EFFECTS OF USING TECHNOLOGY ON STUDENT ENGAGEMENT AND ACHIEVEMENT IN SCIENCE

by

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DEDICATION

This study and work is for you, Mom and Dad. I hope I made you proud. This is also dedicated to my loving husband and two sons, Jaxon and Milo.

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ABSTRACT

In this investigation, an eighth grade Earth Science class was studied to determine whether using different technology applications would promote student engagement, interest, and improve student achievement. This particular class was lacking in engagement, interest, and achievement, so this was a great investigation to complete with them. This class completed three units without the technology applications, and three with the technology applications. Results revealed higher student test scores, interest, and engagement during the units using the added technology applications.

INTRODUCTION AND BACKGROUND

Project Background

This is my fourth year teaching science. I was an elementary teacher for five years before this. Our school needed a science teacher for all the 7-12 grades, so I decided to add a broad field science endorsement as well as a Master of Secondary Science Education degree.

My first year I taught entirely from the book. The curriculum was completely new, and suddenly I was teaching seven different sciences. We read the sections and answered the end of section questions. I noticed that students appeared bored and not engaged. I, as the teacher, was also bored, and did not enjoy what I was teaching to my students. By my second and third years I tried hard to teach myself labs and hands-on activities to get my students more engaged. Student engagement increased some, and students seemed to do better on homework assignments and tests. I do not have a functioning lab, so I decided to look into different types of technology that I could use in my classroom. By doing this I decided that choosing this as my AR project would be a decisive idea.

Action Research Questions

My AR focus is to help students get that interest and engagement back in what they are learning. I would like to promote engagement and achievement with the use of these added technologies. To me, engagement is actively listening and participating,

students have a positive attitude while they are in class, and they are completing and turning in quality assignments on time.

My main AR question was, What effects does using a variety of Internet applications in the classroom have on student engagement and achievement?

My sub-questions included:

1. What effects did using technology have on student assessment scores?
2. How has the use of technology impacted my teaching?
3. What changes were seen in student attitudes towards learning and achievement while using technology?

CONCEPTUAL FRAMEWORK

Articles in Direction for AR Project

The use of technology may increase the number of students engaged in the science classroom when technology is effectively integrated. Technology can be thought of as a tool to help teachers present new material, and help students to engage with the use of technology.

Our school curriculum is used for instruction, and is used in helping students learning the objectives. When using technology for activities they should also be aligned with the curriculum (Kretschmer, 2012). Using technology in the classroom may help improve standardized test scores, but when it is only used to align with curriculum, it may not have those results.

> Technology used as a tool to help students analyze, compare, contrast, or evaluate resources, the computer facilitates the student's internal cognitive processes by serving as an extension to their intellectual capacity. This heightened capacity helps students think more critically as they manipulate information (Baylor & Ritchie, 2002, p. 398).

When we just use traditional teaching, it does better educate students, but it doesn't always prepare students for real life situations. The use of technology combined with traditional teaching will teach those higher order thinking skills, and better prepare students to be creative problem solvers. The combination will also work to use real world issues that students can relate to, and this will also make what students are learning more meaningful and interesting.

The ‘will, skill, tool’ model is an established theoretical framework that explains the conditions under which teachers are most likely to implement information and communication technologies (ICT) in the classroom.

> Computer and Internet applications are more often used by teachers in the classroom when: (1) teachers consider themselves to be more competent in using ICT for teaching; (2) more computers are readily available; (3) the teacher is a form teacher and responsible for the class; (4) the teacher is more convinced that computers improve student learning; and (5) the teacher more often employs constructivist forms of teaching and learning” (Petko, 2012, pp. 1351-1359).

The will, skill, tool model was developed specifically for teachers and identifies three core variables that helps explain the variance in levels of how much technology is integrated in the classroom. The most important variables in these models are a positive attitude from the teacher toward the use of computer technology in the classroom, the skills in working with the technology, and access to the computers. The validity of the will, skill, tool model was tested by giving teachers a questionnaire used to evaluate their technology activities. The will, skill, tool model is a six-stage rating scale, along with two other comparable scales that teachers can use to apply what they know about technology in the classroom. Three hundred fifty-seven teachers were given the questionnaire. The questionnaire had also listed 20 different Internet applications. “Among the 357 teachers who responded, 32% indicate that they work with at least one of the applications almost every day, and 62% do so at least occasionally, while only 4% never use digital media in the classroom” (Petko, 2012, pp. 1351-1359).

In an action research project increasing motivation and engagement in elementary and middle school students through technology-supported learning environments was explored. This educator was trying to define the problem of the

> Lack of student motivation and engagement with some behaviors that were targeted such as disruptions, lack of participation, homework completion, coming to class unprepared, asking to leave the class, engagement in personal interests, asking off topic or inappropriate questions, sleeping or putting the head down in class, and showing up tardy to class" (Godzicki et al., 2013, p. 20).

These types of behaviors are quite common with students.

> These observations led the teacher to document evidence of the problem through a Student Survey, which assessed students' perceptions of technology usage in and out of the classroom. In analyzing data from the Student Survey, about one third of students felt class activities were not related to their interests nor did they incorporate technology in ways that motivated and engaged them to learn (Godzicki et al., 2013, p. 33).

Technology-supported lesson plans which featured technology tools such as computers, laptops, iPods, iPads, interactive whiteboards, document cameras, video and audio recording devices, computer software, etc. were created and implemented during the project action plan. After analyzing the data, the results showed that students felt their teacher provided activities related to their interests and students were more likely to engage in classroom activities when technology was used. Based on the results of the action research project, the teacher concluded that students were more motivated and engaged in what they were learning when using technology.

A first year teacher completed a study on technology use in her classroom as an aid to inquiry based teaching. She looked at thirty-eight students that participated in a series of six inquiry-based activities using various instructional technology (IT) applications. "Her approach to inquiry-based instruction involved helping students find

answers in ways similar to those practiced by scientists" (Capobianco, 2007, pp. 271-295). Throughout the study she kept a journal and reflected on her findings regularly, and also sometimes shared her journal writing with her students. She also constructed a form that was designed to gather feedback from students about their engagement with each IT application, as well as the effectiveness of her instruction of the IT application.

> The feedback form included a five-point scale that measured the following criteria: clarity of instruction, difficulty with the application, interest in the application, and practicality of the application. In addition, the feedback form included two open-ended questions that encouraged students to share their ideas and concerns about the application" (Capobianco, 2007, pp. 271-295).

She administered the form after each of the six IT applications were integrated. When she was designing the integration of each IT activity, she "paid particular attention to three key factors: (a) the unit objectives in the curriculum, (b) the national standards for science as inquiry that applied to each unit, and (c) the technologies that were available and appropriate for fostering inquiry-based skills" (Capobianco, 2007, pp. 271-295).

Data from the student formative feedback forms indicated very high and consistent levels of interest in and ability to engage in inquiry using technology. Using various types of technology with several different units helps enhance student learning. When technology is integrated effectively, it increases the chances that students will find what they are learning to be more fun and interesting. Getting feedback from students about the different technologies used, will give an idea of what was effective and what wasn't.

METHODOLOGY

Demographics

The group that I chose to complete my project with, was my 8th grade Earth Science class. I also was this group's 3rd grade teacher when I taught elementary. The class consists of four girls and five boys, with one being Hispanic, two Native Americans, and six Caucasian. Two students are receiving Title I services. I have been their only science teacher so far in middle school, and will follow them as their science teacher until they graduate high school. Our school is very rural, and consists primarily of farming and ranching families. We are also located 30 miles from the Fort Peck Indian Reservation. The entire school, K-12 grades has 121 students.

Treatment

The purpose of this study was to determine whether students were more engaged, and had better academic success with what they were learning when using technology as an added resource. My nine students from my 8th grade Earth science class participated in this study.

I taught six different units intermixing the use of technology so, three will use technology applications and three will not. The Internet technologies that I used were Google Classroom, Kahoot, and PBSlearning. Google Classroom is a free service developed for schools to use in creating assignments, assigning assignments, and grading assignments. It is aimed at helping educators efficiently manage and assess student

progress, while being able to be connected with students at school or from home. Kahoot is a game-based learning platform students can use to create, share, and play learning games based on what they are covering in class. Kahoots are played in a group class setting. When students join a game, they use a unique PIN that they are given by the host (the creator of the game). The game host uses a big screen like a SMART board to project the game. Players answer on their own devices, while questions are displayed on the shared screen. PBSlearning is a partnership of PBS and WGBH Educational Foundation, and is a free service. It offers access to public media and delivers research-based, digital learning. Students are able to explore the curriculum concepts on their own once they are assigned them. These interactives are aligned with National and Common Core State Standards.

The units came from my existing curriculum as it is already aligned with NGSS. The first three units taught without the added technology applications are on Dynamic Earth which includes: Weathering, Deposition, Erosion, Rock Cycle, Earth's Plates, and Earth's Changing Surface. Earth Through Time covered: Age of Earth's Rock's and Earth's History. Circulation of Earth's Air and Water covered: Circulation in Earth's Atmosphere, Circulation in Earth's Oceans, and The Water Cycle. These first three units were taught as I normally do using the student workbook, workbook hands on labs, and activities. Each unit took about 3 weeks to complete. They each consisted of 2-4 lessons within each unit. I do use Google classroom in this class to post assignments.

The next three units using the added Internet applications were Weather and Climate covering: Influence on Weather, Weather Prediction, and Influences on Climate.

Earth's Natural Hazards covering: Natural Hazards, Natural Hazard Prediction, and Reducing the Effects of Natural Hazards. The final unit is Resources in Earth Systems covering: Natural Resources and The Distribution of Natural Resources. These units again, took about 3 weeks to complete, and consisted of 2-4 lessons within each unit.

I continued to use Google Classroom to post assignments, but I also had students collaborate on activities using this platform. I would assign an activity in Google Classroom, and each member of the group would contribute in either a doc or Google Slides. I would at times assign each member a different colored font so that I could see how much each contributed. Since I have nine students in this class, each group had 3 members. I didn't change the groups during this study, but instead had them remain together throughout the entire study. I used Kahoot and PBSlearning to help students be better prepared for the unit assessments. As each unit was completed, students created a Kahoot game that consisted of 20 questions. Kahoot questions had to consist of vocabulary terms and content from the units. I chose to use PBSlearning interactive lessons throughout the units for a more hands on experience to help build on what they were learning. These interactive lessons allowed students to work at their own pace while using media and tools that save student work as they go. I was able to assign these interactives in Google classroom, to track student completion.

Data Collection and Analysis Strategies

To determine student's prior knowledge of each unit, I had them complete a pre-assessment before beginning each of the six units. The pre-assessments were all 20

multiple choice questions, and came from the curriculum. At the end of the units, students completed a posttest that consisted of a mixture of 20 multiple choice and short answer questions. I compared the results for each unit to determine how much was learned and retained. I calculated how much students improved by comparing class averages for the pre and posttests.

The instruments that I used were a Likert survey, interview, teacher journal, and behavioral observation that I noted in my journal. I chose one day to observe student behavior before using treatments, and another day with the use of treatments. The survey, interview, and behavioral observation were completed both before the treatment, and after. Throughout the units I looked at student work, such as the end of lesson self-checks to see if the turned in work was of better quality and achievement. After the treatment I had students complete the survey again. Instead of conducting another interview I had students complete a minute paper after we finished the final unit using the added technologies. I asked them to write for one minute describing which methods they liked best, and which they didn't. I also asked them to indicate their feelings of learning with the use of the technologies.

I used triangulation to help ensure validity and reliability by using a variety of data collection methods. They offered me different datasets that gave me both qualitative and quantitative data. I was able to analyze the results of the datasets independently, but was also able to compare them to each other to help come to my conclusions. This project has been approved by the IRB and can be found in Appendix A.

Table 1. Data Collection Methods, (*N*=9).

Research Questions	**Teacher Journal**	**Interview/Minute Paper**	**Pre and Post Tests**	**Student Work**	**Behavior Observation**	**Surveys**
What effects did using technology have on student assessment scores?			X	X		
How has the use of technology impacted my teaching?	X	X	X	X	X	X
What changes were seen in student attitudes towards learning and achievement while using technology?	X	X	X	X	X	X

Appendix B contains a copy of the Likert survey and the interview questions can be found in Appendix C. Appendix D contains a copy of my post Likert survey.

DATA ANALYSIS

For my Likert student survey, there were 12 questions that I put into four categories: Attitude Towards Learning and Engagement, Confidence Towards Learning Science, Attitudes Towards School/Science, and Attitudes Towards Working with Others on Science. Overall, most students had a positive attitude when it came to science. The statement on staying focused during instruction was answered with about half the class saying that they disagreed, and the other saying that they agreed. Some students were very honest, and admitted to being easily distracted with one admitting that she daydreams at times. Another student stated that sometimes when someone is messing around, they get distracted by them. The other statement on paying attention was answered very similarly. This class doesn't have many behavioral issues, but definitely have a lot of energy and can be difficult to get focused at times.

There were no negative attitude answers given from this group. All students agreed that they all like science, and look forward to coming to science. One student answered both agree and disagree on the question asking about looking forward to coming to class. His reasoning was he disagrees if we are just reading, but agrees when he gets to work on a project. Most students felt confident about what they were learning, with a couple stating that if there is something they don't understand, they ask for help. They all like working in groups, and all felt that they contributed to their groups when working. The following figure shows the results of the Likert survey.

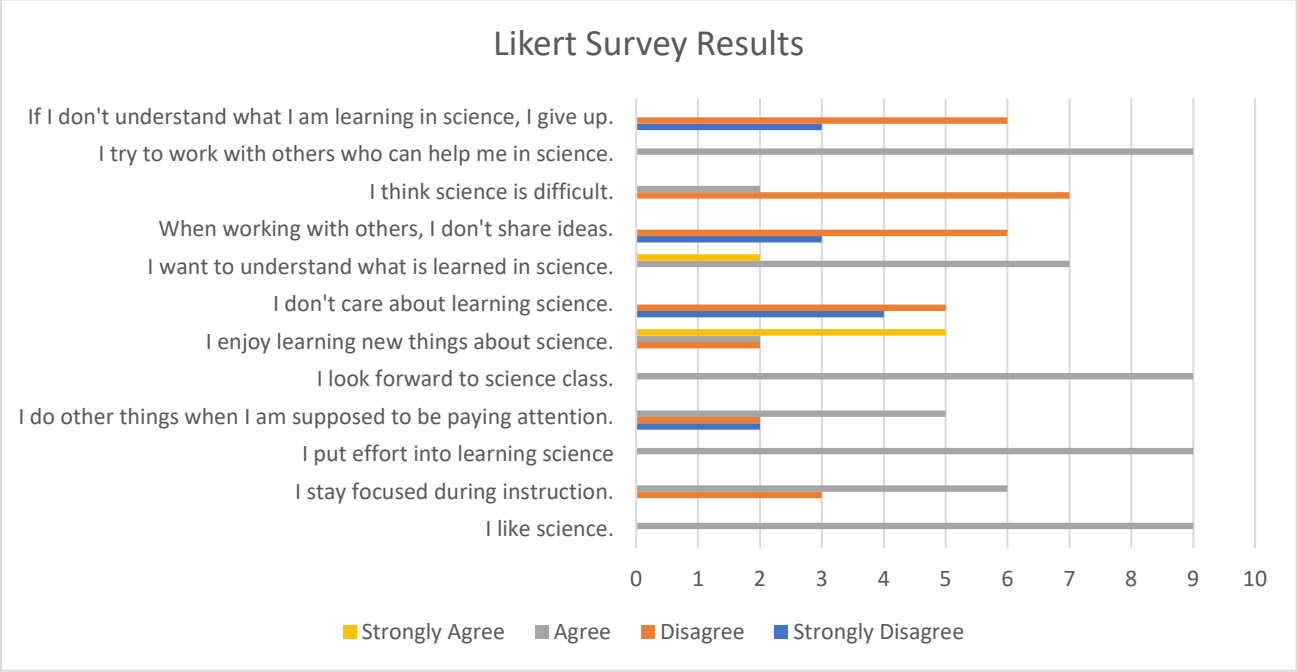

Figure 1. Likert survey results, (*N*=9).

After using the treatments, I gave another similar Likert survey. I changed three of the questions with questions pertaining to the use of Kahoot, Google Classroom, and the PBSlearning interactive lessons. The answers were all extremely similar again with students having a positive attitude towards science. Nothing was very different, only the answers about the technology. They all strongly agreed about using Kahoots, with some stating in the probe question that it was fun, and it helped them review what they had learned. They all agreed with the use of Google Classroom to complete group activities and projects. They stated that they enjoyed working with their group, because they all felt like they got to contribute. They also thought that it was fun to work together. All nine students disagreed that using PBSlearning interactives was helpful or fun. For the probe question as to why, most stated that it was too hard to figure out and use. I did notice

frustration from some students when they were completing the interactives, as for some the website wouldn't work or connect correctly for them. They also had a hard time reading and understanding the instructions that the interactives gave them. I think this is partly because this group likes to be told exactly what to do by me, and not complete something independently by following written instructions.

The student responses from the student interviews support the data from the Likert survey. I asked ten interview questions, and grouped them the same as with the Likert survey. The student interviews supported the patterns that I found in analyzing the Likert student survey data. I interviewed all nine students. When I asked students to describe science class, all nine students described it as "fun" and "interesting." When asked their favorite part of class and what they find enjoyable all nine students stated "group work", "projects", "labs", and "experiments". The questions on interests, and what they would like to learn more about in science let me know what students find interesting. Seven students want to learn more about "space", one would like to learn more about animals, and one would like to learn more about the human body.

Most students answered that they feel like they understand what they are learning in science, and they know that they are learning because "they can do things without help," "answer questions quickly," and "think through questions, and answer them." Some answered that they feel like they understand what they are learning, but also have times when they don't. They answered that they know that they don't understand "when something doesn't make sense," or "when they can't remember something." One student stated that he knows when he is learning or not learning when he completes an

assignment or a test, and how confident he feels about it. I have one student that works very hard, and she stated that sometimes she doesn't understand what is being covered in class, because sometimes I "go through the lessons too fast."

During the interview I also learned that they all enjoyed working in groups on projects and activities. This class answered in the interview that they enjoyed using technology in class, especially the microscope. I had set up a couple times some stations that included microscopes, and they did really enjoy this. They also like using the SMART board, and their Chromebook. When they complete their Kahoots, we connect the game to the SMART board, and the rest of the students join the game from their Chromebook. This is definitely a favorite with this class. Some things that students didn't like were writing out vocabulary definitions in their journals, and reading a lot of pages during class time. They are not shy about their dislike of this when we do this during class time, so this was not a surprise. When asked what I could do differently seven students said nothing, and two said more labs and experiments. The following table breaks down the interview questions with responses.

Table 2. Interview Questions and Answers, (*N*=9).

Category	Interview Questions	Summary
Attitude Towards Learning and Engagement	3. What is your favorite thing about science? Probe: What about this makes it your favorite part of science? 4. Is there an activity in science class that we do that you don't like? Probe: What about this activity don't you like? 5. Do you have any interests in science that you would like to know more about? Probe: What about this interests you most? 6. Is there anything in class that we do that you find enjoyable? Probe: Why do you enjoy doing this? 9. During class work time, do you enjoy it when we get to use technology? Probe: What types of technology do you like to use?	3. Most students answered that doing labs and experiments, and working in groups on projects were their favorite things about science. One student mentioned that their favorite thing about science is space. 4. Most said they didn't have anything in science that they didn't like. The others responded with vocabulary words in journals, and reading. 5. Most students said that they wanted to learn more space. 6. Almost all students told me that working in groups on projects and activities was most enjoyable, as well as labs and experiments. 9. All students said that they like to use technology, with the microscope being the most popular.
Confidence Towards Learning Science	7. Do you feel like you understand what you are learning in science? Probe: How do you know you understand? How do you know that you don't understand?	7. All students answered "yes".
Attitudes Towards School/Science	1. How is your school year going so far? 2. In your own words, how would you describe science class? Probe: Why do you describe it that way? 10. Is there anything that I can do differently?	1. 9 responded that their school year was going "good" so far, with some saying junior high is a little more stressful. 2. All answered that they thought science class was "fun", "interesting". 10. Most said "no". Those that said "yes" wanted to do more group projects and labs, and one mentioned that I discuss sections further before moving on.
Attitudes Towards Working with Others on Science	8. When we complete activities doing group work, do you feel like you get to contribute? Probe: How do you think you could contribute more? How do you know that you contribute to the group?	8. All 9 students answered "yes" to this. Most said that they work together, and communicate with each other throughout the project with each one having a particular "job"

When I had students complete the minute papers after the use of treatments to share their thoughts on each of the three, they all stated that Kahoot was most fun. They all enjoy working in Google Classroom on group assignments, and they also like the assignments that I post. Not one student liked using the PBSlearning interactives. I only did this three times, but all three times there were problems with the website, and some of the Chromebooks connecting. Students were stressed when this happened, and did not enjoy it at all. If I use this in the future, I may just connect to my SMART board, and we

can go through them as a class. There are a lot of great interactives that go with my curriculum, so I would to like figure out different ways of using it so that students have more fun, and can enjoy what they are learning.

In my teacher journal the day I observed students pre-treatment, some things that I noticed were some students were staring off during oral reading, one student had his head down, and another was playing with his pencil. Once I assigned the assignment in Google Classroom for them to work on independently, most worked on it quietly. There were three boys in the class that had a very hard time staying focused on the assignment, and wanted to talk with each other throughout the class period.

When I observed with the use of the treatment on a day students made a Kahoot, they were all very engaged and seemed to be having fun. All students were contributing, and helping to come up with questions for their games. Watching them all complete the Kahoots was also a lot of fun. The groups came up with great questions, except I did have an issue with a couple of them. One group for example, asked "what's the name of the scientist on page_____?" They were having fun with it, but I reminded them that they had to make questions up that pertained to our lessons.

Before treatments were used, students completed three units with pretests and posttests. The first unit was on "Dynamic Earth", and the average pretest score was 52% and the posttest score was an 84%. The next unit was "Earth Through Time". The average score on this pretest was a 57%, and the average score on the posttest was an 83%. The 3rd unit "Circulation of Earth's Air and Water", students averaged a 48% on the pretest, and the posttest the average score was 84%.

After the use of treatments, I again had students complete 3 units with pretests and posttests. The first unit was “Weather and Climate”, and the average pretest score was 51% and 85% for the posttest. The second unit was “Earth’s Natural Hazards”. The average pretest score was 46%, and the average post-test score was a 90%. The final unit was “Resources in Earth’s Systems”. The average pretest score was 47%, and the average posttest score was 93%. Figures 1 and 2 displays this data from the pre-treatment and post-treatment tests. The gray bars represent the pretest scores and the blue represent the posttest scores.

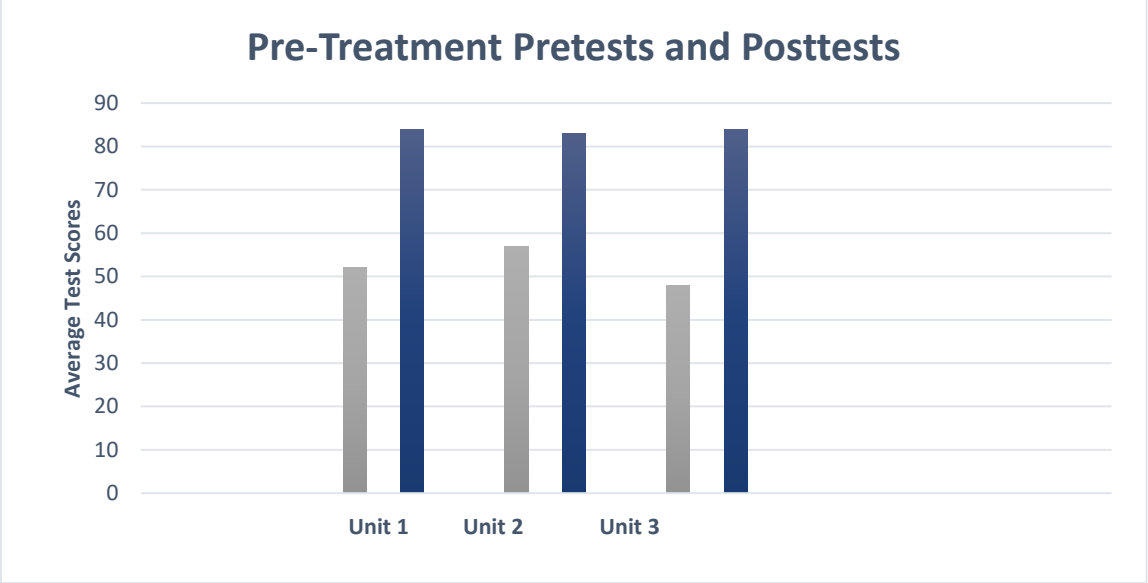

Figure 2: Treatment Pretests and Posttests, (*N*=9).

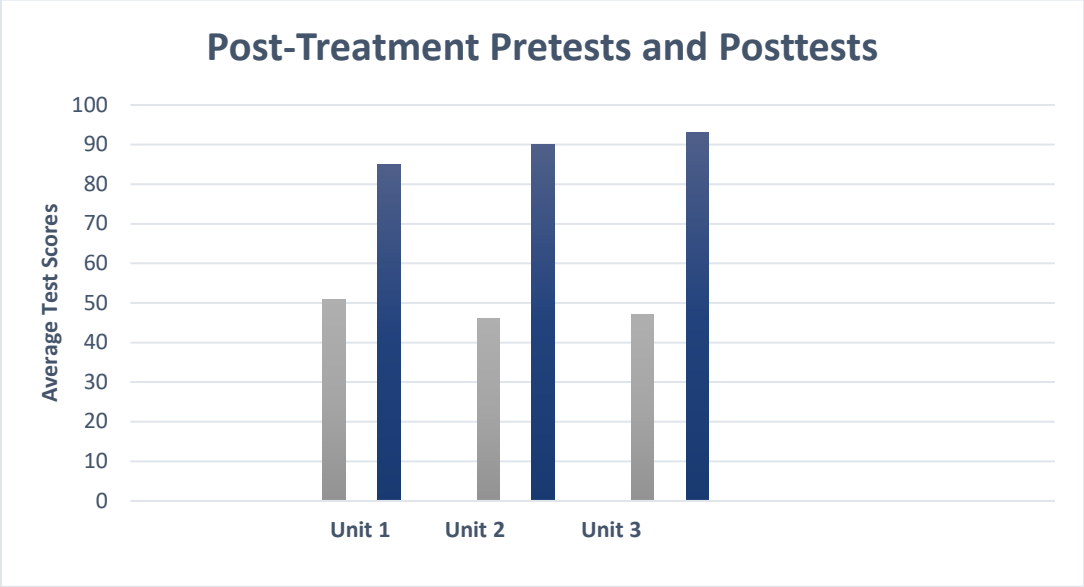

Figure 3. Post-treatment pretests and posttests, (*N*=9).

Looking at these figures, you can see that students did perform better on the post-tests after the use of treatments. There was also a greater increase from the pre-tests to post-tests scores.

CLAIM, EVIDENCE, AND REASONING

Claims From the Study

Students reported in both Likert surveys that they were interested and engaged in science. Since these students know me so well, I have wondered if they were completely honest in their surveys and interviews. That's the problem with teaching in such a small school, all of the students know me well. Also, the day I observed students before using treatments was a day that we were reading aloud from the book. Even after the use of treatments, we still need to have days where we read from the book. I noticed these types of behaviors regardless. I stopped more frequently to engage students in more discussions as a class and a group after treatments, and this helped a lot with engagement. The surveys and interview did indicate that students do like to use technology, and working in groups especially when they use Google Classroom. This was stated during the interview, as well as the Likert surveys.

In response to my main AR question, "What effects does using a variety of Internet applications have in the classroom have on student engagement and achievement?" it was very clear for me to see which treatment produced the highest rate of engagement. Making the Kahoot games for their classmates to play was the favorite treatment. Students were very engaged and having fun. When using Google Classroom to complete group assignments and activities, students again were much more engaged than when they worked independently. Most of the time I observed all students participating with each activity, but there were a couple times that I had to remind a group to include one of their group members.

Achievement rates also increased some when comparing the pre-test and posttest scores. I also seen higher scores, and less corrections with the end of lesson self-checks, and end of unit reviews. My sub-question, "What effects did using technology have on student assessment scores?" was answered with the results of the assessment scores. The posttest scores after the use of treatments increased with the average of all 3 units being 89%, and the average of the 3 pre-treatment posttest score was 84%. I did see a larger increase from the pretest to the posttest after treatments than before treatments were introduced. These weren't dramatic increases, but definitely progress. The biggest change was definitely with engagement and attitude, which was a response to my question, "What changes were seen in student attitudes towards learning and achievement while using technology?"

Value of the Study and Consideration for Future Research

I began this whole new adventure of becoming a science teacher by just using the textbook, and completing end of section questions. I was bored, and my students were bored. This study has taught me ways of getting my students more engaged and looking forward to coming to science class. I don't have a functioning science lab. I have one microscope that works. I can't do dissections with my life science, or anatomy and physiology students as my room has no refrigerator or the tools to complete them. I have one working sink that only has hot water coming out of it, no gas for using Bunsen burners, and all of my chemicals look like they are from when my dad was a student there back in the 70's. I had to find ways to teach my students the curriculum with these added technology resources in order to make what they were learning more meaningful and fun.

This study also allowed me to have discussions and actually allow my students to give me their opinions and ideas. I got a chance to listen to what they want to learn and find interesting in science. It's important for students to feel like they are playing a role in what they are learning. Judging by their body language during group work, and making their Kahoots I can tell they are enjoying what they are doing in class, and so am I.

The use of these added technologies provides equal opportunities for all students to learn and succeed. They have allowed both higher level students and lower level students to feel as though they are contributing to what they are completing and learning.

Impact of Action Research on the Author

If I would get a chance to do this again, one thing that I would do differently is to compare a couple different classes instead of just one. I would do my 8th grade and 9th grade classes. I would've compared traditional teaching in one grade, to just strictly using added technology in the other. Another thing that I would have done differently, would be to have someone else come into my room to observe student behavior and engagement using a behavioral checklist form. I had planned on doing this, but time slipped away from me.

I will continue using these technologies, and next school year look into using some others that I had looked at before completing my study. The increased student engagement and achievement allowed me to see evidence of its value and importance. I will continue using Google Classroom, and have found different applications that can have assignments and activities posted to it that would be great to use as supplemental resources for my classes.

During this study, I have become a better educator as I have opened myself up to continually learn. Learning never stops, and I know that new things will arise during my future years as an educator.

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APPENDICES

APPENDIX A

IRB FORM

MONTANA STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD
For the Protection of Human Subjects
FWA 00000165

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MEMORANDUM

TO: LeeAnn Stangeland and Walter Woolaugh

FROM: Mark Quinn Mark Quinn cgf
Chair, Institutional Review Board for the Protection of Human Subjects

DATE: October 1, 2020

RE: *"The Effects of Incorporating Internet Applications in an 8th Grade Science Classroom to Promote Student Engagement and Retention" [LS100120-EX]*

The above research, described in your submission of October 1, 2020, 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:

_X_ (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.

_X_ (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; and (iii) the information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by section 16.111(a)(7).

____ (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

LIKERT SURVEY

Name_____

Read each statement and circle how much you agree or disagree with each statement.

I like science.

Strongly disagree disagree agree strongly agree

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

I stay focused during instruction.

Strongly disagree disagree agree strongly agree

Can you give an example?

I put effort into learning science.

Strongly disagree disagree agree strongly agree

I do other things when I am supposed to be paying attention.

Strongly disagree disagree agree strongly agree

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

I look forward to science class.

Strongly disagree disagree agree strongly agree

I enjoy learning new things about science.

Strongly disagree disagree agree strongly agree

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

I don't care about learning science.

Strongly disagree disagree agree strongly agree

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

I want to understand what is learned in science class.

Strongly disagree disagree agree strongly agree

When working with others, I don't share ideas.

Strongly disagree disagree agree strongly agree

I think science is difficult.

Strongly disagree disagree agree strongly agree

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

I try to work with others who can help me in science.

Strongly disagree disagree agree strongly agree

If I don’t understand what I am learning in science, I give up

Strongly disagree disagree agree strongly agree

APPENDIX C

POST LIKERT SURVEY

Name_____

Read each statement and circle how much you agree or disagree with each statement.

I like science.

Strongly disagree disagree agree strongly agree

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

I stay focused during instruction.

Strongly disagree disagree agree strongly agree

Can you give an example?

I enjoy using Google Classroom for discussion and assignments.

Strongly disagree disagree agree strongly agree

I do other things when I am supposed to be paying attention.

Strongly disagree disagree agree strongly agree

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

I look forward to science class.

Strongly disagree disagree agree strongly agree

I enjoy learning new things about science.

Strongly disagree disagree agree strongly agree

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

I like making Kahoots to help me study for a test.

Strongly disagree disagree agree strongly agree

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

I want to understand what is learned in science class.

Strongly disagree disagree agree strongly agree

When working with others in Google Classroom, I don't share ideas.

Strongly disagree disagree agree strongly agree

I think science is difficult.

Strongly disagree disagree agree strongly agree

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

I try to work with others who can help me in science.

Strongly disagree disagree agree strongly agree

I think that using PBS learning interactives (like the virtual fossil dig and human impact) is fun.

Strongly disagree disagree agree strongly agree

Why did you agree or not agree with this statement?

APPENDIX D

INTERVIEW QUESTIONS

Interview Questions

How is your school year going so far?

In your own words, how would you describe science class?

Probe: Why do you describe it that way?

What is your favorite thing about science?

Probe: What about this makes it your favorite part of science?

Is there an activity in science class that we do that you don't like?

Probe: What about this activity don't you like?

Do you have any interests in science that you would like to know more about?

Probe: What about this interests you most?

Is there anything in class that we do that you find enjoyable?

Probe: Why do you enjoy doing this?

Do you feel like you understand what you are learning in science?

Probe: How do you know you understand? How do you know that you don't understand?

When we complete activities doing group work, do you feel like you get to contribute?

Probe: How do you think you could contribute more? How do you know that you contribute to the group?

During class work time, do you enjoy it when we get to use technology?

Probe: What types of technology do you like to use?

Is there anything that I can do differently?