THE EFFECT OF USING NEARPOD AS A TOOL OF ACTIVE LEARNING IN THE HIGH SCHOOL SCIENCE CLASSROOM.

by

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A professional paper submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

in

Science Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

July 2016

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DEDICATION

To my family. To my parents, Bright and Judy, who were not only the best first teachers I could have ever dreamed of and who demonstrated how important an education is. To my sister, Suzanne, who is always there encouraging me to step outside of my comfort zone. To my children, Andy and Wynn, who have been encouraging when I've needed it and quiet when I've been working. Thank you for understanding when I haven't been able to sew costumes, bake cookies, or do some of the other traditional "mom" things that you needed me to. To my husband, Brian: thank you for being the voice of reason, voice of encouragement, and cleaner of the house while I have been pursuing this dream. I love you all.

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ABSTRACT

A good portion of what must be learned in the introductory science classroom is most easily conveyed during lecture. Unfortunately students tend to be more passive during lecture than active. This often results in the instructor being unsure of what students understand until it is time for a summative assessment. When active learning strategies are implemented during a lecture some students feel uncomfortable participating and the instructor is unable to determine how successful the lecture has been.

This project investigated the impact of the interactive presentation tool Nearpod on the success of high school science students. Classes were introduced to new material using Nearpod or PowerPoint with active learning strategies. Student achievement was measured using Pretests and Posttests, daily quizzes, classroom, and laboratory activities. Student and teacher attitude was measured using surveys and journals.

Data collection for this project included Pretests and Posttests to measure any differences in the amount of information learned between the two types of presentations. Grades on daily assignments were considered to see if there was any difference between Treatment and Nontreatment groups. Student surveys were given to see if students had any preferences on which presentation program they felt more comfortable with, learned more with, and which one their teacher taught better with. The students were also given the opportunity to express what they liked and disliked about each presentation program. Teacher interviews were conducted to determine how successful and helpful Nearpod was in the classroom. A teacher journal was created to follow the morale of the teacher through this process.

The results of this project indicated that Nearpod does not have a great effect on student grades when compared to active learning with the presentation program PowerPoint. However, students and teachers both prefer the active learning opportunities provided by Nearpod. Active learning seems to be a common factor of how much students learn, not a computer program with opportunities for active participation.

INTRODUCTION AND BACKGROUND

Russellville, Arkansas is located in the River Valley area of Arkansas, between the Ouachita mountain range and Ozark Plateau. It is located on the Arkansas River and Lake Dardanelle in Pope County. Russellville is home to Arkansas Tech University and the only nuclear power plant in Arkansas, Arkansas Nuclear One. There are multiple manufacturing plants located in Russellville that are very active in the production of frozen dinners, processing chickens, and automotive parts. Russellville High School serves approximately 1200 students in grades 10 through 12. The high school is known for its outstanding STEM program, religious studies program, and drama department.

During the 2013-14 school year, Russellville High School began transitioning into a one-to-one computer initiative. This initiative would provide every student with a school-issued laptop to use during the school year. The pilot class for this program was the combined Advanced Placement Environmental Science and Human Geography class, co-taught by two of our former teachers of the year. These courses were taught during consecutive class periods with both instructors present. Students in this course tend to be higher level students from all three grades. During this time, all educators were issued a touch screen laptop to begin preparing for the 2014-15 school year when all students would receive the touch screen laptops.

The opportunities for laptop use were overwhelming to many teachers and the administration encouraged gradual implementation of the technology into classroom instruction. Teachers were required to provide an online learning platform where assignments could be posted, drop boxes could be created for assignments, and tests

could be taken. Teachers were also encouraged to try new methods of instruction for use when the students received their laptops.

During the pilot year teachers were given small group training on some classroom software. They were also encouraged to be creative and work with their departments and small groups to share different methods of instruction using laptops and various applications available through the internet. Some teachers chose to not use the computers at all while others hoped to do almost everything on the computers. The Biology Department spearheaded this movement and attempted to use the touchscreen and PDF files to write everything on the touchscreen and go completely paperless. In doing this, we learned the hard way that students really were not using their minds to learn the new science material as much as they were to learn how to use the computer.

Rather than think of biology when taking notes on the touch screen or writing material on a digital lab report, the biology teachers found students thinking more about using the computer. We found that this caused our students to take more time to do work of an unacceptable quality. Students also had a very poor retention of science concepts. During lectures, some students refused to use the touch screen to write their notes and simply started typing their notes as if they were taking dictation. The digital note system fell apart and the teachers were left wondering if all of the work and planning that had been done was really worth it.

After much discussion, the biology department decided to move back to lecture as it had been done prior to the one-to-one initiative. Teachers used a PowerPoint presentation while students used prompt notes, notes with blanks for students to fill in

important words or phrases as needed. This was used to allow students enough time to listen to the teacher and watch for demonstrations while ensuring all of the pertinent information was recorded in notes. Grades did improve and attention during lectures was directed more toward the instructors. The department believed there must be some way to encourage students to be active participants in their learning using this new technology. Other classrooms had seen success using clickers to monitor student understanding during lecture. Finding an application where students could use their laptops to demonstrate what they did or did not understand during a lecture would be extremely helpful. This could encourage students to be more active participants in their learning. It would also allow the teacher to immediately return to information that was misunderstood rather than waiting for a test or other assignment when it would be too late.

The biology teachers had been trained in methods of active learning with students. The teachers implemented many different strategies ("Think, Pair, Share," "Cold Call Questioning," "Exit Slips," "Warm-ups," etc.) to help encourage all students to be active learners during class time. The teachers found these strategies to have limited success. The students who had traditionally been considered more intelligent by their peers often dominated the class while those students who did not have a history of classroom success chose not to participate (which might have caused their grades to suffer). The teachers hoped to find a tool where the "playing field" could be more leveled and all students could participate, perhaps in an anonymous fashion.

The biology teachers also found that these traditional active learning methods took a great deal of time to implement and evaluate. Students had to write down answers to questions after discussion with their peers. Teachers had to create, pass out, take up, and grade exit slips. Cold call questions had to be written and students chosen to answer them, hopefully without more confident students interrupting. The amount of instruction time lost was not encouraging the department to continue with some of the methods suggested.

Biology teachers at Russellville High School appeared to have had limited success engaging students in active learning during lecture times. We suspected that this was a result of limited time and understanding of how to actively engage students without losing excessive class time. We wanted all Russellville teachers to have access to technology that would encourage them to create active learning environments during all classroom sessions, including lecture. To accomplish this, we encouraged teachers to include active learning strategies using new technology during classroom lectures.

I learned about Nearpod, an online computer application that can be used as an active learning tool in the classroom, during the 2014 - 2015 school year and, with the remaining biology faculty, have incorporated it within our curriculum. All teachers reported an increase in student involvement during lectures although no records were kept regarding an increase in grades on tests, quizzes, or classroom assignments. Students were initially very excited about using Nearpod during lectures, but became complacent during the school year as more teachers used the program and they were

exposed to it more often. This seemed to cause the program's effectiveness to dwindle and require teachers to find other ways to incorporate active learning into the curriculum.

While other programs with similar capabilities as Nearpod are becoming available many educators are unfamiliar with them as these programs have not been formally evaluated in the classroom. With the information I have gathered informally in the Russellville High School Biology Department, I wondered if the Nearpod program is indeed a good method of increasing active learning in the biology classroom. If it is, should it be used continually or sporadically to assist in the acquisition of more difficult information?

My primary research question was, "What is the impact of utilizing Nearpod, an online computer application, as an active learning tool with high school biology students?" Secondary research questions were:

- How does student performance change when exposed to active learning with Nearpod?
- How do students respond to active learning with Nearpod?
- How does active learning with Nearpod affect my attitude and teaching style as a biology teacher?

CONCEPTUAL FRAMEWORK

The effect of active learning strategies has been well researched and these studies have concluded that students retain material much better when they learn while making connections between new material and previous knowledge (Bergstrom, 2011). Unfortunately many instructors and institutions have had difficulties breaking from the traditional distribution of knowledge: a lecture. Active learning centers on the student and includes many opportunities for formative assessment. The purpose of a formative

assessment is to provide both the learner and the instructor feedback on how new information has been processed so modifications can be made to maximize both student and instructor performance (Winstone & Milward, 2012).

In order to maximize the effects of formative assessment the learner must be allowed to respond to a prompt or question very soon after learning and the instructor must be able to respond to the learners quickly to reteach information that has been misunderstood. In small groups this is not a tremendously difficult task. Winstone and Milward (2012) observed that dialogue is generally more open between instructor and learner in small groups and individuals are more comfortable asking questions about material that is unclear. The instructor may also be more aware of body language that may suggest learners are not sure of information as it is being communicated. In many schools small groups are not a feasible option for instruction. Budgets are cut, teachers are not rehired, and class sizes increase. With larger classes there are often fewer opportunities for the instructor to initiate a formative assessment and therefore the learner to receive feedback on what they have learned (Winstone & Milward, 2012).

Heitzmann (2010) suggests to the reader that lectures must be interactive and recognize multiple learning styles. With both of these elements active learning is emphasized. An interactive lecture might have discussions, pop quizzes, and problem solving opportunities, all of which involve active learning on the part of the student. In recognizing multiple learning styles the instructor is able to include opportunities to engage learners in kinesthetic, auditory, and interpersonal activities, which increase the involvement of learners. According to Heitzman (2010), by improving lectures to

include elements such as these, students will have more opportunities to become more involved in the learning process and therefore become active learners.

With all of these challenges, the use of technology has opened up opportunities for some interesting and fun methods for giving formative feedback to large numbers of students. One of the most popular methods is through "clickers." These are small devices about the size of a cell phone or remote control that allow students to respond to a multiple-choice type question. Students are generally allowed to see the class results on a classroom screen through a pie graph or bar chart (Caldwell, 2007). Questions can be designed by instructors to assess learning on a particular concept and allow students to know if they have answered the questions correctly or not. This helps both instructor and learner in that the instructor will know immediately if a significant portion of the class does not grasp a particular concept. The instructor can then reteach concepts immediately when necessary and decrease the amount of incorrect reinforcement students may do on their own. It also allows the learner to recognize material they are not successfully acquiring and to return to that information to review it more thoroughly (Chen, Whittinghill, & Kadlowec, 2010).

New technology has made clickers much more accessible to many classrooms. While it is difficult for many school districts to afford a set of clickers for each classroom, students often bring their own devices (laptops, smart phones, tablets, etc) to school and are excited to use them in class. Programs such as Kahoot (www.getkahoot.com) give teachers the opportunity to allow students to participate in clicker-like games for review and formative assessment. These require instructors to

create a set of multiple-choice questions for students to answer ahead of time, but they do not require the school to purchase hardware or software. School cost in these activities is negligible as the students are bringing their own devices and the programs are free.

Fies and Marshall (2006) bring up several good points when discussing programs and hardware used in classrooms to engage students. The devices used in this type of system can be expensive and may not be available to every student. If schools are providing students with devices teachers must ensure that they are truly improving the educational experience of the student. Classrooms using response systems can improve student involvement by making part of the student grade dependent on participation. Fies and Marshall also point out that while studies have shown student engagement increases with classroom response systems, some of these same studies report that the curriculum using them has lacked rigor. To ensure curriculum remains rigorous the teacher must be careful to make sure that students use higher order thinking skills while incorporating programs for appropriate response. This can prove to be difficult because many programs only give options for simple questions that are not conducive to higher order thinking.

The lack of ongoing formative assessment in classrooms makes knowing what students understand very difficult. When an educator asks questions of students throughout a lecture or activity they are given the opportunity to correct misinformation. When educators do not use formative assessments they are not able to fix problems and may not even be aware of misinformation until the end of a unit when it is too late to be fixed. Multiple-choice questions are a good start to formative assessment, but they do not

give as much insight to student learning as some other questioning styles may. When students are encouraged to create their own multiple choice questions regarding new material, instructors are given the opportunity to see what misconceptions students may have and classmates are given the opportunity to reinforce their knowledge by answering more questions (Winstone & Milward, 2012). When instructors give open response questions to students during a lecture they often only have a few students raise their hands to answer questions while the rest of the class remains silent (Arnesen, Korpas, Hennissen, 2013). This limits how well formative assessment works because the instructor knows how well only the students answering the question are understanding the material. The understanding of the rest of the students is a mystery until the next formative assessment or summative assessment. If there was the opportunity for instructors to have students answer open response questions anonymously, or at least not where students might be embarrassed in front of their peers, instructors would have another tool to see what students understand at different points in the lecture. Misconceptions can be corrected quickly, which should help learners in the long run.

In the summer of 2012, the program Nearpod was introduced to the educational market. Nearpod enables instructors to import a PowerPoint presentation and add interactive activities to act as formative assessments to reinforce learning. The activities, completed by students on their laptop, cell phone, or other electronic device, include polls (multiple choice questions), drawing (labeling diagrams or drawing structures), quizzes (multiple choice questions), and open response questions. All responses are sent to the instructor's computer, are recorded and are able to be downloaded at the instructor's

convenience. Answers to multiple choice questions can be shown to classes as pie charts so the instructor can respond to inconsistencies in responses and reinforce correct information. Learner responses to open response questions and drawing activities can be shared anonymously with the rest of the class. This may reduce the embarrassment felt by some students who are more uncomfortable answering aloud while still giving the instructor the opportunity to share relevant information with the rest of the class. Although it has had almost 100,000 teachers register accounts and can be run from the Internet or with a downloaded application, very little research has been done on its effectiveness in the classroom (Delacruz, 2014).

METHODOLOGY

The primary question of my action research project was: What is the impact of utilizing the educational program Nearpod as an active learning tool with high school science students?" I also wanted to see how students responded to active learning with Nearpod in comparison to how they responded to active learning with more traditional methods of lecture such as PowerPoint presentations. I attempted to measure how student performance changed when students were exposed to active learning with Nearpod using quizzes, daily assignments, and chapter tests. I also attempted to monitor how using Nearpod to encourage active learning affected my attitude and teaching style as a biology teacher.

The students participating in the study were my biology students and my marine biology students. I taught three sections of 10th grade biology and one class of marine biology for 11th and 12th grades. My biology classes had 19, 27, and 25 students while

my marine biology class had 17. An exemption for research methodology utilized for this project was received from Montana State University's Intuitional Review Board and compliance for working with human subjects was maintained (Appendix A).

The project included both Treatment and Nontreatment units. During Treatment units the classes had instruction delivered via the educational program Nearpod. The program included active learning methods including multiple choice polls and quizzes where students received feedback regarding their understanding of material covered previously or during the current lecture. Students submitted their answers through the presentation program and then the responses were shared via a pie chart. I reviewed answers with the class and reminded them why they were correct or incorrect and retaught material when approximately 80% of the class did not demonstrate sufficient understanding.

Students also responded to open response questions and submitted them to me during the lecture during both Treatment and Nontreatment. During Treatment this was done with the Nearpod program. During Nontreatment this was done using pieces of paper or individual whiteboards. I shared some of these answers with the class as needed to demonstrate where understanding and where confusion were happening. The students whose answers were shared were not identified by name because Nearpod does not use an identifier when things are shared. I had planned to have students write their own multiple-choice questions and submit them through the open response feature. I hoped to share these immediately to help the rest of the class with their understanding of new material. Unfortunately, my students really struggled with this, so I modified the activity

by having them search for pictures to describe a concept. I then shared these pictures with the class and reviewed the material.

Students in the Treatment were also able to demonstrate their ability to identify structures using the draw feature of Nearpod. I uploaded diagrams into the presentation and asked students to label important features. Students then submitted the diagrams for my review and I shared those diagrams to assist instruction.

For the Nontreatment, I mimicked the action learning activities done in the Nearpod program. The multiple choice type questions were done using slides within the PowerPoint presentation for the lecture. Students responded using individual whiteboards at their desk and held them up so answers could be seen. I corrected incorrect answers as needed both for individuals and for the class as a whole. By doing both Treatment and Nontreatment with every unit, I hoped to avoid issues with the difficulty of the material being taught affecting data. I was able to take data from the Nearpod program but was not able to take data from the Nontreatment classes as their feedback was done using whiteboards.

Open response questions were done in two ways with classes during Nontreatment. Students wrote some questions on whiteboards while other questions were answered on paper to be turned in. Questions that were deemed valuable or important to share were shared verbally with the class or written on the large whiteboard at the front of the room. Others were shared during the next day's class as a review. Students labeled diagrams in their notes rather than on the computer, which meant that they did not have the ability to search for images during lecture while in Nontreatment.

The study began in January and continued into March. During this time period we studied four different units in regular biology: photosynthesis, cellular respiration, Mendelian genetics, and molecular genetics. Units generally lasted two to three weeks and time was built-in for days off due to inclement weather. Each class had two units in Treatment and two units in Nontreatment. No two classes had exactly the same schedule. I chose to rotate the Treatment and Nontreatment in this manner to minimize the effect of the unit material on grades and to observe any effect of Nearpod on student performance (Table 1). I did not expect difficulty switching from Treatment to Nontreatment during the same unit, although I did find it more difficult to switch from one to the other towards the end of the process. I used reminders from my online calendar to ensure I used the correct materials for each class. Data for the two classes undergoing Treatment or Nontreatment at the same time were combined for analysis with the single class undergoing the opposite rotation.

Table 1
Class Treatment Rotation for Three Sections of Regular Biology

Unit	Photosynthesis	Cellular Respiration	Mendelian Genetics	Molecular Genetics
Fourth Period	Treatment	Nontreatment	Treatment	Nontreatment
Sixth Period	Nontreatment	Treatment	Treatment	Nontreatment
Seventh Period	Treatment	Nontreatment	Nontreatment	Treatment

I also had my Marine Biology students participate in the study during the same time period. This was done during their study of macroinvertebrates. The units studied were phylum Porifera (Treatment), phylum Cnidaria (Nontreatment), and marine worms and phylum Arthropoda (Treatment). I had originally planned to include studies on phyla Mollusca and Echinodermata but time did not allow for this.

Both quantitative and qualitative data were gathered for this project, as seen in Table 2. Quantitative data included short, five to ten question, multiple choice quizzes given daily at the beginning of each class period (Appendix B). These were done using Nearpod and the online classroom program, Moodle, provided by the school district. These were graded automatically and students were given feedback after they completed the quiz.

Table 2
Data Triangulation Matrix

Focus Question	Data Source 1	Data Source 2	Data Source 3
Primary Question: 1. What is the impact of utilizing Nearpod as an active learning tool with high school biology students?	Daily Student Quizzes (5-10 multiple choice questions)	Pretest and Posttest Grades	Student Surveys
Secondary Question: 2. How does active learning with Nearpod affect student performance?	Daily Student Quizzes (5-10 multiple choice questions)	Pretest and Posttest Grades	Daily Assignments (laboratory reports, reinforcement activities, review exercises)
Secondary Question: 3. How do students respond to active learning with Nearpod?	Student Surveys	Student Daily Quizzes and Unit Test Grades	Teacher Journal
Secondary Question: 4. How does using active learning with Nearpod affect my attitude and teaching style as a biology teacher?	Teacher Journal	Student Surveys	Interviews with Biology Department

Another quantitative measure was Pretest and Posttest grades. Students took a Pretest immediately before beginning a unit and then took the Posttest immediately after completing the unit. Pretests and Posttests consisted of the same questions for each unit chosen from question banks used in previous years. Tests generally consisted of multiple choice questions, open response questions, and diagrams. These were also taken using Moodle and were primarily graded by the program. Multiple choice questions and diagrams were graded automatically with feedback after the test was completed and submitted, while open-response questions were graded by the instructor. Feedback for open response questions was given on an individual basis and generally reinforced a correct answer or explained why a response did not receive credit. The data analysis was done using the Wilcoxon Signed Rank test to determine if the distribution of the paired scores was attributed to the Treatment or if they would have had the same distribution if no Treatment had been given. I used an alpha level of 0.05 for all tests.

A final quantitative measure was daily assignments. Daily assignments included laboratories, reinforcement activities, and review exercises (Appendix C). These were done on paper and were reviewed during class so students could have correct answers for review. Units had a minimum of one laboratory assignment although some units had more. Units also had a minimum of one reinforcement activity and one review exercise. The reinforcement activities ranged in difficulty and length for each unit and were determined by the instructor based on student need. The review exercise occurred just before a unit test. Students received a grade for those activities completed during the unit. These grades were compared between the Treatment and Nontreatment groups.

The Wilcoxon Rank Sum test was used with this data to see if the two sets of data had similar distributions, as if no Treatment had been done, or if the Treatment influenced a change in the distribution.

Qualitative measurements were done with student surveys at the end of each unit. Students answered Likert questions to determine their reactions to active learning with Nearpod and how well it assisted them to make connections between previous knowledge and new material. The student surveys were generally only five to ten questions. All surveys (Appendix D) were the same except for the last survey, which did not have the first question (asking which type of presentation was used for their class during this unit, PowerPoint or Nearpod). Students were given a survey during each unit, both Treatment and Nontreatment. Surveys were given at various times during a unit depending on when the schedule allowed. Students were not identified by name, rather by student number, simply to keep track of which surveys had been entered into the Excel spreadsheet and which had not. The surveys also included questions that helped me reflect on how my teaching style was different during Treatment and Nontreatment. These were modeled after questions by Diemer, Fernandez, and Streepey (2012) (Appendix E). These qualitative measurements were analyzed using the chi square test of independence to see if there was a difference in the responses of the Treatment and Nontreatment classes.

With this information I wanted to compare the confidence levels of students with the two presentation types thinking that if students were more confident with material presented in one method they would be more successful with that one. I decided to run the chi square test of independence on all four surveys to determine if there was truly a

statistical difference between the Treatment and Nontreatment. When running these I had to collapse some of the columns to keep from having values that were too small to run the test (for example collapsing the "Disagree" and "Strongly Disagree" categories).

A second qualitative measurement was done with a teacher journal. I reflected on how well students responded to the active learning activities during the lecture. I compared the success rates between the classes in Treatment and the classes in Nontreatment. Each day the teacher with whom I worked most closely spent five to ten minutes discussing the day and how we could improve our teaching practices. I used these discussions to evaluate the process and how the project was moving. During this time I reflected on the differences I perceived during the Treatment and Nontreatment classes. I tried to concentrate on how students responded differently with the Treatment and Nontreatment. Did students wait longer to answer questions when they knew they would not be anonymous? Did students who generally were quieter give better answers with Nearpod?

DATA AND ANALYSIS

To analyze the performance of my students I looked at three different areas: Ten Question Quick Quizzes, Pretests and Posttests, and Daily Assignments. The Quick Quizzes showed very little difference between Treatment and Nontreatment groups in all four units. The means of the groups never deviated more than 6%, and in three of the four units, the Nontreatment means were higher than the Treatment. Only in the Mendelian Genetics unit was the mean higher in the Treatment group. The medians of the Treatment and Nontreatment groups were identical in the Photosynthesis and

Mendelian Genetics units while the medians of the Nontreatment groups were one point higher than the Treatment groups in the Cellular Respiration and Molecular Genetics units (Figure 1). To determine if there was actually any statistical difference between the two groups I ran the Wilcoxon Signed Rank statistical test and found there to be no evidence to support a difference between Treatment and Nontreatment (*p*-values ranged from 0.3 to 3.4).

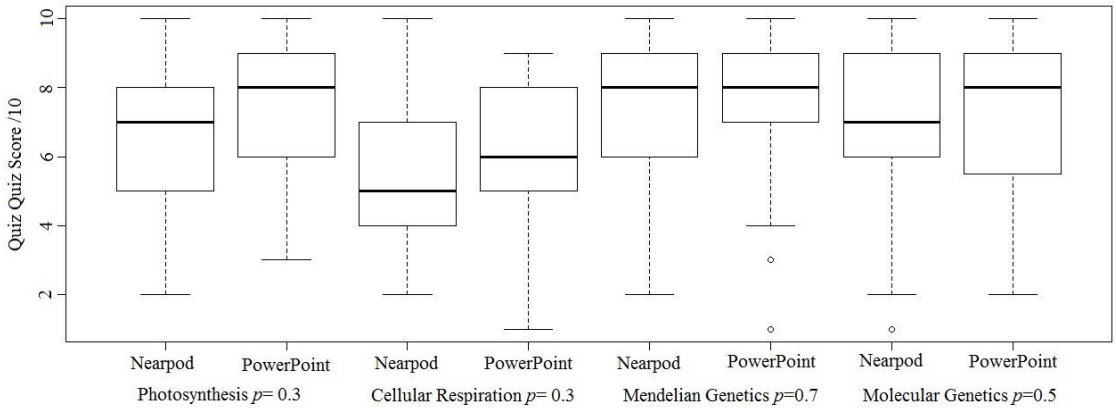


Figure 1. Quick quiz boxplots, (*N*=65).

There was very little difference between the Treatment and Nontreatment groups' Pretest and Posttest data (Figures 2 - 5). While all groups showed improvement from the Pretest to the Posttest, the Cellular Respiration unit had very little difference between the Treatment and Nontreatment while the Mendelian Genetics unit had a larger change between the two tests. There were no discernable patterns and no indication that Treatment had any benefit or detriment when compared to Nontreatment.

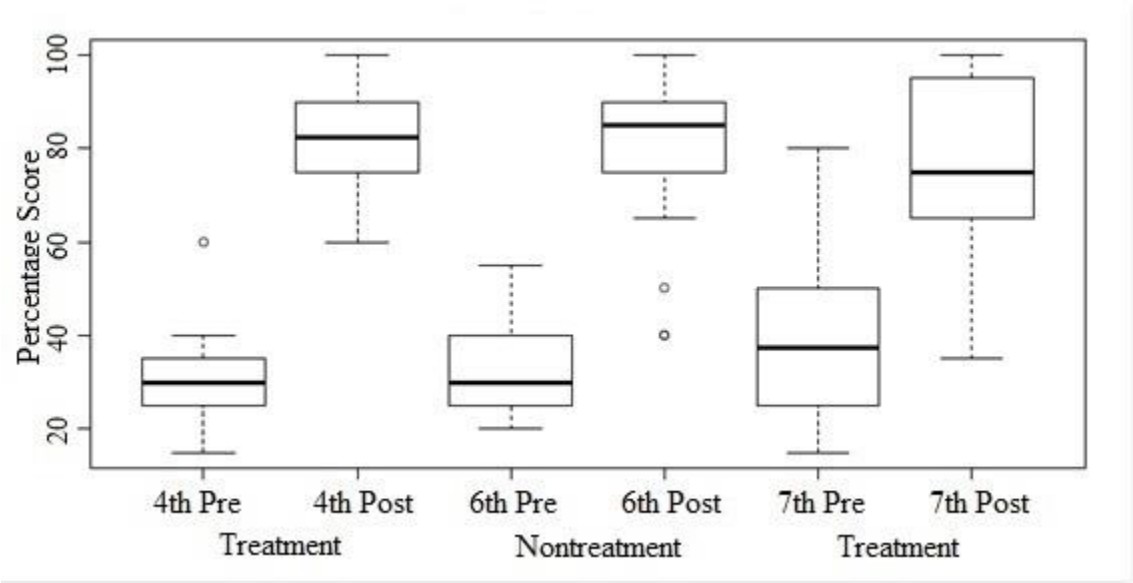


Figure 2. Photosynthesis pretest and posttest grades, (*N*=65).

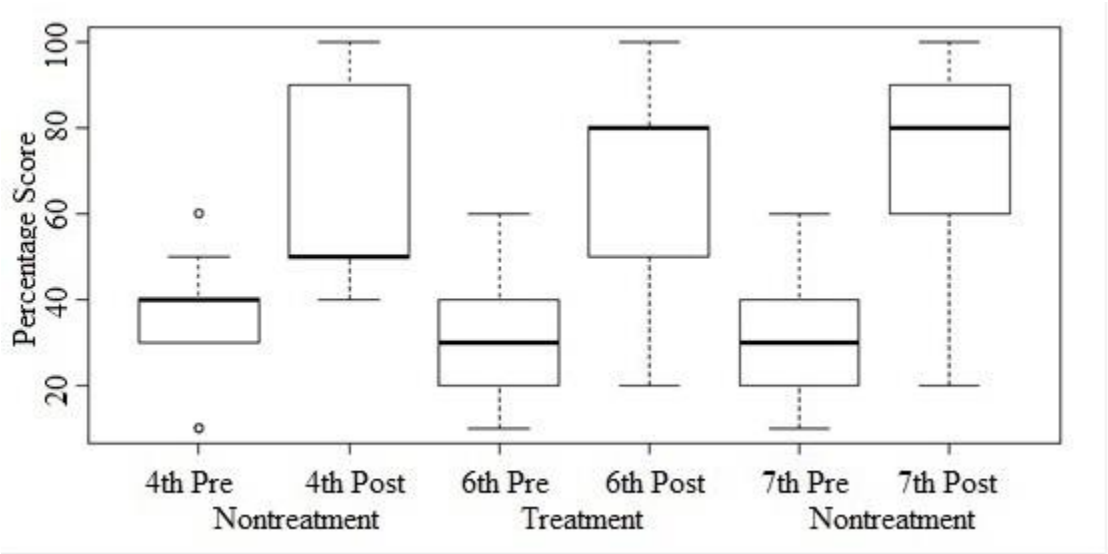


Figure 3. Cellular respiration pretest and posttest grades, (*N*-65).

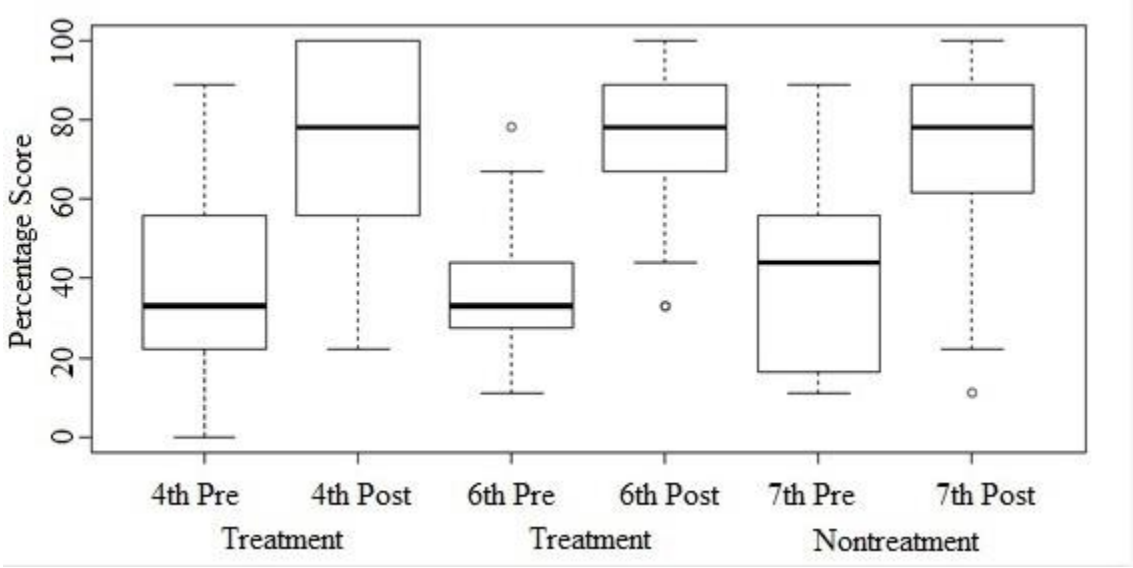


Figure 4. Mendelian genetics pretest and posttest grades, (*N*=65).

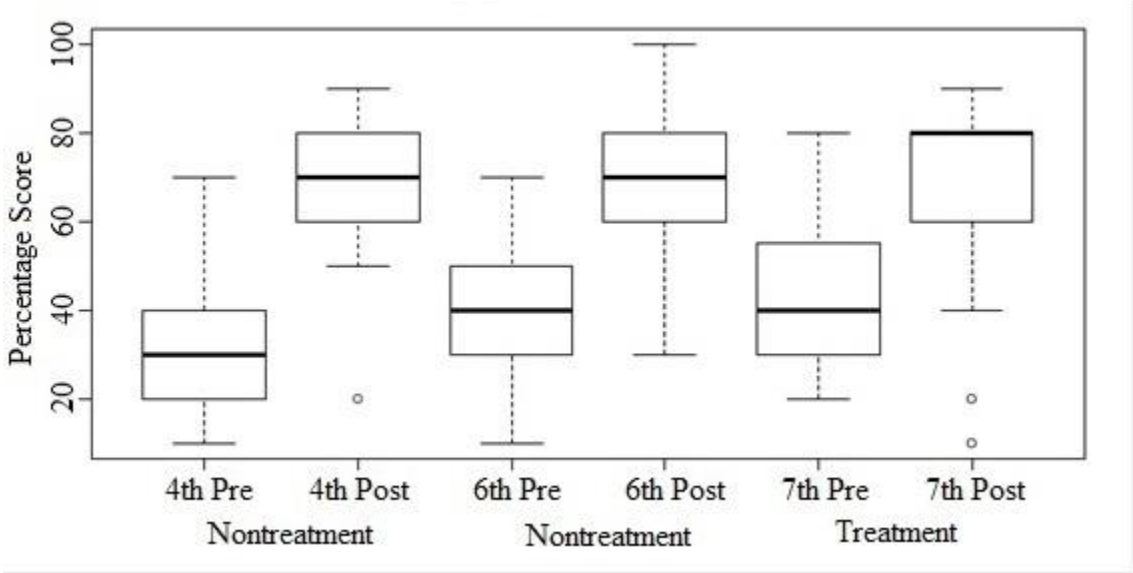


Figure 5. Molecular genetics pretest and posttest grades, (*N*=65).

I found similar results when I analyzed the Pretest and Posttest data from the Marine Biology classes. As there was only one Marine Biology class to include in the study I had to alternate Treatment and Nontreatment units. Two of the units were Treatment while only one was Nontreatment. The average difference in Pretest and

Posttest scores was larger for the first unit on Phylum Porifera (56%). The average difference in Pretest and Posttest scores for the unit on Phylum Cnidaria was not as large (37%). As the Porifera unit was Treatment and the Cnidaria unit was Nontreatment I was hopeful to see the trend continue. The third unit of the study was a Treatment unit on marine worms and Phylum Arthropoda. The average difference in Pretest and Posttest scores was virtually identical to the Cnidaria unit (35%). When statistical tests were run the *p*-value (0.2) indicated there was no difference in gains between the Treatment and Nontreatment units.

The daily assignments showed no trends when comparing Treatment and Nontreatment units. The students who did their work and turned it in generally followed through. Those students who did not do their work and turn it in generally did not during the study. There appeared to be no greater or lesser work turned in during Treatment and Nontreatment units (Figure 6).

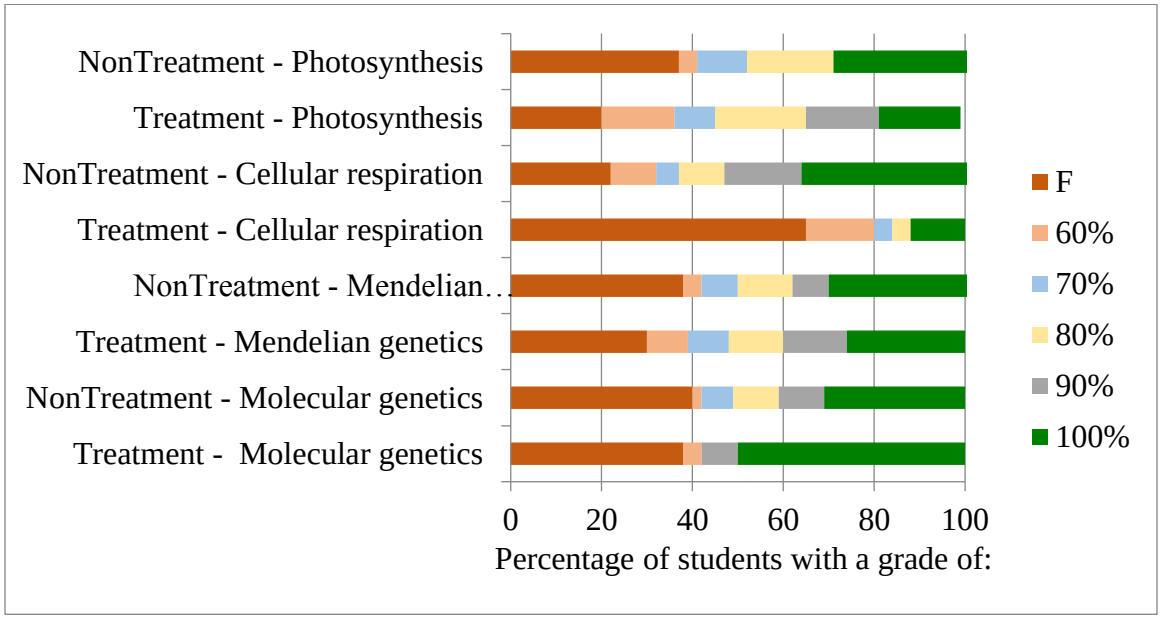


Figure 6. Grade distributions for daily assignments by unit, (*N*=72).

In Marine Biology the daily assignments showed generally the same difference between Treatment and Nontreatment. The average grades for the Porifera unit were slightly higher than the other two units (Porifera: 95%; Cnidaria: 88%, Arthropoda: 89%). When statistical tests were run the *p*-value (0.2) resulted in a failure to reject the null hypothesis, that Treatment had no effect on student performance. Therefore there is no statistical difference between Treatment and Nontreatment.

The Unit Test grades were compared for Treatment and Nontreatment classes for each unit. There were no obvious trends when comparing Treatment and Nontreatment. There was a small downward shift in the means as the units progressed which may be attributed to the increased difficulty of the material. The Photosynthesis and Cellular Respiration units showed a slightly higher mean for the Treatment classes, while the two Genetics units demonstrated the opposite (Figure 7). None of the units showed statically significant differences with *p*-values ranging from 0.47 (Photosynthesis), 0.49 (Cellular Respiration), and 0.48 (Mendelian Genetics), to 0.6 (Molecular Genetics).

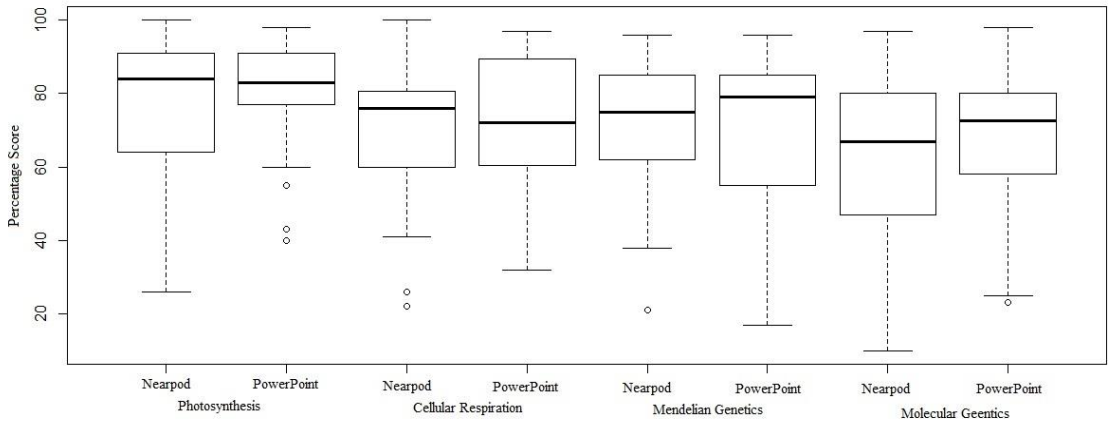


Figure 7. Unit test boxplots, (*N*=70).

Student surveys were used primarily to answer the question: *How do students respond to active learning with Nearpod?* Throughout the time period students overwhelmingly reported preferring Nearpod over PowerPoint when taking notes. When combining the "Really Prefer Nearpod" with "Prefer Nearpod" and the "Really Prefer PowerPoint" with "Prefer PowerPoint" students reported to prefer Nearpod an average of 63% of the time while only preferring PowerPoint 9% (Figure 8).

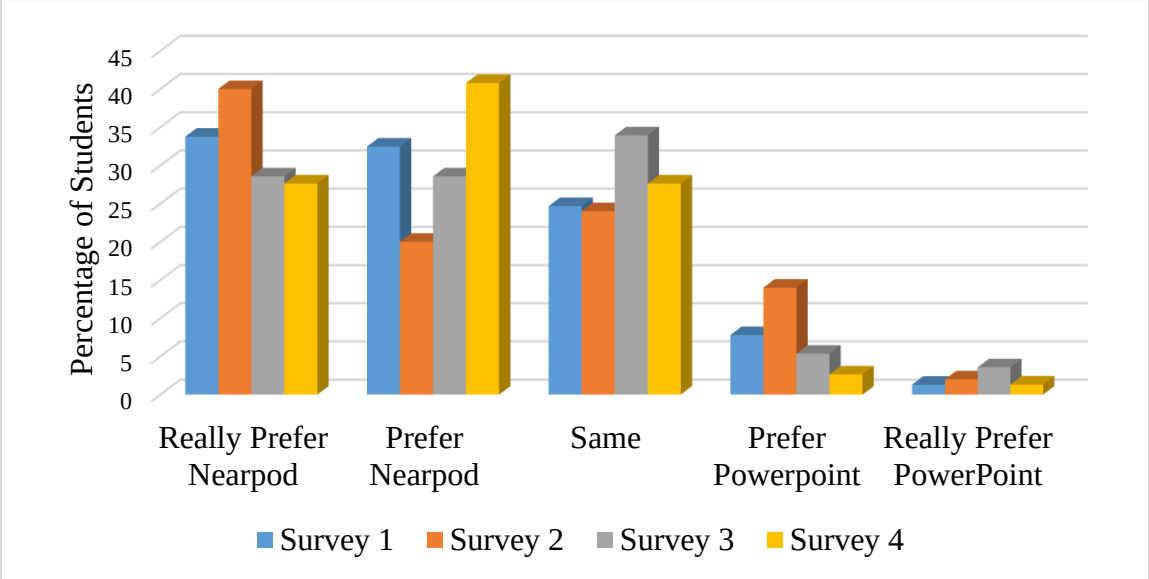


Figure 8. Student responses to the question: *When we take notes I prefer* ____, (*N*=77).

Students also reported that they retained more information when notes were presented in Nearpod than in PowerPoint. In addition, although they were introduced to active learning with PowerPoint during the study, for each of the four surveys, over half the students stated that they retained more information when using Nearpod. There was a drop in the number of students reporting that they retained more information with PowerPoint after the first survey, which continued throughout the rest of the study. Furthermore, the percentage of students who reported there was no difference in retention

with Treatment and retention with Nontreatment rose dramatically after the first survey and remained fairly consistent for the remainder of the study (from 13% to 34%) (Figure 9).

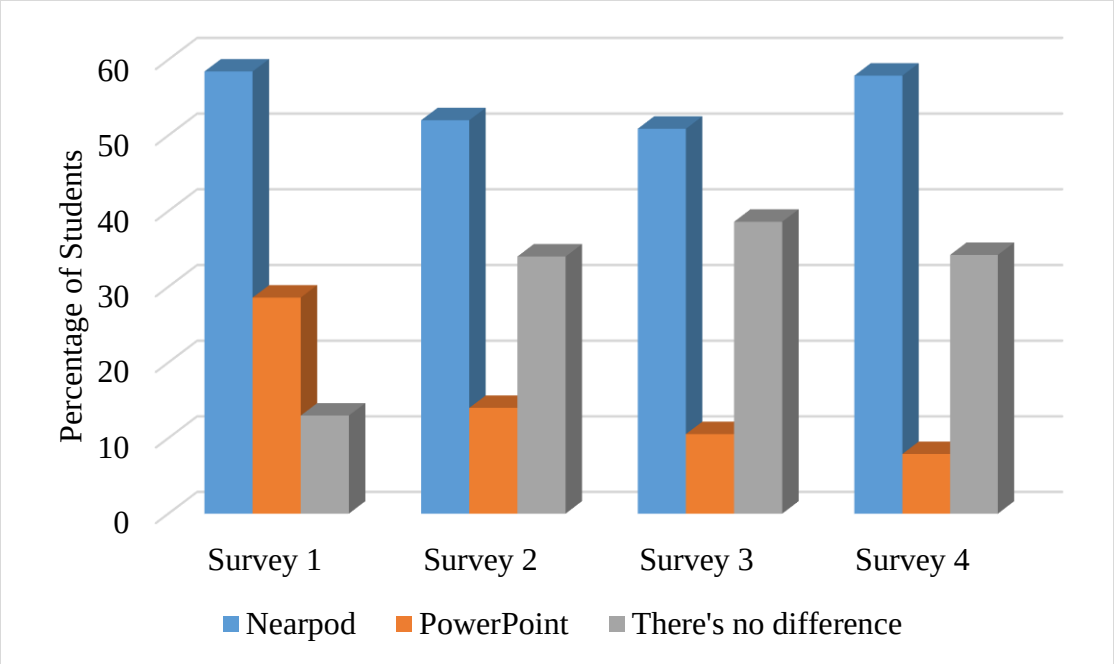


Figure 9. Student responses to the question: *I retain more information when notes are presented in* ____, (*N*=77).

In addition to determining their preferences, I wanted to see how confident my students felt with both types of presentation programs. Although students reported feeling confident with both types of presentations, on average 44% of the students reported feeling more confident with Nearpod than PowerPoint in all surveys (Figure 10).

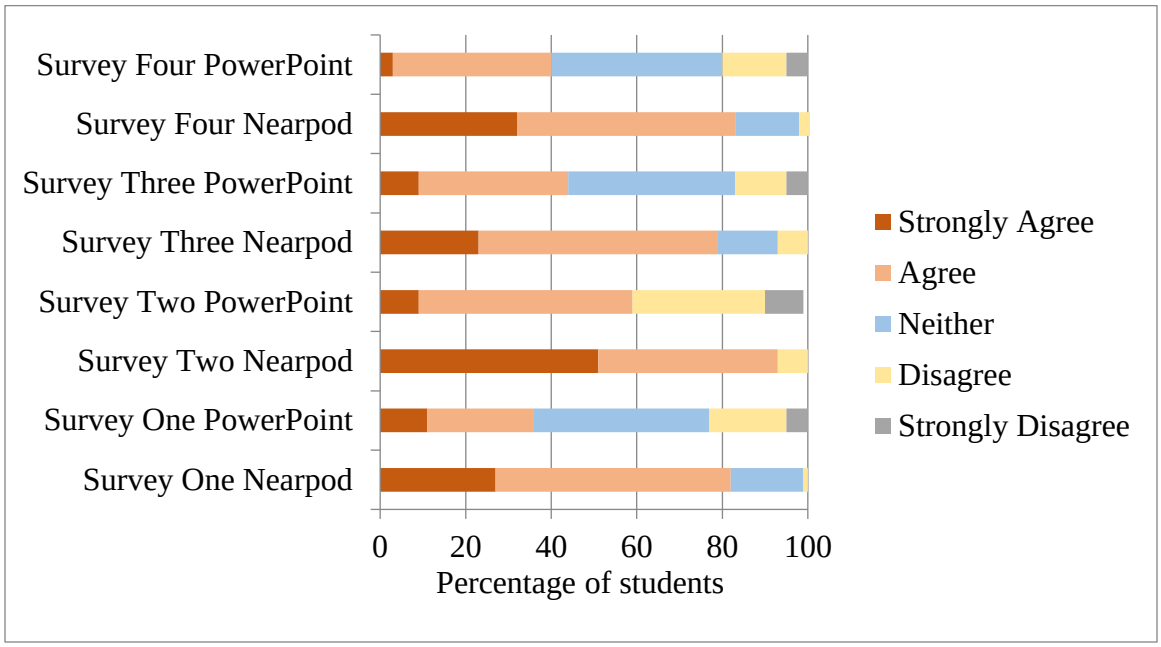


Figure 10. Student responses to the question: *I feel confident when material is presented with ___*, (*N*=77).

When all of the data were combined it was easy to see that students overwhelmingly preferred Nearpod to PowerPoint or had no preference between the two. Responses from students supported this observation and included statements such as "We can do more activities on there to help us understand the subject better," "You get to interact with the teacher more," and "There is nothing different between PowerPoint and Nearpod to me, it doesn't matter what the teacher uses to teach us."

When reviewing the teacher journal (Appendix F) and concentrating on how students responded to Nearpod and PowerPoint, I found that students were more positive with Nearpod when doing activities such as drawing and labeling diagrams than they were during Nontreatment. I wrote

> January 29, 2016: Did lots of diagrams with these past two units. The kids really did better with the diagrams in Nearpod than they did with the whiteboards/diagrams in page protectors. I think we practiced the material

> enough in other activities to make up for any differences, but I am not getting the same enthusiasm with the groups.

I also noted that there really did not seem to be a difference between the Treatment and Nontreatment groups in activity performance or grades when reflecting on the quantitative data collected during the study.

I reflected on my attitude and teaching style within my teacher journal. In general I found myself working harder to compensate for the differences between Nearpod and PowerPoint. As Nearpod made it easier for me to be more animated when reviewing diagrams than PowerPoint, I found myself more enthusiastic with the groups using PowerPoint while learning the structures on diagrams than I was with the classes using Nearpod. I reported feeling that "drawing on paper and holding the picture up just doesn't seem to work as well." I also determined that I need to be more responsive to students when using Nearpod so they would hear positive and negative feedback as immediately as possible, rather than having to wait three or four minutes while their classmates finished an activity or quiz. While using PowerPoint and white boards for interaction I was able to give feedback almost immediately, to which the students responded positively.

Student surveys were also used to analyze my style as a teacher with both presentation methods. As most of my students' teachers use PowerPoint and Nearpod is a bit of a novelty, I expected them to report that I explained things better with Nearpod at the beginning of the project. I was unsure if the responses would change as they were exposed to my teaching with PowerPoint. I saw a slight change as we moved through the grading period. The percentage of students who believed I taught better with PowerPoint

did not change much through the time period (6% to 8%), but the percentage of students who reported that there was no difference between the two presentation methods rose from 22% to 36% during the project. The percentages of students who believed I taught better using Nearpod also decreased as the study progressed (Figure 11).



Figure 11. Student responses to the question: *My teacher explains things better with ____*, (*N*=77).

When discussing the use of presentation programs with the Biology faculty at Russellville High School we all agreed that Nearpod was more beneficial to the students than PowerPoint. The interactive nature of the program made class more engaging and we appreciated the ease it gave educators to incorporate active learning into the classroom. We felt that the student data the program records was extremely helpful in analyzing student performance and giving other interested adults (parents, administrators) a glimpse into the day-to-day activity of the biology student.

I asked my students to respond to several questions regarding what they did and did not like about the two presentation programs worked with during this study. When asked what students liked most about using Nearpod the responses generally fell into several types: students appreciated how interactive they were and liked answering questions, searching for pictures, drawing on diagrams, and taking a short quiz at the end. A few students appreciated that they had the opportunity to use the computers during class while others were excited to be able to see the material on their own computer screens and not have to squint at the SmartBoard or look around the people sitting in front of them.

When asked what they liked most about using PowerPoint the students responded very differently. Many students simply said they liked nothing about using PowerPoint. A few appreciated that they did not have to use the computers and did not have any distractions from them. Others students enjoyed the novelty of using whiteboards with PowerPoint to be interactive and thought the lectures went a little faster than they did with Nearpod. I did not find that the responses to these questions changed as time progressed.

The final question asked students what helped them most when taking notes. Students gave a variety of responses that often did not have anything to do specifically with either presentation method. Many students reported that they needed the explanation from the teacher to really understand the material while others expressed the need to physically write information on paper. Several students recognized the need for

questioning during the lecture while a few others believed that being active in learning was essential.

The primary question, "What is the impact of utilizing Nearpod as an active learning tool with high school biology students?" revealed a clear student preference in both attitude and confidence in the material when utilizing Nearpod. The secondary questions also revealed clear results, "How does active learning with Nearpod affect student performance?" I found there was no difference in numerical grades with any of the categories of grades I used. Student surveys showed a clear preference for Nearpod and the teacher journal showed more interaction during Treatment than Nontreatment when answering the question, "How do students respond to active learning with Nearpod?" When looking at the final question, "How does using active learning with Nearpod affect my attitude and teaching style as a biology teacher?" the teacher journal showed that while I appreciate the advantage of Nearpod, there remains a need for instructor enthusiasm and energy to complement the clear student preference for this platform. The student surveys showed that while students believed that I was competent with both presentation methods, they preferred Nearpod over PowerPoint. Finally, in interviews with my colleagues, we agreed that the ease of utilizing Nearpod to facilitate active learning in the biology classroom was something we did not wish to give up and the records we received of what every student had done during the presentation was fantastic.

INTERPRETATION AND CONCLUSION

In the beginning of my study I was slightly surprised that there was so little difference between the student grades using Nearpod and PowerPoint. After reflecting on the project I believe this was because I was so careful to include all of the active learning activities in the PowerPoint presentations. I generally used PowerPoint when I did not had time to create a Nearpod for a particular unit or there really were not enough good opportunities to add interactive strategies in a particular topic. If I had not included the active learning strategies in the PowerPoint presentations I believe the results would have been very different. However, I would have been testing the difference between active learning with Nearpod and inactive learning with PowerPoint, which would have included too many variables.

I was not surprised to see the overwhelming preference of Nearpod over PowerPoint with my students. They really did seem to enjoy being more active during class and appreciated the opportunities to share with me and the rest of the class what they knew and could find online. I was surprised at the enthusiasm students had for having the information on their own computer screens. I had not really thought about how difficult it was for some students to see the front of the classroom and how refreshing it was on occasion for them to just have to look at their own computer to get the information they needed. I had expected students to either feel confident with one or the other, I was pleased to find that students were confident with both type of presentation.

I found advantages and disadvantages to both Nearpod and PowerPoint. With Nearpod I had the record of what every student did and I did not have to remember which students missed understanding new material when just looking at the white boards. With PowerPoint the students who used their whiteboards to respond received immediate feedback in an almost game-like banter.

I was not expecting the atmosphere in my classroom to change after the study concluded. I am pleased to say that in some small ways it has changed for the better. My students, especially those who are not considered upper level, seem to appreciate using the computers during lecture more. I believe this is because I had never just used PowerPoint during lectures and they did not realize how much how much they liked being more active participants in class. Very rarely do I still find myself having to remind students to stop going to unnecessary websites during class. Students now realize that I can and will teach without Nearpod and as they have reported that they are more confident when material is presented with it, students want to use it.

I have also recognized that I need to show greater enthusiasm when presenting new material. I unintentionally found myself using lots more energy giving feedback when the students were using the whiteboards during Nontreatment units during the project. The students responded with more energy for the material and this seemed to have a very positive effect on the classroom environment. I decided to mimic some of the high energy things I did with the whiteboards such as calling out names and saying "Good job!" as they answered questions correctly or sharing more of their drawings as

we review information and had more enthusiastic participation from students who are not always excited about school.

The goal of this study was to see if the Nearpod program had an impact on student performance in the secondary science classroom. It is my conclusion that it does have an impact and a very positive one. Although I did not see an improvement in grades when using Nearpod, I did see greater student confidence in material than when using PowerPoint. Nearpod made including active learning strategies in a lesson much easier for the teacher than when having to use multiple pieces of equipment for one lecture. Nearpod also gave the educator an easy source for data on student achievement.

VALUE

The process of doing this action research project has been of more value than I could have ever expected. It has given me the tools to really think about how I want my classroom to work and how I might methodically try new methods and measure how they can change the dynamics of the classroom environment. More importantly, it has helped me to understand that just because a tool did not improve grades, it can improve classroom involvement.

My students learned to appreciate the opportunity to use their computers when involved in lecture. Some students seemed to have been surprised at how much they really enjoyed using Nearpod instead of using PowerPoint like they did with many of their other teachers. Others have been pleased with how much easier they have learned material from diagrams than with other, more traditional methods.

This project has reminded me that I really do need to incorporate active learning strategies in my classroom and taking the time to review good information and correct misinformation is vital student learning. With Nearpod it is much easier, and kinder, to correct misinformation with students being anonymous. I can include timid students without them collapsing under the possibility of being embarrassed in front of their classmates. I can better control the students who desire to be the center of attention by only sharing appropriate responses. Even if grades are not always better, classroom management is easier and student involvement is increased.

Nearpod is very helpful for those who find that professional demands have increased over the past few years. For those teachers who teach two, three, or more different subjects it is a huge time saver. It automatically grades and displays quizzes that can be used as exit slips. It records what students draw on diagrams so the teacher is able to see who can and cannot recognize structures. It also allows shy students to post questions they may not feel comfortable asking aloud during the class period. For those administrators who require proof of how material is being presented in a classroom, it most certainly provides the necessary evidence.

This project has also reinforced my belief that I need to continue providing many opportunities for reinforcement. No high school student, especially those who are not considered high level, should be expected to understand sometimes complex scientific concepts after only one lecture. The reinforcement activities and laboratory activities are instrumental in being sure students are able to use multiple senses to learn new material and retain it.

I believe I found the greatest value of this project after discussing it with my husband one evening. He mentioned that it really reinforced what I have believed for my entire teaching career. The educational system in many districts and states seems to grasp onto an idea or program that promises to be a “silver bullet” or “magic wand” and change the face of education for all involved. There is no such thing as a perfect program to fit all learners. The real difference is made by competent teachers who dedicate their careers to helping students of all backgrounds and abilities become the best lifelong learners they can.

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APPENDICES

APPENDIX A

INSTUITIONAL REVIEW BOARD EXEMPTION

INSTITUTIONAL REVIEW BOARD

For the Protection of Human Subjects
FWA 00000165

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MEMORANDUM

TO: Margaret Lowry-Brock and Peggy Taylor

FROM: Mark Quinn, Chair Mark Quinn CJ

DATE: November 9, 2015

RE: *"The Effect of Using Nearpod as a Tool of Active Learning in the High School Science Classroom"* [ML-B110915-EX]

The above research, described in your submission of November 9, 2015, 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.

____ (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

SAMPLE QUIZ AND TEST QUESTIONS

1. Which region of the visible spectrum is not absorbed well by chlorophyll?
    a. Violet
    b. Blue
    c. Green
    d. Red
2. If carbon dioxide is completely removed from a plant's environment, what would you expect to happen to the plant's production of high-energy sugars?
    a. No sugars will be produced.
    b. Carbon dioxide does not affect the production of high-energy sugars in plants.
    c. The same number of sugars will be produced but without carbon dioxide.
    d. More sugars will be produced.
3. What are the three parts of an ATP molecule?
    a. Adenine, ribose, phosphate groups
    b. Stroma, grana, chlorophyll
    c. NADH, HADPH, and $FADH_2$
    d. Adenine, thylakoids, stroma
4. Which of the following is an autotroph?
    a. Leopard
    b. Mushroom
    c. Tree
    d. White tailed deer
5. Which organism is likely to carry out fermentation?
    a. Anaerobic bacterium
    b. Mushroom
    c. Tiger
    d. Tree
6. What are the reactants in the equation for cellular respiration?
    a. Carbon dioxide and water
    b. Oxygen and lactic acid
    c. Glucose and oxygen
    d. Water and glucose
7. Photosynthesis is to chloroplasts as cellular respiration is to
    a. Nuclei
    b. Mitochondria
    c. Cytoplasm
    d. Chloroplasts
8. Breathing heavily after running a race is your body's way of
    a. Recharging the electron transport chain
    b. Making more citric acid
    c. Restarting glycolysis
    d. Repaying an oxygen debt
9. How are cellular respiration and photosynthesis almost opposite processes?
    a. Photosynthesis removes carbon dioxide from the atmosphere and cellular respiration puts it back.
    b. Photosynthesis removes oxygen from the atmosphere and cellular respiration puts it back.
    c. Photosynthesis releases energy, and cellular respiration stores energy.
    d. All of these

APPENDIX C

MUTATION LAB

Mutation Lab

What can happen when things go wrong?

Objectives:

- To demonstrate the processes of transcription and translation.
- To demonstrate how the three types of mutations occur (insertion, deletion, and substitution).
- To demonstrate the effects of the three types of mutations on the amino acid chain produced by a DNA strand.

Background:

The genetic makeup of all known living things is carried in a genetic material known as DNA. DNA is made up of sugar phosphate molecules and bases in a structure that is shaped similarly to a twisted ladder. The bases pair very specifically (A only with T and C only with G) so that when the DNA molecule replicates every cell has an exact copy of the DNA strand.

The order of the bases in a DNA molecule is the key to the genetic code of an individual. Every three bases are known as a codon and codes for an amino acid. Proteins are made up of amino acids and the order of them determines the protein made. In this way the order of the bases in the DNA molecule determines which proteins are made.

DNA is found in the nucleus of the cell, but proteins are made in the ribosomes in the cell cytoplasm. The mRNA molecule is used to carry the message from the DNA molecule in the nucleus to the ribosome in the cytoplasm. RNA is very similar to the DA molecule except that the base T is replaces with the base U and RNA is single stranded (one half of the ladder).

At the ribosome, another type of RNA transfers amino acids from the cytoplasm to the growing amino acid chain at the ribosome. tRNA molecules determine the amino acid coded for on the mRNA molecule for that particular message.

Sometimes there are problems with the DNA molecule that result in a change in the order of bases. This is known as a mutation and there are three different types.

1) Deletion: a mutation where a base is left out.
2) Insertion: a mutation where an extra base is added.
3) Substitution: a mutation when an incorrect base replaces a correct base.

There are three possible outcomes when DNA sequences change:

1) An improvement
2) No change at all
3) A harmful change

In this lab you will determine the short protein for a normal strand of DNA and then the protein if each of the three types of mutations occurs for that particular strand of DNA.

Materials:

- Pencil
- Codon Table (at the end of this lab)

Procedure:

1. The following is a piece of DNA that a protein will be made from. Write the complementary mRNA in the spaces below it.
2. G – A – C – G – C – C – A – T – G – G – A – A – G – T – C
3. ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___
4. Draw a vertical line between each codon. Look up the amino acid for each codon on the codon chart and write them in the spaces below. Be sure to do this in order. This is the "normal protein."
5. _____ - _____ - _____ - _____ - _____
6. The following is the same piece of DNA but with a deletion mutation in the second codon. Write the complementary mRNA in the spaces below it.
7. G – A – C – G – C – A – T – G – G – A – A – G – T – C
8. ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___
9. Draw a vertical line between each codon. Do you see any differences between the codons on this mutated strand and the normal strand? _____ Describe them.

   _____

   _____
10. Look up the amino acid for each codon on the codon chart and write them in the spaces below.
11. _____ - _____ - _____ - _____ - _____
12. Was the number of amino acids the same as the original strand? _____
13. How many of the amino acids were the same as the original strand? _____
14. How many of the amino acids were different from the original strand? _____
15. Do you believe that this mutated DNA strand could create the same protein or a different protein as the original? _____ Why?

    _____

    _____

16. The following is the same piece of DNA but with an insertion mutation in the third codon. Write the complementary mRNA bases below it.

17. G – A – C – G – C – C – A – T – C -- G – G – A – A – G – T – C

18. __ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ____

19. Draw a vertical line between each codon. Do you see any differences between the codons on this mutated strand and the normal strand? _____ Describe them. _____

_____

_____

20. Look up the amino acid for each codon on the codon chart and write them in the spaces below.

21. _____ - _____ - _____ - _____ - _____

22. Was the number of amino acids the same as the original strand? _____

23. How many of the amino acids were the same as the original strand? _____

24. How many of the amino acids were different from the original strand? _____

25. Do you believe that this mutated DNA strand would create the same protein or a different protein as the original? _____ Why? _____

_____

_____

26. The following is the same piece of DNA but with an substitution mutation in the first codon. Write the complementary mRNA bases below it.

27. G – A – A – G – C – C – A – T – G – G – A – A – G – T – C

28. __ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ___ - ____

29. Draw a vertical line between each codon. Do you see any differences between the codons on this mutated strand and the normal strand? _____ Describe them. _____

_____

_____

30. Look up the amino acid for each codon on the codon chart and write them in the spaces below.

31. _____ - _____ - _____ - _____ - _____

32. Was the number of amino acids the same as the original strand? _____

33. How many of the amino acids were the same as the original strand? _____

34. How many of the amino acids were different from the original strand? _____

35. Do you believe that this mutated DNA strand would create the same protein or a different protein as the original? _____ Why? _____

_____

_____

Codon Chart

First Base	Second Base				Third Base
	U	C	A	G	
U	Phenylanine	Serine	Tyrosine	Cysteine	U
U	Phenylanine	Serine	Tyrosine	Cysteine	C
U	Leucine	Serine	Stop	Stop	A
U	Leucine	Serine	Stop	Tryptophan	G
C	Leucine	Proline	Histidine	Arginine	U
C	Leucine	Proline	Histidine	Arginine	C
C	Leucine	Proline	Glutamine	Arginine	A
C	Leucine	Proline	Glutamine	Arginine	G
A	Isoleucine	Threonine	Asparagine	Serine	U
A	Isoleucine	Threonine	Asparagine	Serine	C
A	Isoleucine	Threonine	Lysine	Arginine	A
A	(start) Methionine	Threonine	Lysine	Arginine	G
G	Valine	Alanine	Aspartate	Glycine	U
G	Valine	Alanine	Aspartate	Glycine	C
G	Valine	Alanine	Glutamate	Glycine	A
G	Valine	Alanine	Glutamate	Glycine	G

APPENDIX D

STUDENT SURVEY

Survey Unit 1

Circle the answer that best matches your opinion:

1. Notes were given using _____ this unit.

   NEARPOD POWERPOINT

2. When we take notes I _____

   Really prefer Nearpod | Prefer Nearpod | They're about the same | Prefer Power-Point | Really Prefer Power-Point

3. I retain more information from notes when they are presented in

   Nearpod PowerPoint There's no difference

4. I feel very confident with the material when it is presented using Nearpod.

   Strongly Agree | Agree | Neither | Disagree | Strongly Agree

5. I feel very confident with the material when it is presented using PowerPoint.

   Strongly Agree Agree Neither Agree nor Disagree Disagree Strongly Disagree

6. My teacher explains things better when using

   Nearpod PowerPoint There's no difference

Give a brief answer for the following questions:

7. What do you like most about using Nearpod?

8. What do you like least about using Nearpod?

9. What do you like most about using PowerPoint?

10. What do you like least about using PowerPoint?

11. What helps you most when taking notes?

APPENDIX E

SAMPLE STUDENT SURVEY QUESTIONS

Sample Survey Questions (adapted from Diemer, Fernandez, & Streepey)

The Nearpod helped me learn the course content.
I find lectures with Nearpod keep me more engaged in the learning process.
I like lectures when we do not use the computers.
I participate in class more when we use Nearpod.
The computer tends to distract me from what I should be learning.
I like seeing if my answers are correct privately.
I prefer to let other people answer questions in class.
I like it when the teacher shares my answer with the class.
I remember material more when we have lectures with Nearpod.
Mrs. Brock teaches better when it's just her and the PowerPoint.
I learn more when I do not use the computer.

APPENDIX F

TEACHER JOURNAL

Teacher Journal:

Question One: ***How did the students respond to the new material? Interested, bored, questioning, confused, etc.?***

January 8, 2016: Began study with all classes this week. I spent a good bit of time explaining this project to my students so they really seemed interested in how the two types of presentations are going to be different. No one was particularly confused and those who were bored would have been bored anyway.

January 15, 2016: Continued with first unit of study this week. Students on nontreatment began to figure out that I really am trying to do the same kind of activities they would have done on Nearpod. Some students have found the grids on the back of the white boards – not a good thing.

January 22, 2016: Short week and switched treatment/nontreatment groups. Student who went back to Nearpod seemed to relax a little more probably because they were back to what they were used to. Those who went to PowerPoint were just a little freaked out by the white boards and really interested in the erasers and the color marker they got.

January 29, 2016: Did lots of diagrams with these past two units. The kids really did better with the diagrams in Nearpod than they did with the whiteboards/diagrams in page protectors. I think we practiced the material enough in other activities to make up for any differences, but I am not getting the same enthusiasm with the groups.

February 5, 2016: I've about had it with Marine Biology. Between college visits, research papers, and not having Nearpod attitudes have plummeted and the seniors pretty much think they are done. Not good for data (or my morale) at all.

February 11, 2016: This week was strange in that we didn't really have much class time in Biology because of the day off and all of the tenth graders touring the vocational school. Marine had their second test.

February 19, 2016: Students are acting like normal students. No differences between the two groups except that those not doing Nearpod say that they miss their computers.

February 26, 2016: Began the last unit this week. Some students are becoming a little more vocal about hating PowerPoint and white boards. They have also expressed their excitement regarding this project ending soon.

March 4, 2016: Finished the last Biology notes with the study this week. No one cheered, but everyone was glad that they were no longer guinea pigs.

March 11, 2016: Gave the last test this week. Got to introduce the interns to Nearpod. They had only used PowerPoint in the past and were quite impressed.

Question Two: ***How did I feel during the class periods? Did I have an easier time keeping the students engaged or was it frustrating?***

January 8, 2016: I felt very prepared this week. I got a little frustrated with having to get the white boards and markers out for the students on nontreatment, but I think that's just because it hasn't been in our routine this year.

January 15, 2016: Still feeling good during the classes, but wondered a little this week if I was a little over enthusiastic with the kids on PowerPoint. Drawing on paper and holding the picture up just doesn't seem to work as well.

January 22, 2016: I'm way more active during PowerPoint when responding to student activity during lecture. On Nearpod, I can see everyone's on my computer privately, with PowerPoint I'm having to look across the room and point while saying "yes, yes, great, nope, try again." My fitbit is on overdrive during those times.

January 29, 2016: I'm still finding myself showing much more energy when doing PowerPoint. Finding that those students who would get distracted with the computers will get just as distracted with the whiteboards. Shocker.

February 5, 2016: So we're in the middle of unit three, which means all students have experienced both treatment and nontreatment. All students are beginning to show some wear and tear with this process. The white boards are no longer a novelty. This is causing me to have to work harder to keep the nontreatment kids interested. The kids on treatment are beginning to call out to me wondering if they have something correct or not – rather than just waiting until the end of that activity or quiz. Hmmmm.

February 11, 2016: not enough direct instruction this week to really get any good info.

February 19, 2016: Students not in Nearpod are rebelling. Don't want to use white boards. Next unit is really going to be a challenge.

February 26, 2016: This week I had my first time completely forgetting to take the active parts of Nearpod and putting them into the PowerPoint. Even if there is no real difference in grades between the two presentation programs, I'm going to keep using Nearpod until something better comes along because it makes my world so much easier and I have the data from the program.

March 4, 2016: I think I feel more relieved than anything about not having to have two different types of presentations for the next unit than anything else.

March 11, 2016: Got to introduce the interns to Nearpod. They had only used PowerPoint in the past and were quite impressed.

Question Three: ***Does there seem to be a difference in how the treatment and nontreatment groups are doing? Do they both seem to understand on the same level?***

January 8, 2016: It's really too soon to tell. Not seeing much of a difference yet.

January 15, 2016: Gave first tests today with both subjects. I think that will help a great deal. Not seeing much difference in daily work or small quizzes.

January 22, 2016: Not really seeing much of a difference with the two groups. Not sure I'm getting good responses with all students on the PowerPoint. I have no way to know for sure if I've checked everyone or not.

January 29, 2016: Thinking that the Nearpod kids get the diagrams better than the PowerPoint ones. No data, but my gut is good.

February 5, 2016: Still not seeing a difference. Those students who normally understand material, are understanding it. Those who don't get it, still aren't getting it.

February 11, 2016: No difference.

February 19, 2016: No difference.

February 26, 2016: I think those students who were able to draw on Nearpod this week in the notes are having an easier time on the activities. It could most certainly be the kids in each of the classes, but I'm not willing to bet my shorts on it.

March 4, 2016: The protein synthesis lab seemed to go a little more smoothly with my treatment class than the others. That could have been because a few key students were not present in the treatment class (7^{th} period) – not necessarily the presentation difference.

March 11, 2016: Really wondering how all of the grades are going to turn out for this project.

Question Four: ***How are the grades with the treatment and nontreatment groups?***

January 8, 2016: Too soon to tell. Seriously? It's only been a few days.

January 15, 2016: First tests today. Not seeing much difference with daily work.

January 22, 2016: Grades from the first unit didn't seem particularly different from each other or what I've seen previously. Hmmmmm.

January 29, 2016: Grades aren't really that different yet. Not even with little quizzes. Granted, I'm doing the same review quizzes with PowerPoint that I did with Nearpod, so there aren't any advantages for a group. Second test given today with Biology – we'll just have to see if there is any difference.

February 5, 2016: Not seeing any real difference. Test grades are in, no real difference.

February 11, 2016: No difference.

February 19, 2016: Took a test yesterday in Biology – not seeing any preliminary differences.

February 26, 2016: Not seeing a difference in test grades.

March 4, 2016: Still no difference.

March 11, 2016: Not seeing any difference with anything, but haven't run any statistical tests yet. Kind of hoping I remember everything I should with that.

Question Five: ***How do the students in the different groups do on activities? Is there a difference in the questions the groups are asking?***

January 8, 2016: Again, too soon. Marine biology is doing a Nearpod so I don't expect to see anything different yet. Biology has done one activity. Groups are showing about the same thing.

January 15, 2016: Not really seeing much of a difference. Those who pay attention do well, those who don't make me frustrated.

January 22, 2016: Short week, busy week. No huge difference between the two groups. Too early to call it a trend, but beginning to think that there isn't much of a difference at all.

January 29, 2016: I don't see a difference. Maybe I've been too careful to make sure the activities are identical!

February 5, 2016: No difference. I still like Nearpod better because it makes my world a little easier, but it doesn't seem to make a difference with student comprehension.

February 11, 2016: No difference.

February 19, 2016: No difference.

February 26, 2016: I think the kids who get more practice drawing in Nearpod are doing better with some of the molecular genetics things – matching base pairs, figuring out codons and amino acids, etc.

March 4, 2016: Thinking there may have been a difference in the protein synthesis activity. Nearpod kids did a little better than PowerPoint kids.

March 11, 2016: Big activity this week was a review. Not really seeing much difference in that. Then again, we've had some other activities that have helped review.