increase parent involvement in a secondary mathematics setting. The website communicated what the child needed to do for class, which allowed parents to be involved. However, the article did not state any conclusions about an increase in student test scores due to a website (Lunts 24).

Given that implementing technology faces challenges, it is important to assess what gains can be had from doing so, which this study attempts to do. Graphing Calculators have shown to be a helpful instructional tool in the mathematics classroom. Students' tests score have increased in studies where students were able to use a graphing calculator. Proper education for both teacher and student is needed for students to succeed. The growth in the potential of social

networks, and the growth of their use, can allow teachers to engage more students more often.

Teacher websites have been used to increase parental involvement but no studies were found on the use of a website to aid student learning. A classroom environment in which significant infusions of technology occurred over a relatively brief period of times provides a good opportunity to investigate the roles that graphing calculators, social media, and educational websites can play in student learning.

Justification

Students spend eight hours of their day sitting in a classroom and listening to a teacher lecture. As the teacher looks around, he or she may see students on their iPod, iPhone, iPad or some other technology that has been put in their hands. While at home, students are surfing the internet on websites such as Facebook, Twitter, Reddit, or YouTube. Clearly teens in this day and age are attracted to technology. Improving student performance in mathematics is essential to meeting the challenges posed by a modern technology-based society. Students today don't know the days of writing a paper, in ink, by hand, or the days of finding the standard deviation of 50 numbers by hand. And why should they? Many traditional teachers may find value in these tasks that once were deemed important, which motivates this study, the purpose of which is to investigate what impacts increased technology on the current curriculum has on student learning.

Creating a website, making videos, uploading applets and learning about the new technologies can be difficult but it is what is best for students. The technology breakthrough is only beginning in education. Technology affects almost every aspect of our lives. Files stored on computers also businesses to share information quickly to offices all over the globe. Wireless phones and the internet have made working from home or the beach easy. In the field of medicine, doctors are benefiting from the change to electronic medical records. With the click of one button, doctors are able to see all the care a patient has ever received and use that to find figure out a possible illness. It would seem that, teachers cannot be passed up by the changes the 21st century is bringing.

Previous studies have looked at just using a graphing calculator in the classroom or an interactive whiteboard. Both have shown to be helpful instructional tools. Little research has been done on websites in a secondary mathematics class, and when they have been done there

were no conclusions about if the website increased test scores. Each instructional tool has been studied individually, but no studies were found on the impacts on student learning using several technologies at once.

This study aims to investigate whether technology makes a significant impact on high school students' learning, focusing on the Algebra 2 curriculum. With the aid of technology, students have access to many more resources. In this study, students were able to follow a website created by the teacher with extra help videos, supplemental applets, or simply a calendar with the daily homework. In the Algebra 2 class at White Bear Lake High School, students were able to visually see math on a Smartboard or a graphing calculator. Teachers at White Bear Lake are able to poll their students' understanding with websites such as Poll Everywhere. This allows students to text in the answer from their phone while the data is formed into a graph on the Smartboard for both the class and teacher to see. Bringing this technology into the math classroom gives students a change from the everyday math lecture to an exciting way to learn math.

This study investigated learning environments in which technology is embedded into everyday mathematics in various contexts (i.e graphing calculator, Smartboard, cell phone applets, and a class website). Students had access to videos and applets on the key concepts from the chapter and the notes from every class period. Also, every homework assignment and worksheet is posted on a calendar. This allowed students to do extra work at home if they felt it was needed or to make up missed assignments.

In 2013, White Bear Lake ISD #624 has become a district that was very supportive of technology use. In 2010, however, very little technology for teachers and students were available. Only select classrooms had smartboards, no websites were available for teachers to

post resources, graphing calculators were not available for students and there was minimal support for teachers to learn new technologies. The White Bear Lake School district put in place grant money, technology support staff and after school classes to help teachers integrate technology into their classrooms. Over the course of the next 3 years, teachers became required to use more and more technology in their classrooms. Currently, teachers must update a class website on a weekly basis with a calendar that lists the content covered each day in class. White Bear Lake South Campus has added 12 blended courses to its catalog across all content areas. Students have the option to take Advanced Placement Calculus BC in the traditional format or in the blended format. These blended courses are taught both online and in the classroom. Students are only required to have one or two days a week of classroom time with the instructor. They are required to follow along with the content using online materials the teacher has created. These courses are very attractive to students who participate in extracurricular activities because it allows them to learn the content in a time and place that is convenient for them. Also, it allows students to see what an online course in a post-secondary setting may be like. This project is aligned with WBL ISD# 624's goal of requiring students to use technology in their high school courses.

All of this rapid infusion of technology in the White Bear Lake school district provides a superior opportunity to study the impact of this technology. In 2010, the researcher taught Algebra 2 with an overhead and no access to graphing calculators. In 2013, the researcher taught Algebra 2 with a smartboard, a website, and graphing calculators for all students. The large push of technology from White Bear Lake provided an opportunity to compare the two populations of students and their achievement on a unit test. Algebra 2 was chosen because this course was taught by the researcher in both 2010 and 2013.

Curriculum Investigated in this Study

This study investigated the learning of students during their junior year in Algebra 2. The researcher implemented technology into Chapter 2 of the Advanced Algebra curriculum at White Bear Lake South Campus using the Discovering Advanced Algebra book. The curriculum aimed to learn in a 3 week time period started off with reviewing the concepts of central tendency (mean, median, and mode). This curriculum comprised of students then learning about quartiles, the five number summary and box plots. With this students began to develop the concept of variability. Students then learned to find variance and standard deviation by formula and by calculator. The next section asked students to understand and apply the definition of an outlier. Also, students learned the concept of resistance. Appendix 1 is a sample lesson on these concepts. In the last section of the chapter, students compared and contrasted bar graphs and histograms. Students were then asked to create histograms and box plots to analyze data. Lastly, the concept of percentile rank was introduced and connected to standard deviation. In Appendix 2, the homework assignment for lesson 2.2 is shown. Appendix 3 is the unit test given to both the control group in 2010 and treatment group in 2013.

We employed several lessons as a part of this study in which all the above topics were covered. From year to year, the lessons in chapter 2 have remained very similar. The sample lesson in Appendix 1 shows the lesson from the fall of 2010. These students were taught using minimal technology, some had access to graphing calculators but most simply had a scientific calculator. All lessons were projected onto a screen using an overhead projector. Students were responsible for creating box plots and histograms as well as finding the mean, standard deviation, five number summary and percentiles.

Project Design

For this study, we utilized, as baseline data, the students' Chapter 2 summative test scores from the Fall 2010 Algebra 2 courses when very little technology was implemented in the researcher's classroom. At week 1, we established a routine with the current Algebra 2 students using technology (treatment group). For Chapter 0 and 1 students had access to a Smartboard, graphing calculator, and applets during class. Both at home and on their cell phones, students had access to a website called Schoology with helpful videos, class notes, online discussions and copies of homework. Appendix 4 shows a screen shot of Schoology. Schoology is a user friendly website that is modeled after Facebook, a popular social network used by a large percentage of the researcher's students. Schoology allows teachers to create a calendar, post videos, upload worksheets, and post applets for students to access. During Chapter 2, students were asked to continue to use the technology they had learned thus far in Algebra 2.

The lesson given in Appendix 5 is a sample from the researcher's Algebra 2 course in the fall of 2013 which was projected onto an interactive whiteboard (Smartboard). This lesson is the same topic as the lesson from 2010 but now with enhanced technology. The students in this class were responsible for the same benchmark topics, but they had the use of a graphing calculator, a website for additional resources (Schoology), an interactive whiteboard lesson, and cell phone applets.

With the technology-infused lessons, students were able to make histograms the first day of the unit on their calculators. This gave them a visual perspective on the data. Also, students in the past had struggled with the concept of bin width. Using the bin width applet, student could now see how changes in bin width would look with the same set of data. Lastly, students texted

in answers to the MCA problem of the day and warm up questions which gave the instructor a clear idea of what topics may need to be reviewed before the test.

A typical day in the technology infused classroom of 2013 started off with a warm up that was projected onto a Smartboard. The warm up was to review a topic previously taught in Chapter 2. Students were sometimes asked to do this with their graphing calculators. A student was chosen at random, using a random name picker on the Smartboard, to solve the problem in front of the class. After the warm up, an MCA problem of the day was done. Students were given a multiple choice question on a topic that is included on the 11th grade MCA math test. Then students who had cell phones were asked to text in their answers to the questions using the Poll Everywhere website. The questions was then discussed with the correct answer being revealed at the end. After the MCA question of the day, a new topic or topics were taught to the students. Students were often taught using a traditional method (i.e. without a graphing calculator). If time permitted that day, if not, the following day, students would learn the same topic but using a graphing calculator or an applet on the Smartboard. Once the lesson was taught, homework would be assigned. Each class period would have about 15 minutes for students to start their homework with their classmates and ask the teacher for help if needed. At home, students had access to Schoology which had all the notes from that day uploaded as well as a supplemental video on the topic. Chapter 2 was conducted as described for about 3 weeks.

After the students took the Chapter 2 test and got their results back they were given an anonymous survey given in appendix 6. The survey aimed to analyze students' participation and experience with the technology. Specifically the survey asked open ended questions on what technology what most and least helpful throughout Chapter 2. In addition, the survey asked students if they felt they performed better on the unit test because of the aid of technology.

Results

The Chapter 2 test was worth a total of 39 points. Table 1 shows the breakdown of the data from the Fall of 2010 and 2013:

Table 1: Chapter 2 Test Scores

	Fall 2010 n=63	Fall 2013 n=64
Mean	32.32	32.14
Standard Deviation	3.77	4.02
Median	32	33
IQR	6.5	5.625

In the fall of 2010, the test scores of 63 students were examined. Figure 1 is a histogram of the score breakdowns. The mean test score was 32.23 with a standard deviation of 3.77.

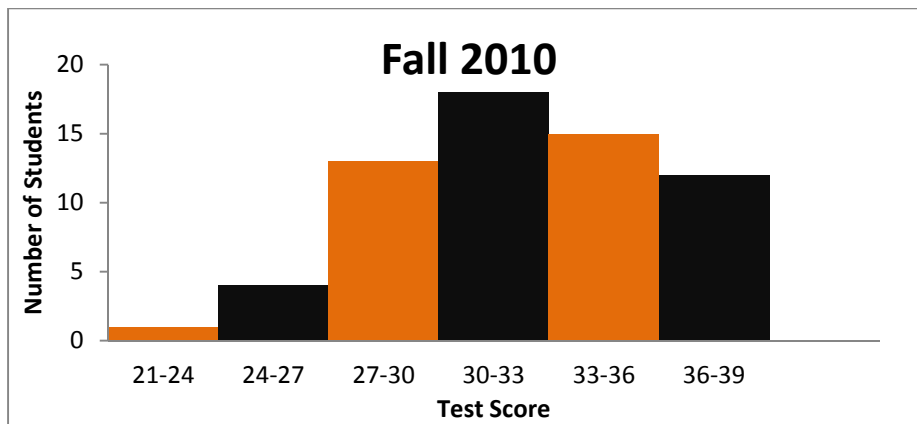


Figure 1 – Fall 2010 Test Scores

The Fall 2010 data is also represented with the 5 number summary in Figure 2.

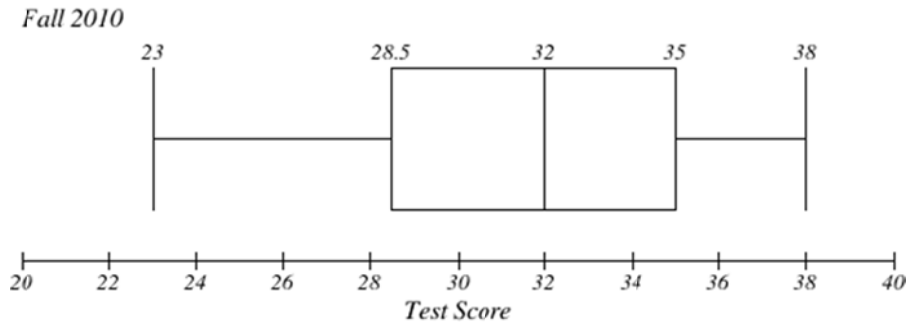


Figure 2 – Fall 2010 Test Scores

In the fall of 2013, the test scores of 64 students were examined. Figure 3 is a histogram of the score breakdowns. The mean test score was 32.14 with a standard deviation of 4.02.

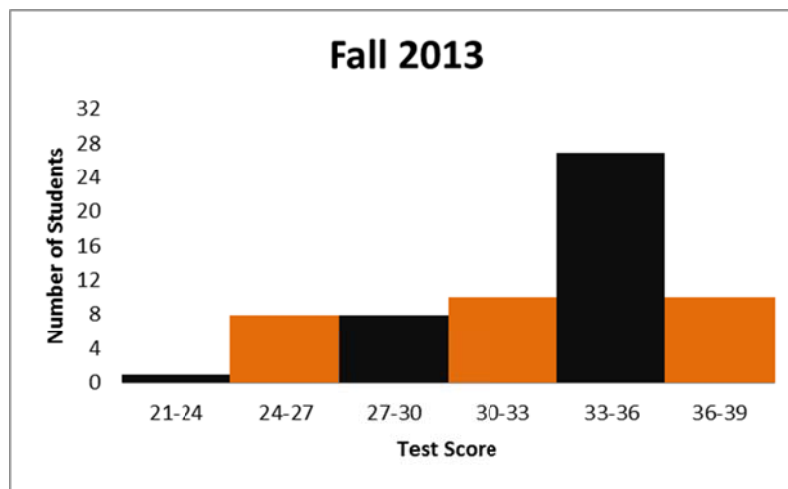


Figure 3 - Fall 2013 Test Scores

The Fall 2013 data is also represented with the 5 number summary in the box plot in figure 4.

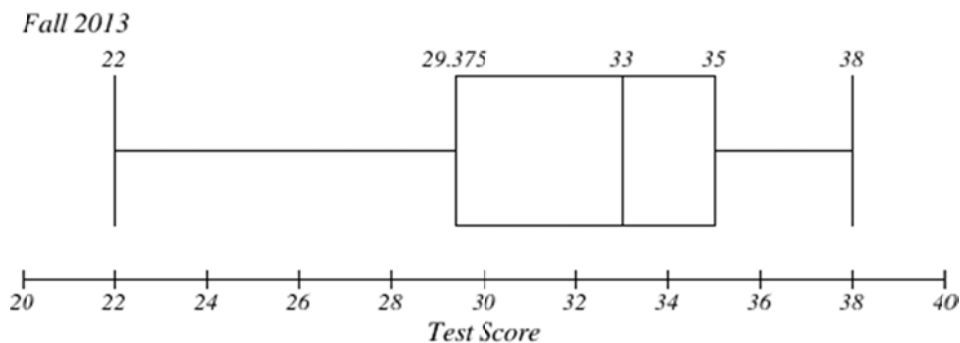


Figure 4 - Fall 2013 Test Scores

Looking at the test scores from both years, the mean test scores are very close. However, in the past three years the students in Algebra 2 at White Bear Lake High School has changed slightly. Looking at the average MAP scores of the two classes, the Fall 2010 Algebra 2 class had an average score 10 points higher than the Fall 2013 class. Thus seeing that the two classes scored the same on the Chapter 2 test, suggests that the aid of technology may have improved summative assessment scores.

Despite the inconclusive test scores, many positives came out of the unit. The students learned to download free graphing calculator applets to use at home and for their science classes. Also, they downloaded applets for the grading program used for all their courses as well as the Schoology website. Students embraced using their phones as tools for learning rather than something to communicate with. The students were able to learn through exploration using the graphing calculator. Students understood the effects of changing a data set and how the mean, median, standard deviation and IQR were affected more than the previous years.

After the students took the Chapter 2 final test and had their scores back, they were given an anonymous survey. When looking at the student surveys, the students' favorite technologies varied. Some of the students enjoyed using the graphing calculator to make the process quicker while others liked having all the notes posted online for them to refer to. The overall consensus was that students enjoyed having technology available and liked learning how to use it. A couple of the students did mention that it was a lot to learn at first, but once they mastered how to use the graphing calculator, it saved them a lot of time. Technology in the classroom is a must. Looking at the student surveys it can be concluded that students enjoyed using technology to learn mathematical concepts in Algebra 2 and they claimed it helped them visualize changes in number sets.

Below is a picture of students working on their math that was posted to the class website:



Students were able to comment on things posted much like Facebook. A discussion board for each chapter was available for the students. They could ask each other or the teacher questions on the website about the material.

Below is a picture of students using graphing calculators to do their work as well as use their phone to look up information on schoology.



Although technology did not seem to improve test scores, the student survey's showed that the students thought using technology was helpful for them. Of the 64 students, 62 of them

agreed or strongly agreed that having a graphing calculator allowed them to learn the material better than if they didn't have one. When asked if they felt they did better on the unit test because of the aid of technology most students felt they did do better having used technology to learn the material. Over half of the students said that there was no technology that was least helpful. When it came to the students' favorite technology, the graphing calculator was the most common answer closely followed by schoology. The students who said they liked schoology the best said it was easy to keep track of what assignments were due and when they were due. Students who said they liked the graphing calculators best usually said it saved them time and it made it simple to understand.



Ms. Schluender

Describing Data on their calculators!



Mon Sep 30, 2013 at 10:53 am [Comment](#) · [Like](#)

😊 1 person likes this

In conclusion, tests scores did not increase when using technology. However, students did agree that using technology was helpful to them. Students said they were more engaged in the lessons and felt more confident going into the unit test. When asked if they felt they did better on the unit test because of the aid of technology most students felt they did do better having used technology to learn the material.

Reflection

Throughout the course work at River Falls I was able to solidify my love of technology. As a student, I was able to learn using technology and I found that the addition of technology was very helpful. In calculus class, having the ability to graph functions to easily see the points needed for an integral made the process much quicker. Also, being able to quickly find derivatives and integrals on my calculator allowed me to get deep into the patterns of calculus. In algebra, I was able to row reduce fast using my calculator leaving more time to analyze the results I had gotten. This allowed me as a student to gain deeper understanding of the content rather than spend tedious amounts of time row reducing matrices. This inspired me with my students and my project.

Also, the professors had varying levels of technology backgrounds. In geometry class, we used Geogabra to create visuals for our students and we mapped parabolas to real life objects. In statistics, we used R to run all of our data. This saved time as we did not have to type in a copious amount of numbers, we were able to upload data, run the numbers, and then use what we had learned to draw conclusions. Not spending time with basic calculations enabled us to learn more material and have a better understanding of when and how to analyze data. Also, I was able to learn a new mathematical tool.

In the future, I would like to try this study with higher level math students. I think this would enhance student growth due to already knowing how to use a calculator. Also, higher level math students use the Schoology website and supplements much more than the regular math students. Higher level mathematics students may increase their learning by doing this.

A new piece of technology that I would like to try in the classroom would be the Ipad. If all students had an Ipad, they could follow along with the Smartboard notes and write in their

own. If student had all of my notes and could just add their own work, it would save a lot of time taking notes. Also, I would get an applet for the Ipad which allows students to submit answers to questions on their Ipad to mine and I could look through their answers. Once the students have submitted their answers, I can project them onto the Smartboard to show common mistakes or alternate solutions very quickly.

If I was doing this project with the same group of students, I would like to increase the study to be yearlong. Then I could compare this group of students to my students in 2010-2011 without technology on all tests. This would help me see if the excitement of the technology wears off as the year progresses. I would use a pre and post test model to do this.

This model makes for the higher levels of learning in Bloom's Taxonomy. Within the cognitive domain of Bloom's Taxonomy, learning is categorized into six levels: remember, understand, apply, analyze, evaluate, and create. In order to achieve higher levels of learning, students must first master lower levels. Unfortunately, higher levels of learning are normally missed within the current education systems due to curriculum demands and time constraints.

The two lowest levels of remembering and understanding are necessary in learning, but not what I value in my classroom. In math we want students to apply, analyze, evaluate and create. I feel that when students have more access to technology they are able to do much more of that. They spent less time on calculations of the mean, median, mode, percentile rank, etcetera and more time analyzing what those things meant in the context of the problems given. Technology allows for higher level thinking to occur more frequently in the secondary mathematics classroom.

This project has helped my professional development immensely. My students loved having technology in the classroom, especially applets and programs they had never seen before.

It was vital to their learning that I was able to navigate through the different technology and help them when they were stuck. Having gone through school and math classes using all different kinds of graphing calculators, answering any questions my students had was easy. I was also able to become proficient when it came to building my website. By the end of my research, it took only an additional 5 or 10 minutes to upload the daily materials I wanted to.

Also, after doing this project, I gained interest in our district's technology programs and their goals for improving student test scores. Technology at our high school needs to be more accessible to our staff if we want them to use it. Rolling a big cart of laptops from the library to the classroom every day is troublesome. Also, our rooms are not equipped to have the Smartboard and the laptops hooked up to the internet, so teachers are not be able to model their expectations as easily as they would like. I want to help teachers learn about technology and what programs could be effective in their current curriculum. I also would want to help get a grant for all White Bear Lake students to have an Ipad all year long. Students could follow in each of their classes with notes. Students can interact with the lesson while sitting in their desk. This would help students stay more engaged in their coursework.

Carrying out this project has helped me see the need for technology in education. The research strongly suggests that teachers who are comfortable with technology in their personal life are more effective with technology in the classroom. Teachers who used technology to learn a subject, like I was able to at River Falls, are more likely to use technology in their own classroom. Technology based Master's programs would be a great way to help build teacher confidence with newer technology but also teach them new ideas. "Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances student learning (Tataroglu 2535)."

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Appendix 1

Fall 2010: Lesson 2.2 Day 2

Warm Up:

Find the standard deviation of the following data:

{8, 7, 6.5, 11, 9, 8, 8.5}

Classwork:

Number 6 in the textbook:

The mean diameter of a Purdy Goode Compact Disc is 10.cm, with a standard deviation of 0.012 cm. No CDs can be shipped that are more than two standard deviations from the mean. What range of CDs can be shipped?

Number 4 in the textbook:

Invent a data set with six data values such that the mean is 10 and the standard deviation of about 0.632.

Number 18 in the textbook:

The data sets give the weights in pounds of the offensive and defensive teams of the 2007 Super Bowl Champion Indianapolis Colts.

Offensive { 198, 332, 290, 295, 295, 320, 252, 185, 230, 214, 251}

Defensive {245, 300, 274, 268, 227, 235, 243, 182, 180, 203, 206}

- a) Find the mean and median weights of each team.
- b) Prepare a box plot of each data set. Use the box plots to make general observations about the difference in the two teams.

Homework: 2.1/2.2 book worksheet

Appendix 2

Algebra 2

Chapter 2.2 Day 2

Name

The data below gives the number of text messages a group 17 year olds send per day:

8, 13, 14, 14, 17, 23, 26, 29, 29, 29, 35, 36, 37, 45

1. Find the 5 number summary for the data

2. Sketch a box plot of the data.



3. Calculate the outlier boundaries for the data set.

4. Are there any outliers? If yes, list them.

5. What is the mean of the data?

6. The standard deviation of the texting data is 11. What percentage of nights fell within one standard deviation of the mean?

7. Thomas is added to the data. He sends 97 text messages a day. This amount of texts are added to the data :

a) What is the new mean?

b) What is the new median?

c) Which is more affected by the addition: The mean or the median?

d) Which is more affected by the addition: The IQR or the standard deviation?

8. Which of the following data sets has the largest standard deviation:

- a) 5, 7, 9, 12, 19
- b) 5, 9, 9, 9, 11
- c) 5, 10, 17, 27, 49

9. Given the following data:

3, 6, 8, 10, 16, 19, 21, 23

Find the mean:

Median:

Standard Deviation:

IQR:

Multiply the data points all by 2. What are the new mean, median, Standard Deviation and IQR?

Add 10 to all the original data points. What are the new mean, median, standard deviation and IQR?

Then add 5 to the data point 23. What are the new mean, median, standard deviation and IQR?

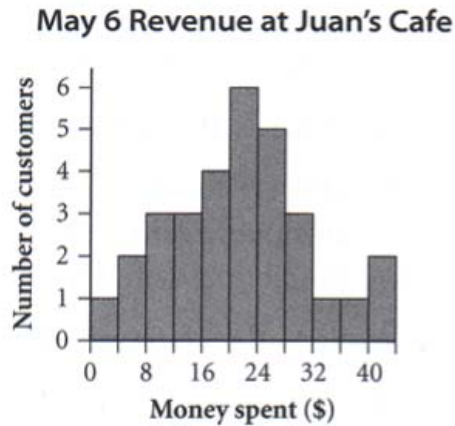
Appendix 3

Algebra 2

Chapter 2 Test

Name _____

This histogram shows the amount of money each customer spent at Juan's café during the afternoon of May 6.



1. How many paying customers came in on May 6?
2. What percent of the customers spent at least \$16?
3. Which value could be the median price paid for a meal?
a) \$11.35 b) \$18.95 c) \$21.50 d) \$25.00

1500 men take a physical fitness exam. They can score in a range from 0 points (least physically fit) to 80 points (most physically fit.)

4. Todd scores a 72 which puts him at the 88th percentile. What percentage of men score higher than Todd?
5. How many men score lower than Todd?
6. Of the 1500 men, Brian scores a 17. This makes Brian the 32nd person from the bottom. What is Brian's percentile rank?

Write your answers on lines provided:

1. _____

2. _____

3. a b c

4. _____

5. _____

6. _____

Here are the shoe sizes for students in an 11th grade math class (F for females students, M for male students):

F	4.5	5	5.5	5.5	6	6	6	6.5	7	7	7	7	7.5	7.5	8	11
M	7	7.5	8	8	9	9	9.5	10	10	10	10	10.5	10.5	10.5	11.5	12

7. A) Find the 5 number summary for the females

B) Find the 5 number summary for the males

8. Sketch a box plot of each on the same axes.



9. A) Calculate the outlier boundaries for the female data set.

B) Calculate the outlier boundaries for the male data set.

10. Is the female with the size 11 shoe an outlier?

11. What is the mean of the male shoe sizes?

12. The standard deviation of the male shoe sizes is 1.40
What percentage of the male shoe sizes fall within
one standard deviation of the mean?

13. Johnny, the biggest student in the school, was absent the day the above
data was collected. Upon his return, his shoe size (size 18) is added to the
data.

a) Which is more affected by the addition: The mean or the median?

b) Which is more affected by the addition: The IQR or the standard
deviation?

7. A) (FEMALE)

Min _____

Q1 _____

Median _____

Q3 _____

Max _____

B) (MALE)

Min _____

Q1 _____

Median _____

Q3 _____

Max _____

8. Use axes provided
to the left

9A) _____

9B) _____

10. YES NO

11. _____

12. _____

13.

14. In Angela's neighborhood there are a lot inexpensive houses, a few medium-priced houses, and one or two expensive houses. If house values were represented on a histogram, would the shape of the histogram be characterized as...

- a) Symmetric b) Skew left c) Skew Right

15. Ms. Smith gives a test where 5 kids earn A, 18 kids earn B, 24 kids earn C, 12 kids earn D, and 2 kids earn F. How would the distribution of Ms. Smith's grades be shaped?

- a) Symmetric b) Skew left c) Skew Right

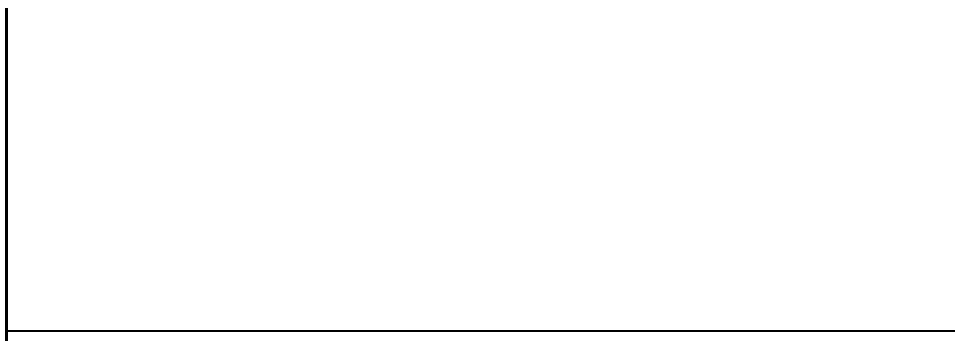
The following data represents a sample of distances between the pupils of the eyes of 22 adults. The measurements are in centimeters.

Pupil Distances: 6.7, 6.7, 5.9, 6.3, 6.3, 6.7, 6.7, 5.5, 6.3, 6.1, 6.0, 5.6, 6.5, 6.7, 5.9, 6.0, 6.1, 6.3, 6.0, 6.3, 6.9, 5.7

16. If we create a histogram covering a range of 5.0 to 7.0 using five bins, what bin width must we use?

17. If a person in this sample has a pupil distance of 6.0, what is their percentile rank?

18. Create a histogram covering a range of 5.0 to 7.0 using five bins. **Be sure to label both the horizontal and vertical axes correctly.**



19. Which of the following data sets has the largest standard deviation:

- a) 5, 5, 5, 5, 5
b) 1, 5, 5, 5, 9
c) 1, 1, 5, 9, 9

14. a b c

15. a b c

16. _____

17. _____

18. Use axes provided to the left

19. a b c

20. After students have taken a test, the teacher decides to double every student's score. Which of the following will change (circle all that apply – there may be more than one correct answer)?

21. After students have taken a test, the teacher decides to increase every student's score by 5 points. Which of the following will change (circle all that apply – there may be more than one correct answer)?

22. After students have taken a test, the teacher finds that the student who scored the highest actually had earned 5 points more than she had originally received due to a correcting error. Which of the following will change (circle all that apply – there may be more than one correct answer)?

20.

Mean

Median

IQR

Standard Deviation

21.

Mean

Median

IQR

Standard Deviation

22.

Mean

Median

IQR

Standard Deviation

Appendix 4

The screenshot displays a web browser window with the following elements:

- Browser Tabs:** "Inbox - brietta.schluender", "Login - Powered by Skyward", "Chapter 2 | Schoology".
- Address Bar:** <https://whitebear.schoology.com/course/51663563/materials?f=2291235>
- Navigation Bar:** "Add Materials", "Options", and a refresh icon.
- Material List:**
 - RYS-2 Video
 - 2.1 Box Plot Video
 - How to find the mean and 5 number summary on your graphing calculator:
 - Chapter 2 Assignments
 - Chapter 2 Lessons
 - Skewness
 - How to calculate outliers
 - Percentile Rank
 - Describing Data in your life
- Left Sidebar:**
 - Course Options
 - Materials
 - Updates
 - Gradebook
 - Attendance
 - Members
 - Analytics
 - Workload Planning
 - Access Code: NBJSB-SX5B3 (Reset)
 - Information: Grading period 2013-2014 Year
- Taskbar:** Windows taskbar with icons for Internet Explorer, File Explorer, Chrome, Word, and PowerPoint. System tray shows the time 9:46 AM on 10/15/2013.

Appendix 5

10/2

Joe DiMaggio played center field for the Yankees for 13 years. He was succeeded by Mickey Mantle, who played for 18 years. Here is the number of home runs hit each year by DiMaggio:

29 46 32 30 31 30 21 25 20 39 14 32 12

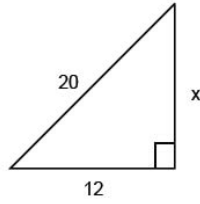
by Mantle:

13 23 21 27 37 52 34 42 31 40 54 30 15 35 19 23 22 17

Find the 5 number summary for each player and make side by side box plots. What does your comparison show about DiMaggio and Mantle as home run hitters?



MCA Problem of the day!



Homework Questions?!?!

Mean vs Median

Mean
 Not Resistant
 Not a number from the data
 Must be calculated
 Must be within the minimum and maximum

Median
 Is resistant
 Is a number from the data (or an average of two)
 Does not need to be calculated
 Must be in the middle of the data

STANDARD DEVIATION

A set of numbers has a standard deviation of 0. What do you know about those numbers?



A set of data has a mean of 10 and standard deviation of 3. You add 5 to each number in the set. What are the mean and standard deviation of this new set?

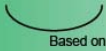


A set of data has a mean of 10 and standard deviation of 3. You multiply each number in the set by 5. What are the mean and standard deviation of this new set?



Measures of center and spread...

Median and IQR



Based on

Mean and Standard Deviation



Based on

Which ones are resistant?

HW#3
2.2 Day 2 worksheet

Appendix 6

Student Survey

Instructions: Check whether you strongly disagree, disagree, are neutral on, agree, or strongly agree with the following statements regarding the use of a graphing calculator and technology during this last unit.

Survey Questions:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I participated in all aspects of the in-class and out-of-class activities during this unit.					
2. I put forth my best effort during the in-class and out-of-class activities during this unit.					
3. The in-class activities helped me better understand the material during this unit.					
4. The calculator instruction was helpful to me as a learner.					
5. Schoology helped me perform better on the unit test.					
6. I feel I performed better in math this year than in other years.					
7. Having a graphing calculator allowed me to learn the material better than without one.					
8. I had more time to apply and practice the material in this class compared to other years.					

9. What was the most helpful technology used in this unit? Explain why.

10. What was the least helpful technology used in this unit? Explain why.

11. Did you feel more confident about taking the chapter 2 test knowing you could use your graphing calculator?

12. Do you feel you did better in this unit because you had the aid of technology?