

EFFECTS OF USING NEARPOD IN A HIGH SCHOOL BIOLOGY CLASSROOM

by

Cynthia Wojtaszek

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 2017

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ABSTRACT

The purpose of this study was to investigate how effective mobile presentation applications are for increasing student engagement and achievement in a high school biology course. In the spring of 2017, the Nearpod application was incorporated and used to present lectures in a section of 11th grade biology class that was one-to-one with iPads. Embedded in each Nearpod presentation were multiple choice and free response questions that periodically checked for student understanding. Students answered these questions directly on their devices before proceeding to the next part of the lecture. Scores on chapter tests were compared to the previous year's class, which did not have iPad technology. It was found that the use of Nearpod did not have any significant impact on student test scores or levels of engagement in class.

INTRODUCTION AND BACKGROUND

Nazareth Academy is a Catholic, co-educational, college preparatory high school located in La Grange Park, Illinois. This western suburb of Chicago is home to generally well-established families, but our students come from all over the Chicagoland area. The school has seen a pretty substantial increase in diversity in recent years, and we focus on fostering a sense of family among all. The school has approximately 800 students and I average about 24 students per class period (Nazareth Academy, 2016). This year I taught one section of 11th grade biology and four sections of 9th grade conceptual physics. This project specifically focused on my biology class, which consisted of 22 students in total. Thirteen of the students were female and nine were male.

Like most private schools, Nazareth is not equipped to offer any special education programs and thus does not tend to accept students with extreme learning needs. With that said, however, some students do struggle academically. Because they are coming in from many different junior high schools, their levels of background knowledge and skill sets are incredibly varied. Also, like any other school, not all students are equally motivated.

A few years ago, Nazareth began a one-to-one technology initiative. Starting with the 2014-2015 school year, all incoming freshmen are required to come to school equipped with an iPad on a daily basis. Students in all four grade levels will be officially one-to-one by the 2017-2018 school year. Teachers are encouraged to integrate this technology into daily classroom life as much as possible.

Because this was the first year that all the classes I teach have iPads, I decided to focus my research on how to most effectively put them to use. Generally stated, the purpose of this study is to investigate how effective interactive mobile presentation applications are for increasing student engagement and achievement in a high school biology course. More specifically, I investigated the following:

1. Do students perform better academically when content is delivered with the use of personal devices?
2. Do interactive presentation applications increase student engagement in biology?
3. Do interactive presentation applications increase students' personal sense of achievement in class?

CONCEPTUAL FRAMEWORK

It has only been a few decades since the first personal computer was introduced to the world. Yet, in this short time span, technology has advanced globally and drastically, and has also become an integral part of the everyday lives of modern youth. Inevitably, this technology has also impacted education. The United States Department of Education reported that by 2009, some 97 percent of public school teachers had one or more computers located in their classrooms every day and 40 percent maintained that they or their students used computers during instructional time often (Gray, Thomas, & Lewis, 2010).

An especially recent trend in schools is the one-to-one classroom, in which all students have individual access to some type of device within their educational settings –

one device for every one student. It has been argued that a new generation of learners is entering our schools and the nature of education itself must fundamentally change to accommodate the skills and interests of these ‘digital natives.’ These learners have grown up surrounded by information and communication technology, and thus learn differently than past generations of students (Prensky, 2001). Not only must educators now embrace technology in every aspect of their teaching, but they must also find ways to keep students engaged and interested through the use of blended learning techniques (Malin & Perini, 2013).

Tablets, specifically iPads, have become especially popular in today’s classrooms and are a common choice for inclusive school environments with diverse student needs. These devices are flourishing with educational applications and built-in accessibility features (Maich & Hall 2016). Not only can the iPad help in classroom instruction, it can also reduce teacher workload by allowing student responses and assignments to be collected automatically (Dhir, Gahwaji, & Nyman, 2013). However, due to the scarcity of pedagogy-wide and long-term research works, solid evidence that definitively confirms the iPad has a positive academic effect on learning outcomes is not available (Dhir, Gahwaji, & Nyman, 2013). Further, research-based evidence for classroom use of tablets is just now emerging, and many teachers struggle with integration (Maich & Hall 2016).

An ongoing point of focus is trying to determine how the delivery and understanding of course content can be affected by technology. While a major concern is the distraction that devices and internet can enable, multiple research studies suggest that

even when laptops are used strictly to take notes, learning may still be impaired because the use of devices results in shallower processing. Thus, although there are a number of ways that devices could be used for note-taking and this may be common practice in classrooms, many researchers have suggested that laptop note-taking is less effective than longhand note-taking for learning (Mueller & Oppenheimer, 2014). Consequently, the question remains how devices could be put to better use during instructional time.

A main part of instructors' frustration surrounding technology in the education system thus far may be due to the fact that many assume youths are inherently drawn to digital technology and that it is intrinsically engaging. This, however, may not necessarily be the case. In order to truly motivate students, it is important to consider how digital technologies promote membership in participatory culture. More nuanced approaches to their use are key (Jacobs, 2012). There is a need to develop guidelines for preparing new curricula and pedagogical strategies for successfully integrating iPads into educational settings. This includes identifying and understanding what young learners expect from the iPad as a technological tool, then reviewing and customizing instruction in order to use the right applications, the right design of activities, and the most effective ways of providing the learning experiences and educational outcomes (Dhir, Gahwaji, & Nyman, 2013).

When it comes to content delivery, it is imperative for teachers to continually update their skill sets to incorporate the new technologies that are available for enhancing student engagement (Malin & Perini, 2013). Fortunately, many different websites and applications exist to provide quick and easy content production and delivery to students.

One popular interactive mobile presentation application is Nearpod. This global application, launched in 2012, allows educators to create lessons and provide guided presentations to students directly on the screens of their personal devices. Lessons are produced by uploading slides, and then inserting interactive features such as polls, quizzes, live Web sites, images, video, or audio content. When the instructor is ready to launch a lesson, students join the presentation using a unique PIN and are then unable to exit the presentation without the instructor's knowledge (Moore, 2016).

The customization features are said to be the main advantage when using Nearpod for lesson creation. Further, the ability to poll or quiz students mid-lesson helps instructors gauge understanding of the materials and maintain interest. Another valuable feature is the instructor's ability to access reports that provide detail on individual student responses as well as analyze group performance. Though initially developed for elementary and secondary schools, since the application's launch, Nearpod has proved to be popular in higher education as well. Schools identified as using Nearpod include Stanford, Harvard, and Brighton Universities (Moore, 2016).

METHODOLOGY

In order to examine the effects of interactive mobile presentation applications on student engagement and achievement, 22 students in a high school biology course were surveyed during the spring of 2017. This course was an 11th grade college preparatory biology class. These students were compared to a class of 20 students in the same course from the spring of 2016, when technology was not present in the classroom, thus serving as the non-treatment group. The research methodology for this project received an

exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained (Appendix A).

To obtain baseline information on student opinions of and attitudes toward the use of iPads in education prior to implementing the technology into my classroom, the Student Technology Questionnaire was administered (Appendix B). This questionnaire contained a variety of Likert-style and open-ended questions. It asked students how frequently they have used their iPads for learning in other classes at our school, and in what ways the iPads have been put to use for educational purposes by their other teachers. Students indicated how much they felt the iPads help their engagement and understanding of course material when used. They also indicated if they had ever used Nearpod in another class before, and what they thought of it if they had. This data was analyzed for common trends in responses.

The treatment began in the spring of 2017 when the Nearpod application was used to present lectures during biology. Students logged in to the live sessions by inputting a unique PIN and were then guided through slides, which appeared on their individual iPad screens. Lectures were teacher-paced, and students wrote notes in their notebooks as I led them through discussions of what was being presented. Embedded into each lecture were occasional multiple choice, true/false, and open-ended questions. These formative assessments provided me with immediate feedback on how well students understood the material being presented. In order to make sure all students were participating, I did not move on in lecture until all had answered the questions, and then the answers were discussed. I downloaded session summary reports from Nearpod at the end of each

lecture and I recorded informal observations on how actively involved students appeared throughout.

To tell if the use of Nearpod had an effect on students' understanding of the course material, the same chapter tests were administered to the students in my 2017 class as were administered in my 2016 class. The differences in the test scores between the two years were examined using the Randomization Permutation test.

To determine if the use of Nearpod had an effect on student engagement and personal sense of achievement, the Student Attitudes towards Biology Survey was administered before and after treatment (Appendix C). This Likert survey first asked students to indicate how important it is for them to do well in biology and if they are achieving their desired grade. It then asked them to indicate the amount of effort they feel they are putting in as well as how engaged they feel. Finally, it questioned them on their levels of comfort participating in class and taking tests. The Student Attitudes towards Biology Survey was scored using a Likert scale of *strongly agree* (5), *agree* (4), *neutral* (3), *disagree* (2), and *strongly disagree* (1). Pre-treatment and post-treatment responses were compared and analyzed using the Wilcoxon Signed Rank test.

In addition to the quantitative data collected in the surveys, qualitative data was collected during post-treatment interviews. These were conducted with a random sample of students, who were interviewed using the Post-Treatment Interview Questions (Appendix D). Students were asked how they liked the use of the Nearpod application in biology and how effective they thought it was at helping them learn and stay engaged. This data was analyzed for common themes (Table 1).

Table 1
Data Triangulation Matrix

Focus Questions	Data Source 1	Data Source 2	Data Source 3
<i>Do interactive presentation apps increase students' understanding of biology?</i>	Nearpod formative assessment questions & session reports	Chapter test scores	Post-Treatment Interviews
<i>Do interactive presentation apps increase student engagement in biology?</i>	Student Attitudes Towards Biology Survey	Post-Treatment Interviews	Teacher Observations
<i>Do interactive presentation apps help increase students' personal sense of achievement in class?</i>	Student Attitudes Towards Biology Survey	Post-Treatment Interviews	Student Technology Questionnaire

DATA AND ANALYSIS

On the Student Technology Questionnaire that was administered prior to treatment, 86% of students said they use their iPads in school for educational purposes either *every day* or *almost every day*, while the remaining 14% said they used their iPads *sometimes* ($N=22$). In total, the students listed 15 different ways their iPads are used regularly. Included in the list was the use of electronic textbooks, Google Classroom as a learning management system, various other Google applications, Quizlet, Notability, and Kahoot. However, when asked how often they have used their iPads for instructional

purposes specifically in science classes throughout the past three years, the majority of students said they were used only semi-frequently or not frequently (Figure 1).

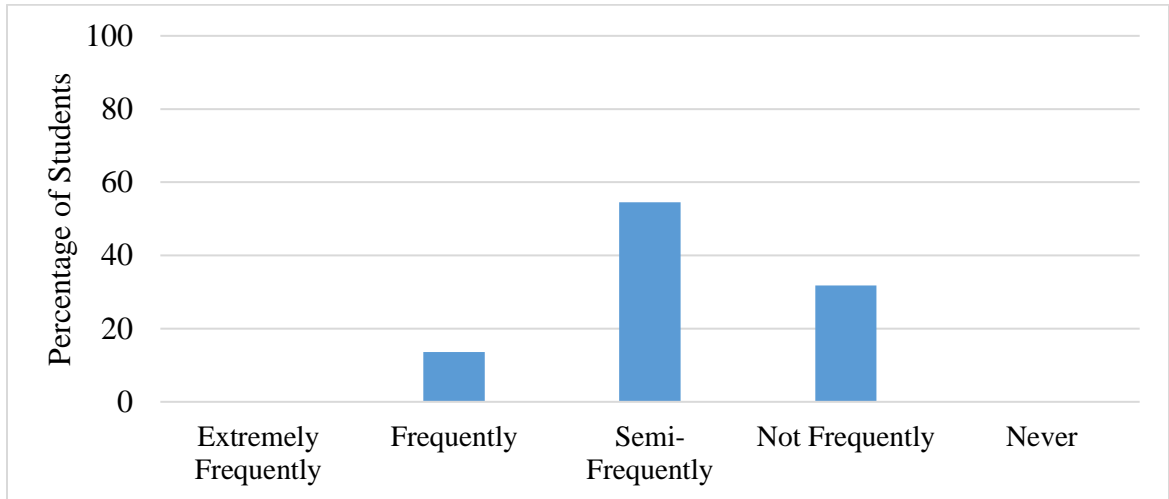


Figure 1. Student responses from the pre-treatment questionnaire regarding how often they have used iPads for educational purposes in science classes throughout high school, ($N=22$).

When specifically asked if they had ever used Nearpod in another class, every student responded yes. They indicated its use in other subjects such as history, English, and religion, but no one said they had ever used it before in a science course. More than half of the students responded positively about the use of Nearpod in other classes and said they had enjoyed it.

When asked if they agreed with a statement about iPad use during classroom lessons helping them to feel more engaged in class, most students either *agreed* or indicated that they felt neutral prior to treatment. Similarly, when asked if they agreed with the statement that using the iPad during class helps them to learn better, most students *agreed* or *neither agreed nor disagreed* (Figure 2).

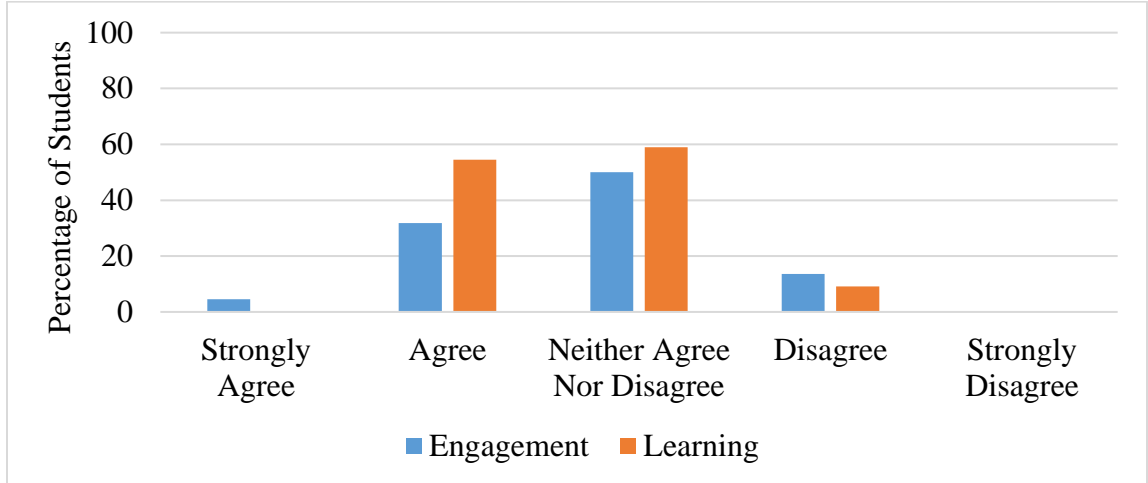


Figure 2. Student responses from the pre-treatment questionnaire statements asserting that iPads help them feel more engaged in their classes and help them learn better, ($N=22$).

In the Student Attitudes toward Biology Survey, 9% of students *disagreed* that they felt engaged during biology class prior to starting treatment, but after treatment, 0% *disagreed* (Figure 3). The Wilcoxon Signed Rank Test was used to analyze the difference in paired pre-treatment and post-treatment Likert data from this survey. The calculated p -value for this question was greater than 0.2, which indicates no statistical difference between pre-treatment and post-treatment responses.

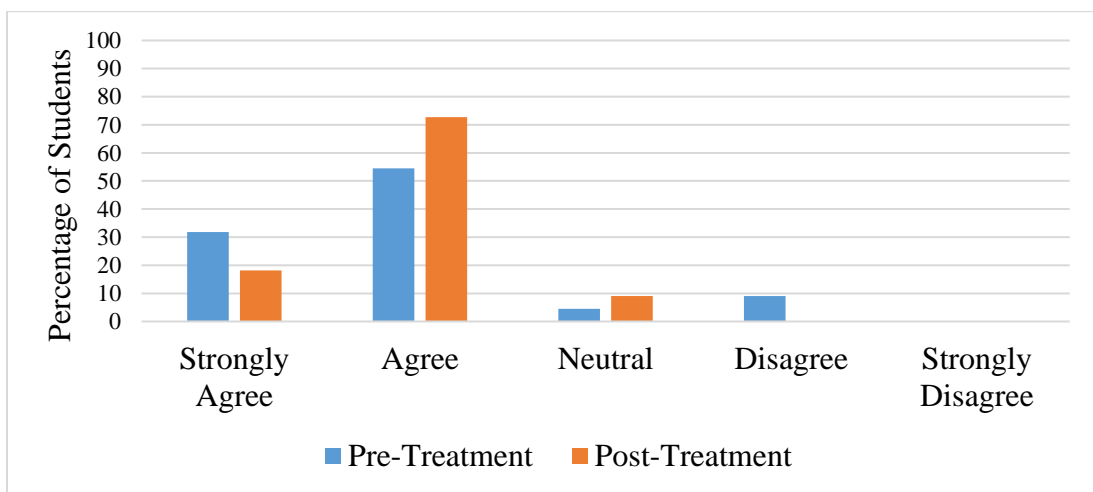


Figure 3. Student responses regarding feelings of engagement in biology class, ($N=22$).

In post-treatment interviews, every student responded *yes* to both of the questions that asked if they enjoyed using Nearpod in biology and if they thought using Nearpod during biology helped them to stay engaged. One boy commented, “It was an easy way to take notes and the questions helped me make sure I was focusing.” A girl responded, “It was good, and easier to take notes from than having to keep looking up at the board. It also made class more interactive.”

When asked what they thought about the use of Nearpod in biology class, one boy said, “I liked it better than taking notes from the projector. It kept us more engaged.” Another boy said, “I liked it because I am on Nearpod on my iPad, so I am not tempted to do something else on my iPad.” However, as I monitored each Nearpod session, I noticed several students not in the presentation screen at any given point in time throughout a lesson. An interviewed girl mirrored this in her response, “I don't mind it but I think it distracts certain people.”

Though multiple students mentioned in the post-treatment interviews that they liked the questions embedded into each Nearpod lesson, there was no statistical difference in students' levels of comfort in answering questions in biology before and after treatment (Figure 4). The calculated *p*-value for this question came out to $p > 0.2$, as did the question about comfort in asking questions during biology class.

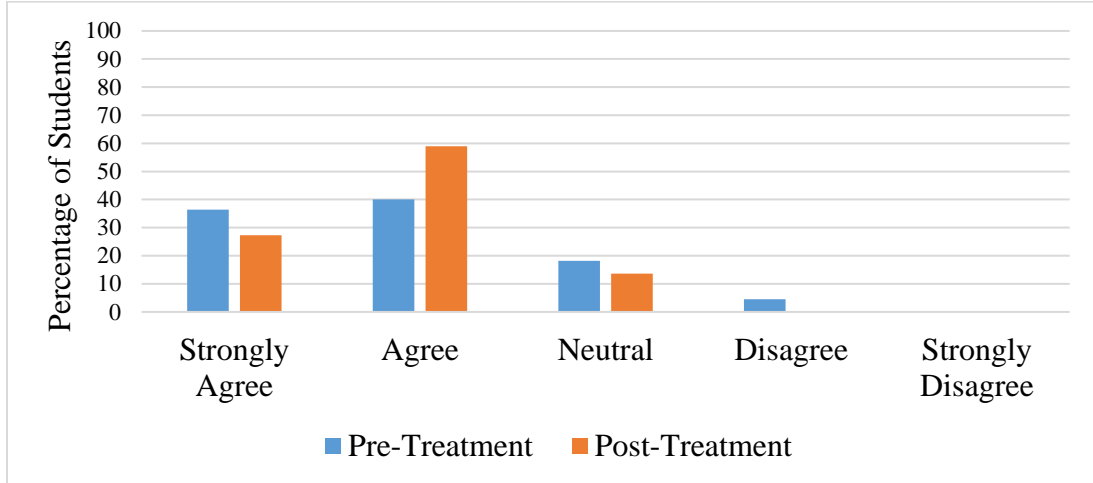


Figure 4. Student responses regarding levels of comfort answering questions in biology class, ($N=22$).

Prior to treatment, only 59% of students agreed or strongly agreed that they felt prepared to do well on biology tests, while 91% of students agreed or strongly agreed after the treatment period (Figure 5). For this question, however, the Wilcoxon Signed rank test yielded results of $0.10 < p < 0.20$. This result, again, is not statistically significant.

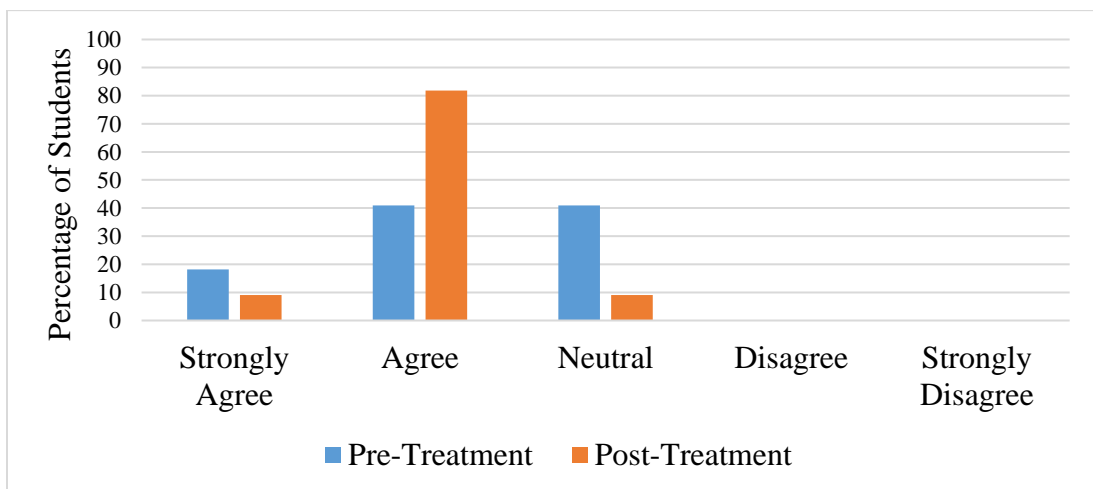


Figure 5. Student responses regarding feelings of preparation for biology tests, ($N=22$).

When asked after treatment if they thought using Nearpod during biology helped them to better understand the content, almost all interviewed students said yes. Compared

to last year's class, this treatment class did usually have higher mean and median scores on summative chapter tests administered throughout the treatment period (Table 2). However, when the test scores of all students in both classes were analyzed using the Randomization Permutation test, the p -values for each one were extremely high, indicating no statistical difference between the scores.

Table 2
Comparison of Test Scores between Treatment and Non-Treatment Group (N=22)

Test	Mean (%)		Median (%)		p -value
	2016	2017	2016	2017	
Chapter 13	78.6	80	77.5	80	0.74
Chapter 16	83.45	83.09	84	83	0.92
Chapter 19	79.9	82.04	80	88	0.33
Chapter 18	86.95	90.41	87.5	93.5	0.23

Further, though 86% of students *strongly agreed* and the other 14% *agreed* that it is important for them to do well in biology class in both instances that the Student Attitudes toward Biology survey was administered, only 36% indicated agreement that they were achieving the grade they want prior to treatment. After treatment, this number dropped further to 32%, despite the fact that most students claimed they were working to the best of their ability.

INTERPRETATION AND CONCLUSION

Although almost all students in the treatment class reported that the use of Nearpod helped them to better understand biology content and there was an increase in the mean and median scores on the tests taken during the treatment period, this increase was more likely due to chance than the use of Nearpod. When test scores from the 2015-

2016 and 2016-2017 biology classes were compared, this year's class usually had slightly higher mean and median scores, even on tests administered before the treatment period when neither class utilized iPad technology for learning. This leads me to believe that this year's class simply had a somewhat stronger group of students in it. Thus, I would conclude that students do not perform better academically when content is delivered with the use of personal devices.

Just as interactive presentation applications do not significantly increase students' understanding of biology, I also found through the data collected that they do not significantly increase student engagement. Though the vast majority of students said that Nearpod did help them to stay engaged after treatment, many of them already claimed to be sufficiently engaged prior to the use of Nearpod, which made any difference difficult to recognize. I do, however, question the complete honesty of some of these survey responses, especially since the surveys were not anonymous.

Since Nearpod allows the instructor to see who is actively logged in to a presentation at any given moment, I monitored this during each Nearpod session I conducted. I noticed that several students logged out quite frequently. This meant they were switching back and forth between applications or browser windows and were clearly distracted by other things on their devices, which was disappointing to see.

However, even though statistical analysis also revealed no significant difference in student feelings of preparedness to take biology tests, I felt like I did observe a difference in this aspect. I think this was largely due to the question feature of Nearpod. Students were formatively assessed throughout each lesson and were constantly provided

with individual, instant feedback. This was my favorite part of the application, and students also made multiple similar comments in post-treatment interviews. Both they and I were able to gauge their level of understanding during each lesson, and because I was able to collect this data so quickly, it was a lot easier for me to clear up misconceptions on the spot or go back over obvious points of confusion. Overall, though, it does not seem that interactive presentation applications significantly increased students' personal sense of achievement in class. By the end of the treatment period, most students still did not feel like they were achieving the grade they wanted in biology class.

VALUE

I was delighted by the great number of positive comments made at the end of the study about the use of Nearpod in my biology class. However, all this positive feedback honestly came as a bit of a surprise to me, because at the start of the treatment period I did not always personally enjoy the use of the mobile presentation application. I was looking to make my biology class more interactive and promote more dynamic and meaningful participation. I wanted to see if incorporating the student devices into lecture sessions might help do so.

However, I felt that Nearpod made the lack of verbal discussion participation worse. Students did input answers to questions when they came up on the screen, but being able to do that made them seemingly less willing to participate aloud when I wanted to further discuss the content. Students may have been engaged with the lecture, but the silence in the room was slightly awkward at times. Also, some students chose to screenshot the slides rather than actually take all of the notes by hand like they were

supposed to. There were instances that I was okay with this, particularly when there were images on the slide that they may have wanted to keep to see again, but I feared that this practice might result in shallower processing of the material. It also gave them more opportunity to become distracted during the lecture session. I am not sure how this practice actually affected the learning of the students who chose to utilize it.

What I really appreciated about the use of Nearpod, however, was that it was an excellent formative assessment tool. It was quick and easy to use, and it also promoted whole-class participation. With the traditional system of verbal questioning and hand-raising, only a few students usually answer questions in class, but with Nearpod, I was able to gauge the attention and comprehension of every student in the room since they were all required to answer the questions embedded into each presentation.

Next school year, I am interested in also trying something different and using Nearpod in my physics classes in a flipped classroom format. This could be done by assigning self-paced student lessons for homework. I feel that some of the features of the application that I was unable to use during class would work nicely at home, such as the ability to embed videos into the presentation. Nearpod could also work well for distance learning situations or with absent students. For example, if students were proactive about keeping up with material on days they were not present in class, they could log on to the Nearpod sessions from home, and this could keep them from falling too far behind.

As a teacher, this entire process based on the action research model has impacted me greatly. I am now constantly considering what could be made better in my classes. I am always thinking about what new instructional strategies I could try in order to help

my students stay engaged and achieve to the best of their abilities. I am also still continuously looking into better ways to utilize the iPad technology for educational use. I don't think there is any single answer or any one application that is going to accomplish everything on its own. I believe the key to keeping students engaged is utilizing a variety of instructional strategies so coming to class each day is a unique experience and the routine is not always the same. Moving forward, I would like to continue the use of Nearpod in biology, but probably not as frequently. I would limit my use of this and other related applications to only lessons that seem to be best suited for them, and I do not think all lessons necessarily are.

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APPENDICES

APPENDIX A
IRB EXEMPTION



INSTITUTIONAL REVIEW BOARD
For the Protection of Human Subjects
FWA 00000165

960 Technology Blvd. Room 127
 c/o Microbiology & Immunology
 Montana State University
 Bozeman, MT 59718
 Telephone: 406-994-6783
 FAX: 406-994-4303
 E-mail: cherylj@montana.edu

Chair: Mark Quinn
 406-994-4707
 mquinn@montana.edu
Administrator:
 Cheryl Johnson
 406-994-4706
 cherylj@montana.edu

MEMORANDUM

TO: Cynthia Wojtaszek and John Graves
FROM: Mark Quinn *Mark Quinn CJ*
DATE: November 18, 2016
SUBJECT: "Effects of Using Nearpod in a High School Biology Classroom" [CW111816-EX]

The above research, described in your submission of November 18, 2016, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

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

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

APPENDIX B
STUDENT TECHNOLOGY QUESTIONNAIRE

Please know that participation in this study is voluntary and will not affect your grade.

1. How often do you use your iPad for educational purposes in your classes at this school?
 - a. Every day / all the time
 - b. Most days / most of the time
 - c. Some days / sometimes
 - d. Rarely ever
 - e. Never

2. Throughout your years in science at this school, how frequently have iPads been incorporated into the classroom lessons for educational purposes?
 - a. Extremely frequently
 - b. Frequently
 - c. Semi-frequently
 - d. Not frequently
 - e. Never

3. How strongly do you agree with this statement? “When I am able to use my iPad during classroom lessons, I feel more engaged in the class.”
 - a. Strongly agree
 - b. Agree
 - c. Neither agree nor disagree
 - d. Disagree
 - e. Strongly Disagree

4. How strongly do you agree with this statement?
“Using my iPad during class helps me learn better.”
 - a. Strongly agree
 - b. Agree
 - c. Neither agree nor disagree
 - d. Disagree
 - e. Strongly Disagree

5. What are some ways you regularly use your iPad for class purposes?

6. Think of all of the classes you have taken here and all the ways you have used your iPad for educational purposes. What have been some of your favorite ways to use your iPad for learning?

7. Have you ever used the app *Nearpod* in any of your classes? If so, please state which class(es) and how you liked using the app.

8. How many of your teachers allow you to type notes on your iPad in lieu of writing notes by hand in a notebook?

9. Do you prefer to write notes by hand or type them out? Please explain why.

APPENDIX C

STUDENT ATTITUDES TOWARDS BIOLOGY SURVEY

Please know that participation in this study is voluntary and will not affect your grade in this class.

Directions: Indicate how strongly you agree with each of the following statements.

1. It is important to me that I do well in biology class.
Strongly Agree Agree Neutral Disagree Strongly Disagree
2. I am achieving the grade I want in biology class.
Strongly Agree Agree Neutral Disagree Strongly Disagree
3. I am working to the best of my ability in biology class.
Strongly Agree Agree Neutral Disagree Strongly Disagree
4. I feel engaged during biology class.
Strongly Agree Agree Neutral Disagree Strongly Disagree
5. I feel comfortable asking questions in biology class.
Strongly Agree Agree Neutral Disagree Strongly Disagree
6. I feel comfortable answering questions in biology class.
Strongly Agree Agree Neutral Disagree Strongly Disagree
7. I feel prepared to do well on biology tests.
Strongly Agree Agree Neutral Disagree Strongly Disagree

APPENDIX D
POST-TREATMENT INTERVIEW QUESTIONS

Verbal statement: Participation in this study is voluntary and will not affect your standing in this course in any way.

1. What did you think about the use of Nearpod in biology class?
2. Did you enjoy using Nearpod in biology?
3. Do you think using Nearpod during biology helped you to stay engaged?
4. Do you think using Nearpod during biology helped you to better understand the content?
5. What could be improved about the use of Nearpod in biology?
6. Is there anything else you would like me to know?