

TECHNOLOGY IMMERSION IN THE 8TH GRADE SCIENCE CLASSROOM

by

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Marcia Julia Blome

July 2014

DEDICATION

This paper is dedicated to my loving husband Brad Blome, who has supported my journey through this masters program with an enormous supply of patience, love and chocolate.

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ABSTRACT

In this action research project, technology immersion was integrated at various levels of content instruction with the purpose of measuring student engagement in eighth grade science. Students applied increased levels of technology during the course of introduction of material, exploration and assessment. The data collected shows an increase of engagement while improving understanding in science.



## INTRODUCTION AND BACKGROUND

### Teaching Experience and Classroom Makeup

Students at my public school do not view science as one of their favorite courses. I believe this has to do with the way we are delivering the content. After seven years teaching seventh grade, I recently started teaching four sections of eighth grade general science, but already I have noticed a lack of excitement in the class. As a teacher, I want to see my students interested about the science I am presenting and feel passionate about. My job is to ignite their curiosity and provide the platform for student learning. My problem is that students are not engaged in the science classroom. I want to measure engagement, but I need to address the question of what is engagement. In a basic sense, it measures the relationship between school and students. I have found that there are several that one can look at when attempting to answer the question of whether a student is engaged. Libbey (2004) looked at several factors others collected when trying to compile a list of what engagement looks like. Her research looked as far back as 1993 to how researchers measured whether students were engaged in school. Many of the lists included homework preparation, test scores and student attitudes. One measure used in 1993 was involvement in a religious organization at school! That is clearly out of place in 2013. But I think most of the indicators mentioned appeared to have merit. I prefer no exact definition for engagement but more a list of behaviors that add up to the sum. One way to put it is that a truly engaged classroom is disappointed when the bell rings to change classes. The question I have is how can I increase the engagement so that I too see that desire to stay in science class. My action research explored whether or not technology immersion in the classroom will increase student engagement. I hoped to

prove with my action research that the difference can be measurable in students' attitudes and how they view science. If student engagement were to increase, then students will likely listen more attentively and perform better on assessments.

This problem of engagement is not one that is unique to my school as our nation as a whole has been discussing what to do about the lagging science and math scores compared to the rest of the industrialized world. We have established some programs to address these concerns like Science, Technology, Engineering and Math (STEM), and the Common Core State Standards, which my state is one of five not to have adopted yet. But I feel that one of the issues that also need addressing within this framework is what to do about the engagement of the American students.

If our students are not interested and passionate about a curriculum, they will not major in this field in college. This is a large problem for our nation that needs to be corrected. Our culture is different from other countries and we need to adapt our classrooms to reflect the culture. Asian countries instruct differently than European and we need to thoughtfully develop what should be the American 21<sup>st</sup> century model. Technology immersion in society started here and we need to use that to our advantage in the classroom for student engagement.

One of the main reasons I have decided to pursue the technology angle is that I have raised 3 children of my own who use technology in varying degrees everyday. I see that when they have a question, they go straight for a computer instead of a book on our home shelves. They know that answers can be found almost immediately by using the correct words in a search. To entertain themselves, they laugh about different clips they have seen on You-Tube and will share these on their computers, or smart phones. I need

to recognize that many aspects of their childhood have been completely different from mine and it should be validated by how they learn at school. With these issues I think that this question is relevant enough for capstone research.

### Focus Question

My action research question was: *What is the effect of technology on student engagement in the eighth grade classroom?* As I stated above, I was trying to figure out a way that I can increase my student's interest in science class. I believe that technology is one of the avenues that I know kids today are interested in so with that in mind, I used that knowledge as my lever to test engagement. Technology is a huge issue in schools today and so much money is being spent on computers and tablets with the hope that they will have a positive impact somewhere on the learning. I have two sub-questions that I will explore.

1. *What is the effect of technology on the minority students' performance on summative assessments?* My district is scratching its head trying to figure out ways to bring up our minority test scores. There is no real plan on how to do this, just to do "everything we can" to help these students succeed. I would like to be more specific in my approach and that leads me to my first sub-question.
2. *How has the technology immersion changed my teaching 8th grade science?* I also wonder how the increased use of technology will change my teaching experience. Will I find that it has been a great experience and an adventure that I can't get enough of? Or will I find that using this amount of technology is a headache of websites not working and students not being able to use it without eating up valuable instructional time.

### Support Team

Dr. Crystal Bolamperti is a huge advocate for teachers and the amount of time it takes to prepare effective instruction. She has been a support in my goal of integrating technology into classroom instruction. Dr. Bolamperti initiated a Technology Committee in our building. It's her personal goal that all teachers should increase their use of technology in the classroom. She is a wonderful resource for whom to turn to when questions arise as well as accessing her insight in teaching from 20 years of experience.

Also on my support team is the history teacher on my 8<sup>th</sup> grade team, Lance Mosier. Once upon a time, our school had money to employ someone part time to assist teachers with their technology problems and questions. Lance was this person who also taught history the majority of his time. Due to budget shortfalls, teachers now have to rely on their own resources when they want to learn how to implement any new technology. Lance was highly appreciated when he fulfilled this position and will help anyone if he has time that meshes with a shared plan period. He has had medical issues this school year, so his input was limited during the writing of this paper.

I included an eighth grade student in my support team as he is the student that I want to truly engage but seem to have failed. This student is of Latino ancestry and doesn't seem to ever study or do well on assessments. He is usually tuned out of class and never asks questions. I have tried to build a relationship with him since last year, but I want to see students like him flourish in class. I think he is an interesting touchstone as to what might be engaging to students who have decided they are not really interested. I seated this student someplace where I could ask him questions, but he didn't feel like all

eyes were upon him. In other words, I continually put him on the fringes of a row so he was not smack dab in the middle of the class.

### CONCEPTUAL FRAMEWORK

The first thing I need to understand is what strategies will attract my students so they are interested in the curriculum I am trying to teach them. Gill (2011) pointed out in his research that students will disconnect from the learning if the teachers do not enhance the instruction to keep them interested. According to the U.S. Department of Education (2011), technology positively increases student attitudes resulting in higher attendance in technology rich schools. The question then remains: What will enhance instruction? Gill (2011) used student response systems and computer animations to make a connection with his students. When appropriate, he also activated prior knowledge by showing familiar movie and television clips to hold their interest and activate discussion. In addition, he applied inquiry and small group work to involve the students in the lessons. Basically, he varied his instructional strategies to increase engagement Gill (2011).

I often do small group work and try to carry out as many labs as possible given my limited resources. A recent study (Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt, and Wenderoth, 2013) showed that student performance rose in active learning environments compared to traditional lecture. But what I haven't tried is immersing my students in technology while also using these approaches. Together I hope to see an increase in excitement about the topics being taught. Students come to school already motivated as young children and our job is not to demotivate that drive (Bowman, 2011). A national survey by the Kaiser Foundation found 8 to 18 year olds average about 7.5 hours a day with some type of technology (Kaiser Family Foundation, 2009). According

to the U.S. Department of Education teachers need to create learning experiences that resonate with student's daily lives (Office of Educational Technology, 2010). Students should have more control over their learning, specifically when they do it and how (Pink, 2009). These preferences would be hard to satisfy without technology, which can provide access to a learning time without specific hours (Sawmiller, 2010).

When deciding which technologies to employ, I found choices to consider from several sources on the Internet (Sotta and Najifi, 2013). The collective resources found on the web now have a name commonly referred to by some as Web 2.0. These include applications, social networking, messaging and other computer based technologies. Instructional design employing these can be tricky and great care has to be taken when trying to take advantage of these creative tools. There are several choices of technology instruction and each might appeal to a different style of learner (McCoog, 2007).

When using technology in the classroom, Bull and Bell (2008) point out that effective technology must enhance the instruction, not be the purpose of the lesson. Higher level thinking and increased engagement (Lempke, Coughlin & Reifsneider, 2009) are the reason students should be spending time with technology. Most American students born after 1990 are comfortable using a computer and should have limited difficulty following basic instructions on the use of technology. But these authors say that a variety of computer technologies are going to help students understand science better. So it is not just in finding answers on a web-quest, but apps on an i-Pad, probe-ware, interactive web sites, computer-project based learning, and other creative applications will need to be employed to succeed in this direction. Motivation can also be increased

when students have an audience for their scientific reflection in the form of a Blog (Sawmiller 2010).

The sub-question I would most like to answer is about the impact technology will have on student engagement of minorities. A study found in the *Journal of Research in Science Teaching* (Yerrick, Schiller and Reisfeld, 2011) had me thinking about creativity within my classroom. Not only do I need to use the technology as a tool, I must be aware of the populations I am trying to engage. The article, *Who are you callin expert?* (Yerrick, Schiller and Reisfeld, 2011) points out that different strategies must be employed to reach students who view failure as a social status.

Many of these students come into science viewing it as a list of facts and figures that must be memorized. This article refers to research that advocates for asking more what the students' views are on science and what effective instruction looks like. It is no surprise that students thought they learn better from teachers whom they thought liked them. With this in mind, my surveys include questions on learning styles with areas for open-ended responses. Another finding from the study above was that once the relationships were solidified, the students were enjoying the use of technologies brought into the classroom (Yerrick, Schiller and Reisfeld, 2011). This research examined a remedial earth science high school class in which inquiry and technology were traditionally limited. The teacher in this study used graphing calculators and probe-ware. The calculators made the step of graphing easier for the students and ended up with the same critical thinking. The probe-ware was sited as encouraging the gathering of live data easily. Both of these engaged the students to see that science uses tools and is not

just facts and figures. I intended to utilize the graphing calculators within my last treatment unit.

It will be imperative that when integrating technology into instruction that teachers do not fall into the mindset of using the technology to keep a teacher-centered approach to classroom instruction (Godzicki L., Godzicki N., Krofel, M., & Michaels, R., 2013). The technology needs to be innovative. Instructors should not use a whiteboard just like a chalk-board. With these aspects in mind I designed my methods.

## METHODOLOGY

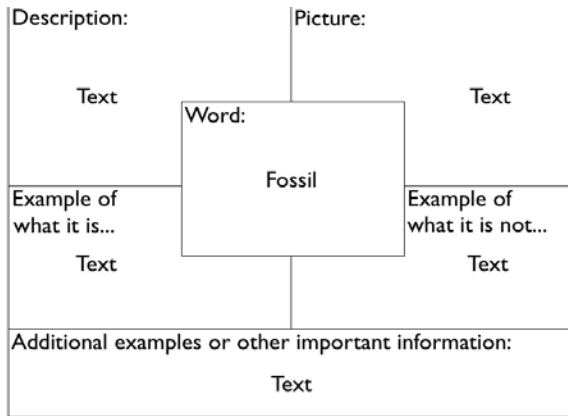
### Description of Treatment Changes

Traditionally, I have taught lessons by giving notes, reading out of the book, small group work, a lab experience and review of material before assessments. This style of teaching has shown fairly average summative results with few failures. This learning cycle has a limited use of technology, usually only incorporating presentation software or teacher presented video clips from YouTube. The treatment used for the action research-based classroom project immersed students in various technologies while continuing my previous pedagogy.

The instructional design of the technology was tailored to the various material taught. I employed technology by the use of web-quests, online student flashcards, interactive sites that quiz students, instant feedback from websites like [www.socrative.com](http://www.socrative.com) and project-based learning on computers. In order to direct the students to the technology, many of the links and resources were made available at my district-based portal for teachers to communicate with students known as Blackboard. I



the information given during a traditional lecture. This is a skill that many middle school students struggle with when learning new content, and one the Cornell note taking attempts to address.



*Figure 2: Frayer Model.*

Student homework consisted of a vocabulary keynote template downloaded from my website, see Figure 2. Frayer Model. The vocabulary term is in the middle of the square and students fill in four criteria about the word; definition, image of the words meaning, definition in your own words and what the word does not represent. Students complete one slide for each vocabulary term and then send their completed work to my Blackboard dropbox. I had already introduced students to this format during the first quarter so my expectations were not new to the students.

No hard copies of the section from the book that we were learning about were available, so students had to read from an online version. The next day a web-quest on the same material was used to guide students to an interactive website. This website from the National Science Foundation guided students through geologic time and gave visual perspectives to engage student learning and understanding along the way. Found at the

end of the web-quest was a short 10 question formative assessment to help students determine if they understood the content.

After a review of the material and a study guide, students took a summative online test of their understanding. I administered the test from my Blackboard website and utilized pictures that contained hot-links for students to click on the appropriate image to answer a number of questions. Students could immediately see scores at the end and go back to see which questions they missed. To wrap up the unit, students completed a poster project.

As shown in Table 1 the next 3 week treatment unit started with an online pre-test on ecosystems with several vocabulary terms that students were familiar with but did not really understand the meaning. Another Cornell style note document was downloaded for student use to take notes. In this unit, I had the students create accounts for [www.quizlet.com](http://www.quizlet.com) which is an online flashcard website for students to test their vocabulary. Homework included studying my teacher created flashcards and play the vocabulary games from this unit. This provided additional practice for the summative assessment found on my Blackboard site.

Finally, students accessed an interactive website developed by several Nebraska non-profit organizations called [www.projectbeak.org](http://www.projectbeak.org). From this collective website I allowed students to have a creative experience at one of the menu choices called “Build a Bird”. Students explored success rates of birds with different beaks, wings, and heads found in different habitats. This website was also the source of the second web-quest for the treatment. For this web-quest students looked exclusively at beak adaptations. Another online portal explored was from the University of Colorado interactive

simulation for natural selection. During this unit students created their own quizlet flashcards since they had all established accounts during the ecosystem unit. Finally, the education site of [www.brainpop.com](http://www.brainpop.com) was utilized throughout the ecosystem unit and two and a half week biodiversity unit with quick informative videos and interactive quizzes.

The capstone activity for the unit was the student project. This individual artifact involved Internet research on an endangered species to be presented using a keynote. A teacher-designed storyboard was downloaded from my Blackboard site with a rubric to guide students on their requirements. As we moved through the biodiversity unit, I introduced the interactive site, [www.Socrative.com](http://www.Socrative.com) where students gave instant response to questions about their understanding for teacher analysis. They had used the site recently in their history class so were familiar with its design and use.

Table 1  
*Units Experiencing Treatment*

Treatment Units	Earth Science	Ecosystems	Biodiversity	Renewable Resources
Weeks	3	3	2.5	2.5
Technology Implemented	Presentation of Notes on Keynotes and Cornell Note Style Templates  Online Book  Vocabulary Builder with Keynote  Web-Quest  Blackboard Assessment	Presentation of Notes on Keynotes and Cornell Note Style Templates  Interactive Websites  Vocabulary Builder with Keynote  Web-Quest  Blackboard Assessment	Presentation of Notes on Keynotes and Cornell Note Style Templates  Instant audience feedback website with computers  Online Flashcards  Endangered Species Project using Keynote  Blackboard Assessment	Presentation of Notes on Keynotes and Cornell Note Style Templates  Instant feedback website with computers  Students Rebuild Website  Online Flashcards  Blackboard Assessment

My last unit to include the action research was on renewable resources and lasted two and a half weeks. In addition to the notes, online tests and online flashcards, I planned to use the math departments' old graphing calculators. Because directions were limited with no support, I choose to forgo the graphing calculators in favor of an interactive learning program Students Rebuild for my renewable resources unit. This curriculum has an educational website about the global water crisis which is divided into three areas; learn, act, and reflect. After some information on the varied resources of water and student centered activities, students watched videos about the way water is viewed around the world and compared their experiences to ours in Nebraska. Students read some online information about one women's story about how the accessibility of water changed her life. Finally, students had to reflect on this unit and submit personal feedback into my online dropbox. This was not the original technology intention of the unit, but due to limited resources, this is what actually ended up occurring in the classroom.

### Sample

I teach six classes a day, but only four of them are eighth grade general science, so that was the population of students I decided to target. My other two classes are an elective course that tends to draw students who really like science and tend to do above average in school so they would not be the target for my action research to increase student engagement.

According to the Official Nebraska Government Website, Nebraska Department of Education: [Reportcard.education.ne.gov/](http://Reportcard.education.ne.gov/) there were 929 students at Westside Middle School during the 2012-2013 school year. 21% were minority and 32.9% received free or

reduced lunch. In the four general sciences chosen, I teach 106 students, with an average of 26 in each class. Over half of my students come from middle class backgrounds, yet 1/3 are on free or reduced lunch. The remaining 10% are from what would classify as an upper income household. Twenty-three are identified by the district data as minority, which includes Asian, Black, Hispanic or American Indian. Most have been within the district and therefore have received similar science experiences as their white counterparts. However, some have transferred into the district at the start or part way through middle school. These transfer students have traditionally come from a local district that has low test scores within the state of Nebraska. Due to this fact, their grade schools focus heavily on math and reading with limited exposure to science.

I measured engagement on assessments, attitude surveys, homework completion and observations. Before I began the treatment process, I received the necessary administrator approval through sign off methods for research data collection from my district. The study design for my research project was reviewed by the Montana State University Institutional Review Board (IRB), and was granted IRB exemption on November 22, 2013 (Appendix A).

### Instruments

The first data source included a survey and attitude Likert style scale. I wanted to hear directly from the students their positive and negative perceptions of school and especially science. These true beliefs and feelings needed to be collected before we began treatment. I wrote a list of questions to be answered, and then looked at numerous books and capstones for ideas to add to my original list of questions. Quantifiable data

can be collected from the Likert questionnaires but because there are several open response questions so I could gather qualitative data to gain insight into the student thinking. The students were the source of the data.

(Appendix B).

One way to check validity is to ask questions from both a positive and negative perspective. I looked at the obvious points like those mentioned above, but I think attitude plays a major role in student performance, so I included questions concerning “feelings” about school. Some of the positive questions included rating whether students like being in school, feel excited at school, or admit that school can put them in a good mood. On the flip side some questions to consider were feeling frustrated at school, tense or anxious at school, or even agree that it makes them angry. These are pretty broad questions, but when asked before treatment and end of the year, then I got an accurate picture of engagement in the science classroom.

The second source for data came from teacher journaling. I used a journal throughout the treatment and post-treatment phases. This was helpful for recording qualitative data. The last data source was observations. I called upon members of my support team to visit my science classroom to record qualitative observations to share. We met shortly after the observations so they could give me valuable oral feedback. Together this triangulates the data from three different sources. When I consider other methodologies, I reflected on the capstone that I initially read. Kretschmer (2012) did research on technology integration that I implemented in my capstone. She utilized student questionnaires and examined test scores but she also used qualitative methods to

support her research. These included journaling, interviewing and examination of artifacts to determine time used on homework. Journaling helped to make sure that I didn't forget what happens during each day as I administered treatments. An occurrence during journaling which can seem trivial often emerges as interesting outliers to include in my observations. One way to measure engagement is to assess the amount of time spent on preparation outside of class and I realize that I will see some of my students score negatively in this category. There are students who refuse to do homework as it might be viewed as a social negative and "giving in" to the system. (Yerrick, Schiller, Reisfield 2010).

The first research sub-question, "What is the effect of technology on the minority student's performance on assessments will require three data sources:

- 1) Pre and post student surveys and attitude scales
- 2) Pre and post student assessments
- 3) Pre and post student interviews

The first data source will be the student surveys and attitude scales that I will have used for the primary question for my action research (Appendix B). I think that comparing the answers of the minority population to the general group will possibly raise some questions, but also give me good information in order to develop my interviews. The source of this data will be the school identified minority students which includes students who identify as a race other than "white". The data provided to me includes Asians, Black or African Americans, Hispanic and American Indian or Alaska Native.

My second data source comes from holding a pre and post interview session about science engagement. I chose individual interviews rather than focus groups to provide

richer understanding than in a small discussion group where they may feel pressured to say something that is expected by their peer group. The interviews give me some good qualitative data from the student source and additional insight into information I wouldn't be able to gather otherwise (Appendix C).

One way engagement is measured can be by performance on assessments. If students are listening and engaged in the subject, then they should be vested enough to study and perform well on assessments. That makes this last data source of students a valuable one to include and will give me additional quantitative data to analyze. Below is a copy of the research matrix in Table 2 that I compiled of all the data triangulation.

Table 2  
*Research Matrix*

Data Collection	Surveys	Assessments	Teacher journal	Homework Completion	Observations	Interviews
Research Questions						
What is the effect of technology in the eighth grade science classroom?	X	X	X	X	X	
What is the effect of technology on minority students' assessments?	X	X		X		X
How has the technology immersion changed my teaching 8th grade science?	X	X	X	X		X

As a way to ensure the validity of the research, I employed several strategies during the course of the treatment. I started by making sure I was able to collect data during a prolonged period of time. I implemented several different ways to incorporate technology into my classroom. I also kept excellent records on student's grades and homework completion to help solidify my triangulation of data. In addition, I consulted with other teachers about my action research to incorporate technology into the science classroom and my observations of the outcome compared to their observations. These peers helped me to interpret my observations and provide feedback on questions I had.

At the end of the treatment and conclusion of the post-survey, I shared my data with the students. I re-explained that they had been part of my masters program and I had collected data over the past few months on their attitudes about science, technology and academic achievement while covering four units in science. I helped them to recall the different types of technology that had been used and asked them in a class discussion what part of the units did they enjoy the most.

## DATA AND ANALYSIS

In this section I will be examining the data collected while students were experiencing treatment for technology. At the start of this action research project, the class was asked to complete a survey of their opinions on various topics. Students completed a Likert survey on a Google Doc form. The survey was given to four classes of eighth grade science at the start of the class. They were given as much time as needed to answer the survey questions and answered open responses as necessary. After a few months of

treatment, the survey was given again. A few of my students were unable to complete the survey due to reading comprehension, absences and lack of available staff.

The 22-question Likert survey was broken into three main categories. Ten questions on positive student attitudes about science were asked and then to balance that were six questions categorized as negative science attitudes. The last category contained questions on comfort with the use of technology. Table 3 below shows the results of the questions and Appendix B has the entire Likert Survey.

Table 3

*Average Scores per Category from Student Likert Survey Pre-Treatment*

Category	Average Score (N=101)	Percent
Positive Attitude on Science (Questions 1, 2 4-7, 16, 19-21)	3.7	73%
Negative Attitude on Science (Questions 3, 8-10, 15, 22)	2.3	12 %
Comfort Level with Technology (Questions 11 – 14, 17-18)	4.1	86%

Key: 5 = Strongly Agree 4 = Agree 3 = Not sure 2 = Disagree 1 = Strongly Disagree

It appeared that there was a generally positive attitude about science class even before treatment. The Likert Survey showed a 3.7 for a slightly higher than not sure about views on science. If I looked at the average, 73% either strongly agreeing or agreeing about questions pertaining to positive views on science. In the open response questions many brought up the fact they like learning about the earth probably because the unit we were currently doing was on fossils and stratigraphy. However in the open response question that followed from question one stated, *I enjoy science*, I had several refer to

astronomy as a favored topic. A good example of this was one boy who said, “Because I like to know about our planet and all the different and interesting things it can do. I also like to learn about stars and planets and galaxies.” I did have a student outlier whom I thought would have had a more positive attitude as she has been identified as gifted. I found her complaint during the pre and post treatment had to do with the topic of religion. She said, “I do like science but dislike the frequent use of evolution for explanation, but this is a public school and that is required.” She followed with the open response to explain her not sure opinion on liking science, she says, “I am a creationist and it is frustrating to have evolution taught in school.” I had another student mention religion as a factor for not liking science. It makes me wonder if there were those who felt the same way, but just didn’t mention it in the open response. There was another student whom I thought had a fairly good attitude, as she had superior social skills and is identified as gifted. As a follow up to why she said she wasn’t sure if she liked science, she said, “I find science not very entertaining and every year it seems like we learn the same stuff.”

Another illustration of general attitude was from the follow up responses to statement number five which said, *The science instruction that I have received will be helpful to me in the future.* I noticed a pattern to the response as many cited that future instruction in either high school or college would require them to have background knowledge on basic science concepts. I was not expecting so many to consider future classes when answering this question. I think the following quote summarizes the general thought to this pattern, “ It will help us pass high school with good grades, and get into a good college. “ When posing the question, I merely wondered what

relationship they put on science class and their life outside of school. The number of responses that made the academic connection really surprised me.

I did get several of the responses I was expecting, like the one that said, “ Like when you cook there are examples or recipes on how to make the food that you are going to make in other words cooking is science.” In 7<sup>th</sup> grade at our school it is stressed during the measurement unit that cooking can be considered a science, so it is nice to see that many remembered that connection. However, this question brought my lowest positive attitude with a 2.7 value. Many were not sure about their response so that brought connections down.

I used both positive and negative responses to make sure that I am not pushing the survey in one direction. The second category includes all these negative attitude questions. Negative attitude was only 2.3. The results validate the majority of students having positive attitudes as negative attitude is recorded by only 12% of the respondents. Question nine stated, *Science is difficult for me* and then asked the open ended, *Why did you answer the way you did for difficulty of science?* Since most of the students did not agree that it was difficult, typical quotes were along the lines of “Because its not hard when you pay attention and study when necessary” I appreciated how this pointed to obvious strategies to do well in any class. However those students who found science difficult were more likely to mention it as confusing subject, like the girl who often does poorly and said, “Because it can be confusing and might set my mind off track.” Another comment I would expect was “ I think I’d enjoy it more if I got better grades on tests. I do well on things that are not tests though.”

The last category was on student comfort level with technology. As I suspected, students at our school have very positive attitudes towards technology. The highest Likert score was found here at 4.1. With six questions on this topic, 86% had a positive relationship with technology and only 3.5% reporting a negative attitude. When asked, *Can you give an example of an electronic media that would be good for science class?* almost every single student had an opinion on a media choice. The most common example given was of an iPad followed by computers being, “just fine”. I was surprised by a couple of students who commented along the lines of, “we already have the computers and more media would take away the learning part.” I find it interesting that students do not correlate technology with academic learning. Overall, many had an opinion, so I believe they had thought about it before the survey, which means this is important to them. I did have nine students out of one hundred and one that did not have any example.

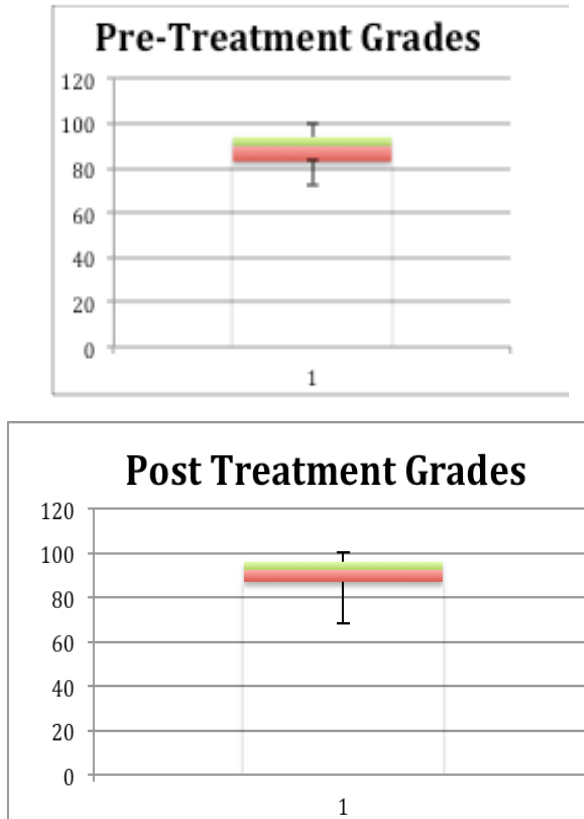
Table 4  
*Average Scores per Category from Student Likert Survey Post-Treatment*

Category	Average Score (N=98)	Percent
Positive Attitude on Science (Questions 1, 2 4-7, 16, 19-20)	3.8	75%
Negative Attitude on Science (Questions 3, 8-10, 15)	2.3	12%
Comfort Level with Technology (Questions 11 – 14, 17)	4.2	85%

Key: 5 = Strongly Agree 4 = Agree 3 = Not sure 2 = Disagree 1 = Strongly Disagree

At the end of treatment, the survey was again administered with a similar outcome shown in Table 4 above. There was a slightly higher positive attitude on science and comfort level with technology by the time the post-treatment was given. Each of these groupings increased a tenth of a percent on the Likert Scale. Although not a huge amount, I found it encouraging that the positive numbers stayed up and did not go down over the course of the treatment. The Likert numbers stayed high as many moved from “Agree” to “Strongly Agree”. Many students chose, “Not Sure” when answering questions in the category of positive attitude. We just finished a unit on physics and several of the lower math students seemed to struggle with their confidence in solving challenging questions. Although this was not part of the treatment, it was immediately after treatment ended and that negative experience for those that struggled could have been influencing the data. I added a question to my post-treatment survey asking them to respond to *I like some units in science more than others*. In the open response section only five out of 101 referred to the unit on Newton’s Laws as an example of a science unit that was really enjoyed. This was by far the least popular unit. I did not use any technology while teaching that unit so that might have been a contributing factor.

Another category of data to consider is the actual grades earned by students nine weeks before treatment and comparing grades to the eleven weeks after treatment. I created a Box-and-Whisker Plot (see *Figure 3*) where half of the students’ grades earned are represented inside the box. The box contains the data from the first quartile to the third quartile. The whiskers show range or spread of the data.



*Figure 3.* Box-and-Whisker Plot of Student Achievement in Grades before and after Technology Treatment, ( $N = 101$ ).

Figure 3 shows that the overall class grade moved up slightly from a median grade of 90 to 92.5. Although the whisker shows the spread of data increased 4 points, (see Table 5 below), I noticed the shift for my lowest performing students to increase their grade from the pre-treatment phase to 88% during the post-treatment phase. On the higher end of the spectrum the upper class average shifted in Q3 from 94% initially to 97% during post-treatment. The mean moved from 88% to 92%. This suggests that the technology did have a slight impact on student achievement. The median grade increases over two points and the students on the lower end of the grade averages moved up their achievement by five whole points and those on the upper end were able to earn another

three points. When each level of learner, low medium and high are able to increase their overall scores, this implies that technology has a positive impact on the learning.

Table 5  
*Median Scores for Box-and-Whisker Plot*

	Pre-Test Grades	Post-Test Grades
Minimum Grade	72	68
Q1	83	87
Median	90	92.5
Q3	94	97
Maximum Grade	100	100
Mean	88	92

Summative work counts for 100% of grades in my district. During treatment students were using more technology but it was not actually part of their grade. The difference between summative assessment results between these two periods was significant. Eighth grade students had an average grade of 88% at the end of the first quarter of the year. Treatment began and at the end of that period the average grade rose to 92%. In neither case did technology homework get graded, it just seemed to impact the learning so most students got a slightly better grade of four points higher. There were not any significant outliers. I found the same students who were above the class average before treatment, stayed above the class average after treatment. I did notice that one minority student who usually stays with the average score actually fell on the lower end of the grades but still within passing.

At the conclusion of the school year, I wanted to find if time brought any new perspective to my students thinking on technology. I shared some results of my research for my masters' project about technology during their time in my classroom. I asked them do a Minute Paper on the use of computers in eighth grade science class. They had to decide if we used them too much, too little or just right during the course of the year. Then they were to explain their response. The results of the paper are below in Table 6.

Table 6  
*Student Perception on Computer Use*

Computer Use in Science	Class Percent N = 25
Too Much	8
Too Little	16
Just Right	76

I was surprised to see that over 75% felt that we used the computers just the right amount. I thought they would have wanted for me to incorporate its use more, but most students responded similar to what one student said, "Just right, Because it was not the only thing we used to learn and it wasn't left out" (See Figure 4). This told me they were comfortable with the amount of time we spent on the computers. Several students commented that they felt we used them every other day which didn't get old. One of my mentors for technology does use computers every day and a few commented on this as boring.

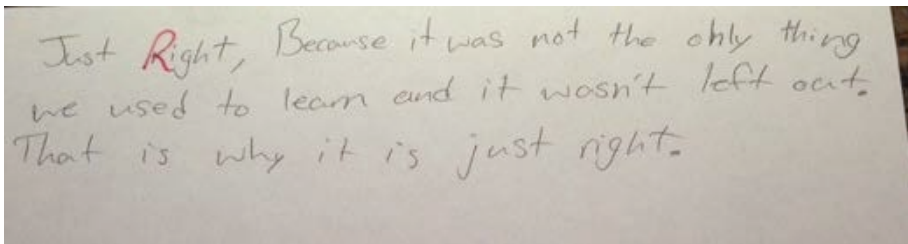


Figure 4. Student Minute Paper.

I asked members of my support team to observe the classroom during the treatment phase so they could give me important feedback. During the unit on ecosystems, one of these teachers commented how the students seemed to be enjoying the unit we were working on. As I reflected on my journal at that time, I know I also was excited to give them an opportunity to research on their computers and create connections between the content that we had been learning in the classroom and create an artifact on endangered species. I watched how the students excitedly shared information with one another during the research phase. They were not required to do this, but were genuinely interested in the facts they were finding. When students gave presentations to the classroom, one teacher from my content area noted what a nice job they had done to meet the requirements and yet show genuine knowledge and interest in the topic being presented. I agreed that I thought that engagement had really taken place. The students took charge of their learning and had excelled when given the technology tools.

As I mentioned earlier in my introduction, I would like to investigate what specific strategies work within the minority populations to increase student achievement. At the beginning of the school year, we looked over the Nebraska Education State Assessment Scores for our school, and saw that minority scores fell below the overall school average. When I compared the data of the overall classroom population to the minority population, I see that there are some real differences in student attitude about science. Positive attitude was two tenths of a point lower and negative attitude was a half point higher than the general population. This confirms what I had suspected that these students (which include Blacks, Hispanics, Asian and American Indian) were not as

engaged in science as the eighth grade as a whole. The comfort with technology was also lower at 4.0 on the Likert scale compared to 4.2 for the entire population. Table 7 below shows the comparison numbers.

Table 7

*Average Scores per Category from Minority Student Likert Survey Post-Treatment*

Category	Average Score (N=98)	Average Minority Score (N=20)
Positive Attitude on Science (Questions 1, 2 4-7, 16, 19-20)	3.8	3.6
Negative Attitude on Science (Questions 3, 8-10, 15)	2.3	2.8
Comfort Level with Technology (Questions 11 – 14, 17)	4.2	4.0

Key: 5 = Strongly Agree 4 = Agree 3 = Not sure 2 = Disagree 1 = Strongly Disagree

When I look at my pre-treatment interview questions administered to random minority students, I found some interesting responses. Three of the four of those participating in the interview said they didn't do well in science. One boy said it best when he said, "Not as successful as I should be. I am lazy and tired a lot." Another girl said, "My family isn't good at science. I always end up passing, but I like projects not really tests. It depends." But surprisingly two of the four said they could see science relating to their life as an adult. The original boy also said, "Like what I told you before, my uncle talks to me about computers and I might get into that when I am older." Another girl said, "Nurses run in our family. I want to work with kids. My Mom works for the VNA (Visiting Nurses Association), my aunt is a nurse my grandma was a nurse. Even my uncle was for awhile." A different girl said she was sure it would but didn't

know how yet. I have one student on my support team that I think would qualify for at risk, considering the background he comes from, the clothes and jewelry he wears and friends that he hangs with outside of class. He confided that some things in science are really hard to understand. In the survey, his open response to an example of how science instruction will be helpful in the future he commented, "Like car and what can fuel are they are going run on." He recognizes that he is not very good at science according to his responses, but tries to pay attention in class. I have noticed he makes eye contact with me frequently and shakes his head in recognition of information when I lecture. This shows me he is trying during school time. He has even worked with me after school to complete some of the assignments. He struggles with the understanding of challenging concepts.

As I am trying to find out if technology will motivate the students, these minority students all agreed they liked having laptops. When asked why, one stated, "It's easier to write stuff down. I can be lazy and this makes it easier." He also talked about listening to music when working on the computer. Another said, "Easier. I don't have to schedule the time to get on one in the morning or after school. And I can keep everything on my computer and don't have to use the (school) server."

Student achievement in the actual grades earned did move up for the minority students during the treatment. Pre-treatment scores for 21 of these students came in at an average of 84.1%. After treatment they rose three and a half points to 87.6 %. In all but three cases, the scores rose at least two points for achievement. This tells me that even though the minority students were not as engaged science class, they felt the impact from the technology treatment and were able to perform better on assessments and graded projects. It should be noted that my school does not include homework in the final grade.

Therefore most of my “homework” would be completion of a rubric-graded project. All students complete the graded homework, due to the policy of accepting late work, enforcing after school requirements or assigned study halls without deducting points from the assignment rubric. This philosophy of outcome-based learning has many positive consequences to encourage students to complete all assignments, even past the deadline. However, it can teach bad behaviors of procrastination without penalty.

My last sub-question to the action research is how the use of technology will change my teaching. After looking at the data, from the first two questions, I can see that I believe technology has a positive impact on understanding science content. I find students are more engaged in their own learning, which makes my job all the more enjoyable. When I requested students to get out their computers to work on anything from a web-quest to an online quizlet, not once in my journal did I write down about any complaints. In fact, I see from my journal that one of the only times I recorded grumbling about technology was when there were *only* four questions for immediate response. They obviously wanted an opportunity to show how much they understood. I wrote about being nervous having received the instructions from a member of my support team, but never having administered this test live, I was unsure of myself. A week later was the next time I employed the open response device, but I made sure to have at least eight questions for their consideration. At the end of the day, I commented how they seemed to really enjoy this opportunity to show me what they knew. In my journal I said, “if they liked the challenge of answering content questions correctly, this excites me as the teacher.” Upon reflection, I wrote, “another benefit of students’ use of technology was that I was able to walk around the classroom having conversations with students while they were

working.” Relationship building is a huge part of teaching and this is one more opportunity for me to work on that. I feel that my journaling combined with the data implores me to continue to find ways to incorporate technology in the classroom.

I noticed over the course of the three months of treatment that I (three times) commented about talking to other science teachers about my technology integration. I wrote how one teacher “was polite to listen”, but another teacher “was genuinely interested in what I was doing. I really appreciate that support.” Later in the treatment, I commented how a different teacher I don’t work with much wanted to know about the details of my research, and “how excited I was to share the outcomes of my efforts.” I see a general trend in my attitude when I read about sharing the integration of technology in my classroom. I know I am not the expert, but I get really excited to share technology that I feel works well in the classroom.

This year there was an aide who occasionally accompanies a student to my classroom. She suggested that I might try to do more pencil and paper work. In my journal after this conversation, I wrote, “I don’t understand why she says that? My resource students enjoy the opportunity to manipulate concepts on the computer. I guess many do need a paper copy of the notes as they do not type as fast and they can get lost trying to keep up. Some of these students on individualized educational plans can get confused trying to figure out what would be important to bold, and where on the Cornell Note Sheet they should put the major concept compared to the definition. But I see that as more of a literacy issue, not a technology one that I can work around. Not all technology is for everyone. After rereading what I wrote in my journal that week, I recognize that I am defensive about my integration of technology. I want to see it work for my classroom, but

I must recognize that it is not one size fits all. From projects to assessments, there still has to be accommodations made for all students to fit their needs.

### INTERPRETATION AND CONCLUSION

My action research question is “What is the effect of technology on student engagement in the eighth grade science classroom.” In order to gauge that I designed a survey to gather pre and post test answers to compare engagement in science.

Engagement is related to attitude so the Likert survey was the logical tool to administer for this data collection in this project.

I was actually surprised to find the students having positive attitudes about science in eighth grade after the first quarter. According to the Pre-Treatment Student Survey the positive attitude was a 3.7 on the 5- point scale. The beginning of the year started with a review of the scientific method and the metric system. It was the first time I taught the units on the rock cycle and fossils, but I was not enjoying the content as much as the other teachers told me I would. My background is in biology and geology can sometimes be very dry in my opinion.

Yet most of my students didn't let this get them down! They must have drawn upon years of previous knowledge with science class and 73% of them recorded they Strongly Agree or Agree that science is important enough to feel positive about the subject. I am in the unique position of having taught many of these same students in seventh grade and know that from my past experience teaching them they are generally good students who apply themselves enough to pass the tests.

By the end of the treatment, the positive attitude rose two percentage points. I think that student attitude indicates an increase in engagement and even though this data

is in the direction I would like to see engagement trend, it was not the overwhelming push that I was hoping for. Since my research question focused on immersing technology in science class and student response to that, I am not surprised to find so many students agreeable to using technology. I have definitely seen a comfort level rise among middle-school students in the last five years. Our 8<sup>th</sup> graders have student computers and the building has finally caught up in the past year to increase our wireless connectivity. The server can handle students using the Internet more and students do not have to become frustrated from locked up computers with the “spinning wheel of death” that was common just a few years ago. I recall five years ago I had asked seventh graders how many had Internet access at home and it was around 90%. The Likert Score for question number 18 at a 4.6 asserts that most students are confident that they can access Internet at home. This leads me to the assumption that computers are part of not only their school life but technology continues on at home, and they feel comfortable with it.

This decrease in frustration has probably helped to increase students’ positive attitudes when we implement projects in technology. The Likert Survey score moved from Pre-Treatment of 4.1 to Post-Treatment 4.2. When students were asked to elaborate on which media would be good for science, the overwhelming reply was iPads. I am not surprised as we are a Mac-based district with a long-standing relationship with Apple Computers. I think that most of my students appreciate technology, but just like school districts around the country, they struggle to understand the best practices to implement new technology. One student might have said it best when they quoted, “I think computers are just fine but it would be cool if we were able to use iPads.”

And that is exactly why I think engagement might increase. It may seem trivial, but if you can hook them with new technology because *it's cool*, then I think we should try the technologies until we figure out which ones will actually hit the mark to significantly increase engagement. We are scratching our heads in this country trying to figure out where our scientists are going to come from and if we continue to turn them off in middle school we are fighting an uphill battle to create all the homegrown scientists needed to keep our society functioning.

The summative assessment scores earned though the treatment phase did go up, yet the overall numbers were not overwhelming, but in the positive direction. Based on my results, technology positively impacted not only engagement but also student performance.

My first focus sub question question asked, “What is the effect of technology on the minority students’ performance on assessments?”. According to the data collected, the overall performance on the group minority assessments rose three and a half points. This may not be a large rise, but I feel that any increase in the score in assessments is notable. That trend can push a student up from what may be considered as an average score into the range of highly proficient. Technology appears to be an attraction for the group to increase engagement. This translated into higher scores. As my district studies achievement data year after year and compares minority scores, I believe that technology should definitely be integrated at all levels during the delivery of content and in some cases, possibly even more frequent from the general population when possible. When I design my lessons in the future, I will be sure to implement the necessary technology.

My overall student body and specifically my minority population appear to have positive gains in achievement when I incorporate the technology piece into the lesson design.

My second focus question asks, “How has the technology immersion changed my teaching 8<sup>th</sup> grade science?”. This question made me think a lot more about what instructional methods I am using. As every person has a unique learning style, I must make sure I am incorporating all approaches into my technology. In the minute paper I gave at the end of the year, 76% felt that we used just the right amount of technology in science class. They also made sure to explain that they didn’t want to use it every day, but incorporate it when it adds to the learning. Using technology just to use it is not smart pedagogy. I will continue to look for sites or apps that I am confident sharing and then try and figure out a way to bring that into my classroom. The challenge will be staying current so that I can continue to excite the learner with a new medium to deliver the required content.

I want to continue to seek out teacher professionals who are trying innovative technology in their classroom. I must make the time, as teachers are all busy and it will require me to seek them out and ask for their valuable time in a very busy schedule already. As my life settles down from the Montana State University Masters Program, I longingly consider the free time to push myself to follow some technology sites on Twitter and explore where they lead me. During this action research, I signed up for some science sites to follow, but the technology sites are really where I will push myself into new territory and outside of my comfort level.

You would think the longer you teach, the less time is spent on developing lessons year after year. But I have found in this journey that it is almost the opposite. I

am never satisfied with last years lesson when I know there is new technology being developed every day. I have to find the unfamiliar, test it, accept or reject and then decide if I can give up valuable instructional time to this new untested technology. Its incorporation could keep me fresh, excited and deliver student engagement that will improve understanding in science.

### VALUE

Science is constantly changing as new information becomes available. The integration of technology into the science classroom is well under way, but by no means complete. Cost of technology in the classroom and training of its use can be prohibitive in certain economic climates. And another problem may be that our educational systems do not possess the technical guidance to move forward due to our own inadequate understanding of the impact of new technology. The reasons can be from the fear of the unknown, to the bureaucracy of state and school administrators as well as politicians (U.S. Department of Education, 2010). Technology is changing as rapidly as our new advances in science, and this fluid situation in the classroom could open educators up to some situations they have never faced before.

As I did my research on this paper, I have come across some new technologies that I am excited to incorporate in my classroom, even before the year ends. I would have never opened up my classroom website to blogging, but I have rethought that after reading the research about the benefits of blogging. This would fill my desire for middle school students to express themselves, integrate technology, and reflect upon their learning in a meaningful way. I wonder if they are mature enough to blog in science

without it turning into a bully platform. I guess that I will need to try it to see how it works at my school.

My teaching with the use of computers will look drastically different than what it did two years ago. I plan on students taking notes using a modified Cornell Note sheet with a template on my Blackboard site. This worked well for both students and myself since I didn't have to make copies of guided note sheets. I also will be using the Frayer model vocabulary builder for many of the units and mix it up with online quizlet.com notecards. I am a huge fan of Socrative.com for formative assessment. I never had an instant feedback device before and now I understand why teachers find them so valuable. I can see at the end of the lecture immediate feedback for what they understood or still were uncertain about.

Giving assessments on my Blackboard site is something that I will incorporate again, but not as frequently. I feel that multiple-choice questions do not push the learner to study like they would for fill in the blank and written essay tests. They are fantastic for the ease of grading when you have a large amount of tests, but I will be cautious about not sticking to one style of assessment. I will use a variety of methods to assess my students understanding.

This year really pushed me to use technology on a bigger scale than I have ever before and I am grateful for the experience. Although the results of student learning were not statistically improved (see Table 5) the attitudes expressed about technology by the students makes me feel that it is worth the effort to develop these opportunities; student engagement in science is the whole reason I have pursued this research.

While digesting the data from my action research project, I noticed a theme. This theme was repeated several times in the open responses to my Likert Survey. One student summed it best by commenting, “ I answered Not Sure (about Enjoying Science) because there are some parts of science that I enjoy and some that I don’t like as much.” There were many kids who had similar feelings and commented about attitudes that changed depending on the topic for a unit. Science is such a broad field of study. Earlier, I commented on my own displeasure with teaching geology and I am a science teacher. Is it ok to say you don’t like science when you just like astronomy or weather but you find the rest of the material boring? This same student may end up becoming an astronomer who just doesn’t like geology. Is it possible attitudes were affected by student thinking on one particular field of science (i.e. geology or physics) and not the overall subject of science. This could raise the question that as I move through general science curriculum in eighth grade, do I need to pay special attention to different topics of study and be aware of middle school attitudes on each one. How do I do that?

One of the last questions I have comes from my sub-question surrounding minority achievement. As I ponder the results of the qualitative data collected from my student interviews, I am struck by how three of the four minority students I interviewed agreed they did not perform well on tests. When asked why that was, they did not have an answer. Interestingly three of the four mentioned music and art as classes they enjoyed the most. One girl told me she was actually going to get a cello for Christmas and she was the one out of the four who did perform well in science. I am learning that music and art are very important to the four students I spoke with. In the future I could look at

some technology that incorporates music into science. Will technology make a difference in these students performance in science and if so how?

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APPENDICES

APPENDIX A  
IRB EXEMPTION

**INSTITUTIONAL REVIEW BOARD**  
**For the Protection of Human Subjects**  
**FWA 00000165**



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**MEMORANDUM**

**TO:** Marcia Blome and Walt Woolbaugh  
**FROM:** Mark Quinn, Chair *Mark Quinn CJ*  
**DATE:** November 22, 2013  
**RE:** "What is the effect of technology on student engagement in the eighth grade science classroom?" [MB112213-EX]

The above research, described in your submission of November 18, 2013, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

- (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
- (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.
- (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.
- (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.
- (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.
- (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

APPENDIX B

STUDENT SURVEY

Directions: The statements in this survey have to do with your opinions and beliefs about science instruction in school and will not effect your grade in any way. Please read each statement carefully, and choose the answer that best describes your opinion.

Remember that this is not a test, and there are no “right” or “wrong” answers, just answer honestly.

To what extent do you agree or disagree with each of the following statements about science? (Choose your closest opinion).

-----

Last Name

First Name

Period Number

- \* Period 1
- \* Period 2
- \* Period 5
- \* Period 8

Gender

- \* Male
- \* Female

1. I enjoy science

- \* Strongly Disagree
- \* Disagree
- \* Not sure
- \* Agree
- \* Strongly Agree

Why did you answer the way you did in the item above?

2. Science is useful in everyday life.

Can you think of an example?

- \* Strongly Disagree
- \* Disagree
- \* Not Sure

- \* Agree
- \* Strongly Agree

3. Doing science makes me feel nervous

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree
- \* Strongly Agree

4. Science challenges me to use my mind

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree
- \* Strongly Agree

5. The science instruction that I have received will be helpful to me in the future

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree
- \* Strongly Agree

Can you give an example of how science instruction will be helpful in the future?

6. I am good at science

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree
- \* Strongly Agree

7. I usually understand what we are doing in science class

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree

\* Strongly Agree

8. Knowing science really doesn't help get a job

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree
- \* Strongly Agree

9. Science is difficult for me

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree
- \* Strongly Agree

Why did you answer the way you did for difficulty of science?

10. Studying hard in science is not cool to do

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree
- \* Strongly Agree

11. I use my computer for science homework

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree
- \* Strongly Agree

12. I am comfortable using my computer to communicate electronically

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree

\* Strongly Agree

13. I enjoy using my computer for projects

\* Strongly Disagree

\* Disagree

\* Not Sure

\* Agree

\* Strongly Agree

14. I would like to use other electronic devices in school like I-pads

\* Strongly Disagree

\* Disagree

\* Not Sure

\* Agree

\* Strongly Agree

Can you give an example of an electronic media that would be good for science class

15. My friends do not study for tests

\* Strongly Disagree

\* Disagree

\* Not Sure

\* Agree

16. I try to do the best I can in science

\* Strongly Disagree

\* Disagree

\* Not Sure

\* Agree

\* Strongly Agree

17. I enjoy working independently

\* Strongly Disagree

\* Disagree

\* Not Sure

\* Agree

\* Strongly Agree

18. I can access the Internet at home

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree
- \* Strongly Agree

19. I am confident I can figure out a science question even if it seems hard

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree
- \* Strongly Agree

20. I ask the teacher for help if I don't understand the question

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree
- \* Strongly Agree

21. I like to be challenged with hard questions in science class

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree
- \* Strongly Agree

22. I never do well in science class

- \* Strongly Disagree
- \* Disagree
- \* Not Sure
- \* Agree
- \* Strongly Agree

APPENDIX C  
STUDENT INTERVIEW

Participation in this interview is completely mandatory and will not affect your grade in any way.

- 1) How are you enjoying your laptop this year? In what ways have you enjoyed it?
- 2) What do you enjoy about using computers for school work? Can you be specific?
- 3) What was your favorite project using technology in the past year? What did you like about it? How do you think it helped you learn?
- 4) What is your favorite class? Why?
- 5) Do you feel like you are successful in science class? In what ways?
- 6) What do you like about science class? Can you give an example?
- 7) Do you perform well on science tests. Why or why not?
- 8) Do you think science will relate to the life you have as an adult? How?
- 9) If I could change one thing to make science participation increase, what do you think it should be?
- 10) Is there anything else you think I should know as your science teacher?

APPENDIX D

BREAKDOWN OF LIKERT SURVEY QUESTIONS IN THREE CATEGORIES

*Breakdown of Likert Survey Questions in Categories*

Categories	Likert Survey Questions	Summary of Responses N = 98
Positive Attitudes on Science	1. I enjoy science *	3.3
	2. Science is useful in everyday life	3.7
	4. Science challenges me to use my mind	3.7
	5. The science instruction that I have received will be helpful to me in the future *	
	6. I am good at science	2.7
	7. I usually understand what we are doing in science class	3.8
	16. I try to do the best I can in science	
	19. I am confident I can figure out a science question even if it seems hard	4.1 4.4
	20. I ask the teacher for help if I don't understand the question	3.9
	21. I like to be challenged with hard questions in science class	3.9 3.2
Negative Attitudes on Science	3. Doing Science makes me feel nervous	2.3
	8. Knowing science really doesn't help get a job	2.3
	9. Science is difficult for me *	2.3
	10. Studying hard in science is not cool to do	2.2
	15. My friends do not study for tests	2.7
	22. I never do well in science class	1.7
Technology Attitudes	11. I use my computer for science homework	4.0
	12. I am comfortable using my computer to communicate electronically	4.2
	13. I enjoy using my computer for projects	
	14. I would like to use other electronic devices in school like I-pads *	4.3
	17. I enjoy working independently	4.0
	18. I can access the internet at home	3.5 4.6

\* Followed by an open response