

THE EFFECTS OF USING THE IPAD TO ZAP ZEROS AND INCREASE  
STUDENT COMPREHENSION OF SCIENCE

by

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## ABSTRACT

This study implemented the use of the iPad in a middle school science classroom to give students digital options for the completion of assignments to lower the frequency of zeros. In Addition, student comprehension of science concepts was measured. The results suggested that the use of the iPad successfully reduced the frequency of zeros and increased science literacy in the 7<sup>th</sup> grade science classroom setting.

## INTRODUCTION AND BACKGROUND

As technology advances, educators must be willing to advance with the times or be left behind. In an attempt to advance with the times, Woodward Public Schools, Woodward, Oklahoma, adopted a one-to-one iPad initiative to put an iPad in the hands of every student. From the moment this technology hit the hands of our students, I began to investigate how these tools could be used to improve the quality of education in my science classroom.

One aspect that seemed to be holding our students back from achieving science competency was the acceptance of zeros for classroom activities and assignments. Students who do not attempt to complete assignments are robbing themselves of the opportunities to practice the skills that are being covered through classroom labs, activities, and assignments. These observations led me to questions such as, Could the negative aspect of students taking too many zeros in my classroom be influenced by the inclusion of the iPad for assignment completion? Would my students be more willing to complete daily classroom assignments if I could implement creative applications to showcase the students' mastery of scientific skills and concepts? In addition, would the comprehension of science skills and concepts be enhanced by the inclusion of lessons and resources available with the iPad into my science curriculum? These questions drove the development of this project and the units of study inclusive in this action research.

This action research-based classroom project was administered to my seventh grade, first hour, science classes at Woodward Middle School South, Woodward, Oklahoma. This school district is located in a rapidly growing city in the panhandle of Oklahoma with an ever-changing population. Traditionally, this town was composed

primarily of families employed in the agricultural business. However, with repeated oil booms throughout our history, we have seen a huge increase in migrant families employed in the energy business consisting of oilfield workers, pipe line contractors, and wind energy consultants (K. Reynolds, personal communication, Aug, 25, 2014). In the past three years alone, our site has gained over 70 students, raising our average daily attendance to 623 students per day (Pearson, 2015). The seventh grade for the 2015-2016 school year was composed of 201 students comprised of 53% males and 47% females. The class had a diverse ethnic population including 75% Caucasian, 18% Hispanic, 5% American Indian, 1% Asian, and 1% Black. Upon further analysis of the student population, we have 39% who received assistance through an IEP and 20% who received ELL services. Woodward Public Schools was classified as a Title I school in Oklahoma based on the number of students who receive free and reduced lunches. Evidence of this classification was the percentage of students considered economically disadvantaged. Of the 2015-2016 seventh grade class, 55% fall into the economically disadvantaged category including 7% that are homeless. According to the 2015 sixth grade Oklahoma Core Curriculum Test; 33% of the class scored advanced, 40% scored proficient, 22% scored limited knowledge, and 5% unsatisfactory. This indicated that 27% of these students are not performing at the expected levels (Aurora 2015).

The demographics of this city and school district revealed that multiple learning disabilities multiplied by the intense number of economically disadvantaged students lead to an overreaching problem defined by a lack of motivation. Unmotivated students are more likely to not complete their assignments and accept zeros for their grades. This research was dedicated to student motivation in order to engage these students in the



learning process with the use of the iPad and its assignment completion and lesson presentation applications. The hope was that an engaged learner will be on task and excited to complete their assignments. These observations and hopes lead to the creation of my primary focus question that guided my action research project, *Does the use of the iPad for assignment completion reduce the frequency of zeros accepted by students?* In addition, the following subquestion was addressed, *Does the use of the iPad for instruction and completion of assignments increase student comprehension of science skills and concepts?*

### CONCEPTUAL FRAMEWORK

A growing trend seen by teachers across the curriculum is that our students are accepting more and more zeros for their assignments. Paur (2012) explained the acceptance of zeros by students and parents is troubling many educators who are actively teaching in the classroom. Since this trend is on the rise, educators need to look closely at our treatment of zeros and why our students are not completing their assignments (McMillian, 1999).

Paur (2012), in her graduate level research project for the University of Minnesota State, asked educators to think about zeros and evaluate if they are truly an indicator of knowledge or a lack of effort. In reality, teachers more often use zeros as an indicator for a lack of effort and motivation instead of a reflection of how much of the content they understand. Teachers have typically used zeros for assignments for decades as a motivating factor to get students to complete their work. In addition Paur (2012) continued by asking should a student be expected to try hard if they feel it is impossible to improve their grade? The question remains, how do zeros affect the students?

confidence and motivation? Paur (2012) in her research also stated the use of zeros affects the motivational value of the learner in a negative way. Students with zeros have a sense that it is futile to try when a grade gets too low. In fact, students who received frequent zeros feel they are not able to recover and therefore exhibit less effort because of a feeling of helplessness. Paur (2012) suggested educators must find an avenue to get students actively engaged in a meaningful learning environment to negate the effect of students' acceptance of zeros for their assignments (McMillian, 1999).

A meaningful method of engaging teens may be in the area of technology for instruction and assignment completion. Teens are on the forefront of the always-on mobile access to the Internet. According to a recent survey, 95% of teens have constant access to the Internet. Teens have more ways than ever to stay connected throughout the day and night. An extended look shows that three in every four teens access the Internet using personal cell phones, tablets, or portable devices (Madden, 2013). This new generation of learners can be called digital natives. A digital native is defined by their continuous use of technology such as using computers, watching videos, playing video games, playing digital music, using cell phones, and the use of digital toys (Aronin, 2011). This use and availability of digital technology has quite possibly changed the way that the current generation processes information in their brains and alters the way they learn. This digital technology can be used in the classroom to capture and hold the interest of our students. Students are much more motivated to do assignments when offered choices for completion using technology. According to a poll conducted by the National Science Teachers association, one educator responded. "I like to use technology when I feel I can bring something new, especially when students can be creating with

technology instead of just consuming,” (National Science Teachers Association, 2016, p. 8). Teachers must meet the needs and levels of interest of this current generation in order to engage and motivate students for learning to occur. If teachers can capture and hold students’ interest in a subject matter using technology, then student motivation and achievement are sure to follow (Boles, 2013; Murphy, 2013; Prensky, 2001).

Even though cell phones and tablets are currently a vital part of our daily routines, initially schools did not allow this technology to be present in the classroom. Cell phones and tablets were seen as a distraction to the learning process and in no way could be used to benefit the teacher or the student. Currently, 85% of all schools utilize technology with a “Bring Your Own Device” (BYOD) policy that allows students to bring and use their devices in the classroom (Heilbronner, 2014). Educators are beginning to see the benefit of digital technology in the classroom as schools begin to harness this new generation of learners. Because so much time is spent with access to the internet, be it on a portable device or a video game, it is imperative that educators create opportunities using digital platforms and social networking within the learning environment (Boles, 2011). To capture and retain the attention of our students, educators must evolve with the changing technology and learn to harness its benefits (Heilbronner, 2014).

The use of technology is opening many options for learning, most of which are not traditional methods used in classrooms or in current pedagogy. Teachers of this generation may find it necessary to utilize the benefit of digital platforms for educating the learners of today (Aronin, 2011). One such digital platform that seems to be gaining momentum within school districts is the tablet such as the iPad. Teachers could use portable devices such as the iPad in the classroom to inspire and engage students.

Technologically advanced districts are rapidly turning to an initiative to put an iPad in the hands of each student in the classroom (Boles, 2011). Technology is changing quickly and science education can be on the cutting edge of the use of this technology with the implementation of applications (Heilbronner, 2014).

The iPad offers many applications that can be utilized by the teacher or learner to enhance instruction and current classroom pedagogy (Boles, 2013). To use technology to its fullest benefit, teachers must be technology explorers and players (Bergen, 2012). However, the use of applications needs to be carefully examined and adequate planning put into the integration process. So often teachers chose an application out of excitement to showcase a new educational tool. However, they later realize that the application used for the assignment really did not have a good fit with the concept being presented. Teachers should not start with these new technologies or applications in mind when planning a particular unit of study. Instead they must start with specific learning goals and work backwards to the appropriate application that would support the concepts being covered. Teachers should start with the main objectives, decide how students can best learn the concepts, and then select digital applications that will enhance and support the concepts at hand. The decision for the most appropriate applications to use for assignments should come at the end of planning a unit, not simply because it is cool or interesting, but because it offers a unique experience for the learner to enhance the learning under way. The best lessons are those that use technology to further content knowledge while effectively managing the curriculum and the classroom (Murphy, 2013).

Digital natives require a media-rich learning environment to hold their attention (Prensky, 2001). In today's world of teaching to a digital native generation, it is imperative that teachers evolve to the use of portable devices, iPads, and the use of applications in the classroom. Whereas in traditional education a teacher would assign paper and pencil worksheets, vocabulary terms, and section reviews, educators can now use non-traditional digital platforms for completion of assignments and evidence to show mastery (Aronin, 2011). One educator responding to a NSTA poll states that colleagues and students alike prefer paper to see the overall picture and then use electronic resources to complete the assignment or activity (National Science Teachers Association, 2016). Educators should be on the cutting edge with students in the use of new digital tools and applications for the classroom. From the enhancement of curriculum with videos and animations, to the manipulation of data, to the delivery of professional looking worksheets to students, the iPad can simplify and enhance the science classroom (Lucking, 2012). NSTA (2016) reports that of the teachers utilizing electronic resources 91% use videos, 76% use lab simulations, 55% use electronic books, and 45% use games to enhance classroom learning. Teachers, especially science teachers, can harness the dynamic nature of the applications and electronic resources associated with the iPad and digital learning. Once students grasp the benefit of using applications for assignments, they can make global connections and show their true understanding of the concepts they are tackling (Murphy, 2013). When students are engaging with science topics using digital applications, they are able to make long-lasting connections to the concepts under study. Applications can and will revolutionize the types of assignments that students can use as a part of the evolving classroom (Boles, 2011; Johnson, 2014).

Many applications that can be used to replace traditional assignments are already in place, and several of these applications are completely free to the teacher and the learner. Vocabulary assignments can be completed using flashcard applications such as Quizlet and word clouds. Various other applications are currently available for students to use such as character voice overs, Power Point games, blogs, comic and graphic novels, interactive time lines, and many more to show student understanding and mastery of concepts. Johnson boasts of the learning management systems that will revolutionize the classroom routine for the teacher as well as the student. Examples of these learning systems are Edmodo, Google Classroom, and Schoology. The new digital world offers an extensive list of applications for the creative teacher and learner to explore (Aronin, 2011; Johnson, 2014).

From the mimeograph, to the adding machine, to the typewriter, each generation has its own version of technology (Boles, 2011). Today's digital natives are defining what technology looks like in this century. Educators must accept this new technology and harness the benefits that digital platforms such as the iPad and the myriad of applications that are free to the public can offer for our students and our classrooms. Student motivation comes from being engaged in the learning process. An engaged learner will be on task and excited to complete their assignments (Paur, 2012). Students may be actively engaged in a meaningful learning environment to negate the effect of students accepting a zero for their assignments with the use of technology (Johnson, 2014).

## METHODOLOGY

Data was collected and analyzed to determine if the treatment of the iPad was successful in reducing the frequency of zeros and increasing science literacy in the seventh grade science classroom setting ( $N=24$ ). The treatment consisted of the implementation of the Apple iPad into the science curriculum as an alternative to traditional methods, such as paper assignments, of instruction and assignments. The iPad was used for instruction and assignment completion using a variety of general applications throughout the course (Table 1). These general applications were used throughout all units of study for the treatment year. The research methodology for this project received an exemption regarding informed consent by the administration at Woodward Middle School (Appendix A). In addition, this project also received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained (Appendix B).

Table 1  
*General Applications Used During The Treatment Of The iPad For Science Instruction*

iPad Application	Classroom Usage
Edmodo	Used as a learning management system. This serves as a common classroom tool for dissemination of notes, digital discussions, formative assessments, polls, surveys, links, videos, presentations, assignments, announcements, quizzes, and summative tests.
Teacher Webpage	Serves as a common place for students to access login codes, course syllabus, lesson plans, classroom links, calendars, teacher contact information, and email links for turning in assignments.
Notes	Used for short assignments, test corrections, one-sentence summaries, and muddiest point comments.
Pages	Used for longer assignments and document sharing.
Doodle Buddy	Used for completion of documents shared in .pdf format and digital note taking.
www.quia.com	Used as a secondary learning management system.

iBooks	Used for sharing and storing document in the .pdf format containing classroom concept curriculum.
www.connected.mcgraw-hill.com	Used for our digital textbook.
Quizlet	Used for completion of vocabulary terms, definitions, and as a study aide.
YouTube	Used for sharing classroom content curriculum videos.
Prezi	Used for virtual posters and presentations for assignment completion.
Keynote	Used for presentations and assignment completion.
Penultimate	Used as a digital notebook for classroom notes.
Google Classroom	Used as a common place for students to turn in assignments and posting of instructional materials to be used during classroom activities.
Evernote	Used as a common place for students to turn in assignments.
Kahoot.it	Used for classroom review featuring a game format where each student plays independently
Numbers	Used for data collection and analysis.
Scannable	Used for scanning of documents for distribution as well as scanning and digitally filing student work.
You Doodle	Used for adding drawings over maps and other printable type sheets.
Comic Maker HD	Used for assignment completion when students were making a comic or story
www.zimmertwins.com	Used for assignment completion when students were making an animated video of a concept or story.
www.edpuzzle.com	Used for classroom videos. This app allows for stoppage and a question to be answered before students are allowed to continue.
Nearpod	Used as a presentation app controlled by the instructor that allows students to see exactly which slide the instructor is on from their iPad. Formative assessments are imbedded within each presentation as well as an assessment at the conclusion of the presentation to assess the knowledge gained.
Zip Grade	Used as a testing app that allows a teacher to see a complete statistical analysis of each test question as well as the summative scores.
Class Kick	Used to distribute classroom work and performance assessment. The instructor can continuously see student work, make comments, and grade work from ones iPad.
Socrative.com	Used for quick formative assessments. Students are able to see one question at a time with models imbedded to each question.



In addition to the general applications that were utilized for all units, the iPad was used for content specific applications throughout narrow units of study. This research highlighted two units that served as the focus to show how the iPad was implemented into the science curriculum. The first of these two units was the Heredity Unit that was covered in the fall of the treatment year (Appendix C). The second focus unit was the Earth and Space Unit, which was covered in early spring of the treatment year (Appendix D).

Prior to any instruction using the iPad, students were given the Quarterly Assessment (Appendix E). This test was composed of 50 multiple-choice questions that dually tested students' ability to understand science content and the skills associated with the practices of science and engineering at the seventh grade level according to Oklahoma Academic Science Standards. This test was given four times, once during each quarter, throughout the treatment year. The Quarterly Assessment scores from the third year's treatment group were compared to the scores of the two previous years where no treatment occurred in year one and a blended treatment occurred in year two. The first two year's Quarterly Assessment scores served as control comparisons for this research. The pre- and post- Quarterly Assessments for all three years were analyzed using a normalized gain statistical analysis. The pre-treatment and post-treatment scores were also statistically analyzed using a dependent two-tailed T-test. The results were reported using box and whisker plots.

The Paired Student Attitude About Zeros survey was administered pre-treatment as well as post-treatment to assess students' attitudes about zero grades (Appendix F). The survey asked students to what level they accept zeros and if they thought zeros affect

their overall grades and comprehension of science content. A second paired Student Attitude About iPads survey was administered to assess the level at which students use iPads in learning science and the level that they like using the iPad for assignment completion (Appendix G). The survey asked students if they thought the iPad helps the process of learning or if it is simply a distraction. Both surveys utilized a Likert Scale where students could choose *strongly agree, agree, neutral, disagree, or strongly disagree* to the given statement. The surveys were administered using Google Forms and were evaluated by comparing the survey results, looking for themes in a change in attitude in their acceptance of zeros and their use of the iPad. Both surveys were analyzed for differences using the Wilcoxon Signed Rank Test. Survey results were reported using histograms of the responses for each individual item.

Additionally, six students were randomly selected to be given the Student Interview about their thoughts concerning zeros, their thoughts about the iPad used as an alternative to traditional assignments, what they liked and disliked about using the iPad, and if they felt they learned more using the iPad for instruction (Appendix H). The student responses were assessed for common themes concerning zeros and for generalities concerning the use of the iPad. This data was analyzed for common themes and used as evidence to support the data analysis from the paired surveys.

Interval/ratio statistics were conducted to compare zero frequency data. The frequencies of zeros were calculated using student scores obtained from classwork during the treatment units. The data was analyzed and plotted on a bar graph to determine if a relationship existed. The frequency of zeros versus assignment type was collected from the treatment and the control years. Common assignments were selected from the tested

years. The year one assignment was a traditional paper assignment, year two consisted of a blended approach including traditional paper and iPad usage, and year three was assignments solely completed using an iPad application. Three assignments were chosen from each treatment unit and analyzed for the frequency of zeros accepted by students. One assignment was concerning vocabulary terms, another was an activity-based assignment, and the third was a concept review assignment. The frequency of zeros data was reported using histograms for the compared years.

All data collected was analyzed for common themes and reported graphically using student comments as supporting evidence for the data analysis claims. The methods of collection are summarized in the Data Triangulation Matrix (Table 2).

Table 2  
*Data Triangulation Matrix*

Focus Questions	Data Source 1	Data Source 2	Data Source 3	Data Source 4
Does the use of the iPad for assignment completion reduce the frequencies of zeros accepted by students?	Student Attitudes About Zeros Survey	Student Attitudes About iPads Survey	Zero Interval/Ratio Frequency Data	Student Interviews
Does the use of the iPad for instruction and completion of assignments increase student comprehension of science skills and concepts?	Pre- and Post-Quarterly Assessment	Student Attitudes About iPads Survey	Student Interviews	

## DATA AND ANALYSIS

The results of the Student Attitudes About Zeros Pre-treatment Survey indicate that 55% of the students *strongly disagree* that taking zeros was acceptable ( $N=20$ ). Students also disagreed that taking zeros on daily assignments was acceptable as long as they score well on tests indicated by 90% of the students choosing *disagree* and *strongly disagree*. Students felt that taking zeros would cause them to not learn science and have a negative affect on their overall grade. This can be seen by over 65% of students choosing

*agree* and *strongly agree* on those questions. In addition, 90% of the students felt that if they take zeros on daily work, they would not be prepared for unit tests (Figure 1).

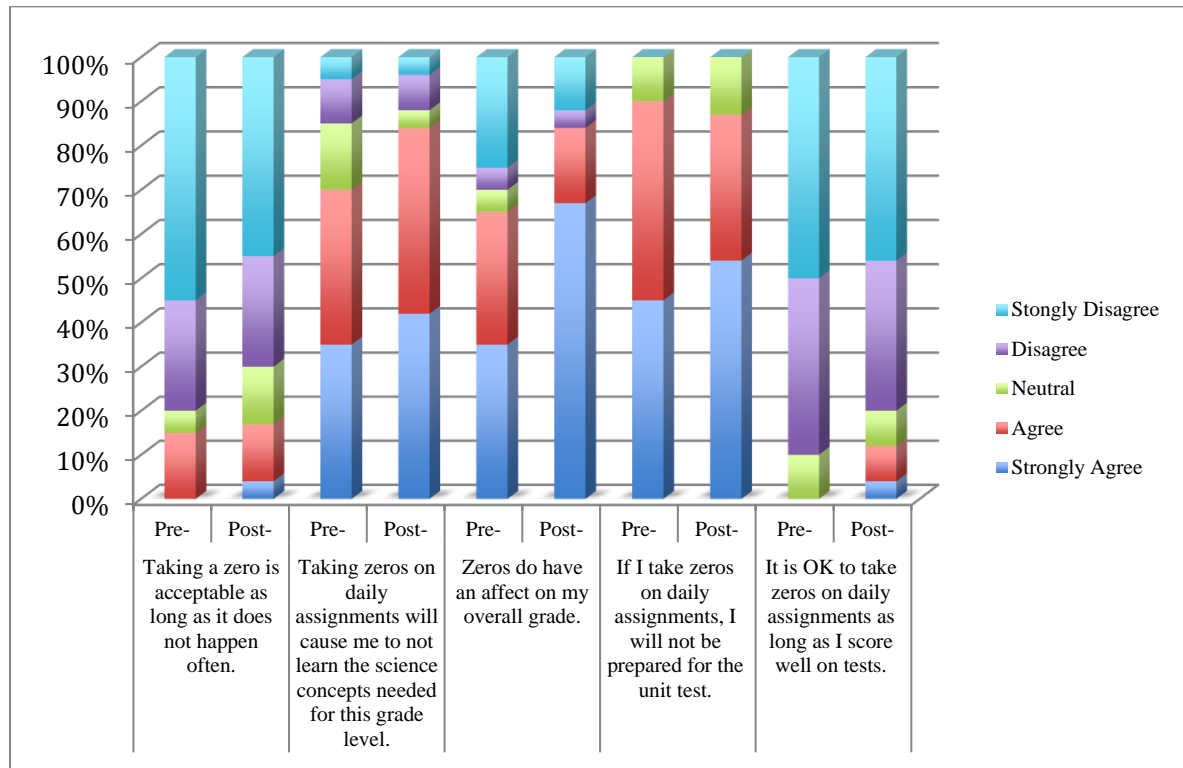


Figure 1. Student Attitudes About Zeros Survey, Likert style student responses on their feeling about zeros, (N=24).

The results of the post-treatment Students Attitudes about Zeros Survey show that 70.8% of the students surveyed disagreed that taking a zero is acceptable as long as it does not happen often (N=24). This value decreased from the pre-treatment survey where 80% disagreed with the same statement (Figure 1). In contrast, the number of students reporting that taking zeros will cause them not to learn the science concepts needed for their grade level increased from 70% in agreement to 83.4% reporting *agree* and *strongly agree*. In addition, students also reported a higher percentage agreeing that zeros do have an effect on their overall grade from a pre-treatment response of 65% *agree* and *strongly agree* to 83.4% in the post-treatment survey. Furthermore, in the post-treatment survey

12.5% of the students responded it is OK to take zeros on daily work as long as they scored well on tests. In comparison, no students responded in this fashion in the pre-treatment survey.

The Student Attitudes About Zeros Survey was analyzed for general trends using the Wilcoxon signed-rank test. The  $Z$ -value was  $-0.9439$ . However, the size  $N$  (5) was not large enough for the distribution of the Wilcoxon  $W$  statistic to form a normal distribution. Therefore, it was not possible to calculate an accurate  $p$ -value. In a second result, The  $W$ -value for this distribution was 4. The critical value of  $W$  for  $N=5$  at  $p \leq 0.05$  was 0. Therefore, the result was not significant at  $p \leq 0.05$ . Indeed, the students' attitude about zeros did not significantly shift from the pre-treatment survey to the post-treatment survey.

The pre-treatment data from the Student Attitudes About iPads Survey revealed that 90% of the students felt that using the iPad was a good way to complete assignments by choosing *agree* and *strongly agree* (Figure 2). One student commented, "It's a lot easier than carrying a bunch of binders and textbooks." Another student added, "You don't have to keep up with all your papers because they are right here." Furthermore, 90% of the students *disagree* or *strongly disagree* that the iPad is only good for playing games and cannot be used for learning science by choosing accordingly. One student said, "I do like playing games on the iPad, but only when I get done with my work." Several students felt that the iPad could be a distraction, but they felt they could wait to play games until after their work was finished. When asked if they prefer iPad or traditional paper assignments, students were mostly split in their preference with 30% choosing *neutral* and almost equal amounts choosing *agree* and *disagree*. One student

even commented, “I would do my best no matter what type of assignment, but I would like it more on the iPad.”

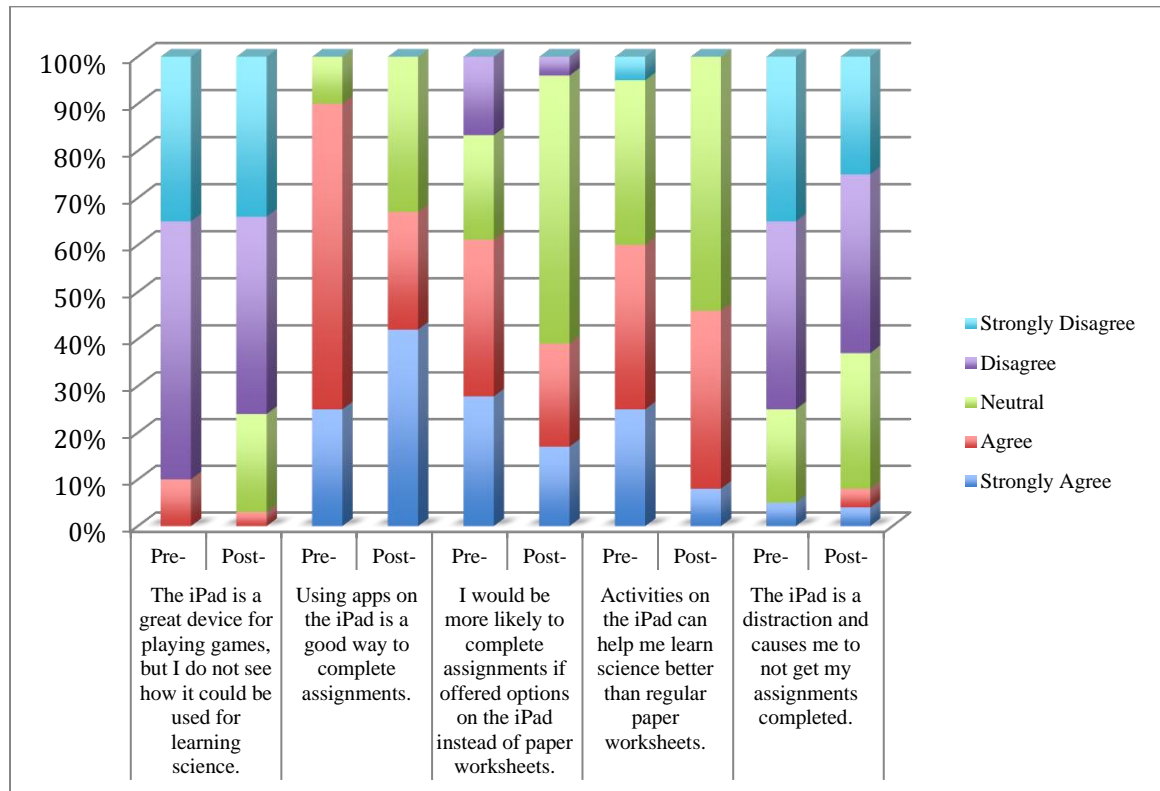


Figure 2. Student Attitudes About iPads Survey, Likert style student responses on their feelings about iPads, (N=24).

The Student Attitude About Ipads Post-treatment Survey reveals that the number of students that felt the iPad is a great device for games but could not see how it could be used for learning science remain relatively constant with both pre- and post treatment responses above 90% for the *neutral* to *strongly disagree* categories (N=24). No students on either the pre- or post-treatment survey disagreed that using apps on the iPad was a good way to complete assignments. In addition, 38.1% of the students responded they would be more likely to complete assignments on the iPad as opposed to traditional paper worksheet (Figure 2). This is down from the pre-treatment response of 45% on the same

statement. However, 56.5% of the students were *neutral* on their preference of iPad assignments compared to paper worksheets. One student commented that he would try his best no matter which type of assignment was given. Furthermore, only 8.2 % of the student respondents in the post-treatment survey felt that the iPad was a distraction that kept them from getting their assignments completed. This was an increase from the 5% on the pre-treatment survey. One student responded that people sometimes play games instead of doing their work.

The Student Attitudes About Ipads Survey was analyzed for general trends using the Wilcoxon signed-rank test. The  $Z$ -value was  $-0.1348$ . However, the size  $N$  (5) was not large enough for the distribution of the Wilcoxon  $W$  statistic to form a normal distribution. Therefore, it was not possible to calculate an accurate  $p$ -value. In a second result, The  $W$ -value for this distribution was 7. The critical value of  $W$  for  $N=5$  at  $p \leq 0.05$  was 0. Therefore, the result was not significant at  $p \leq 0.05$ . Indeed, the students' attitude about iPads did not significantly shift from the pre-treatment survey to the post-treatment survey.

Looking at the gains in science content knowledge, the results show a small normalized gain difference in year one of 0.08. Year two showed a small to medium normalized gain difference of 0.35 and year three showed a small to medium normalized gain of 0.39. A closer analysis showed that the median score for the first year, which was a control with no iPad usage, increased 2% from 52% to 54%,  $p = 0.032844$ . The second year where a blended treatment occurred showed a median score increase of 17% from 49% to 66%,  $p < 0.00001$ . The third year where a total use of the iPad for instruction and assignment was used showed a median gain of 18% from 48% to 66%,  $p < 0.00001$

(Figure 3). The results of the dependent two-tailed t-test showed that all three years resulted in a statistically significant gain in quarterly test scores where  $p < 0.05$ .

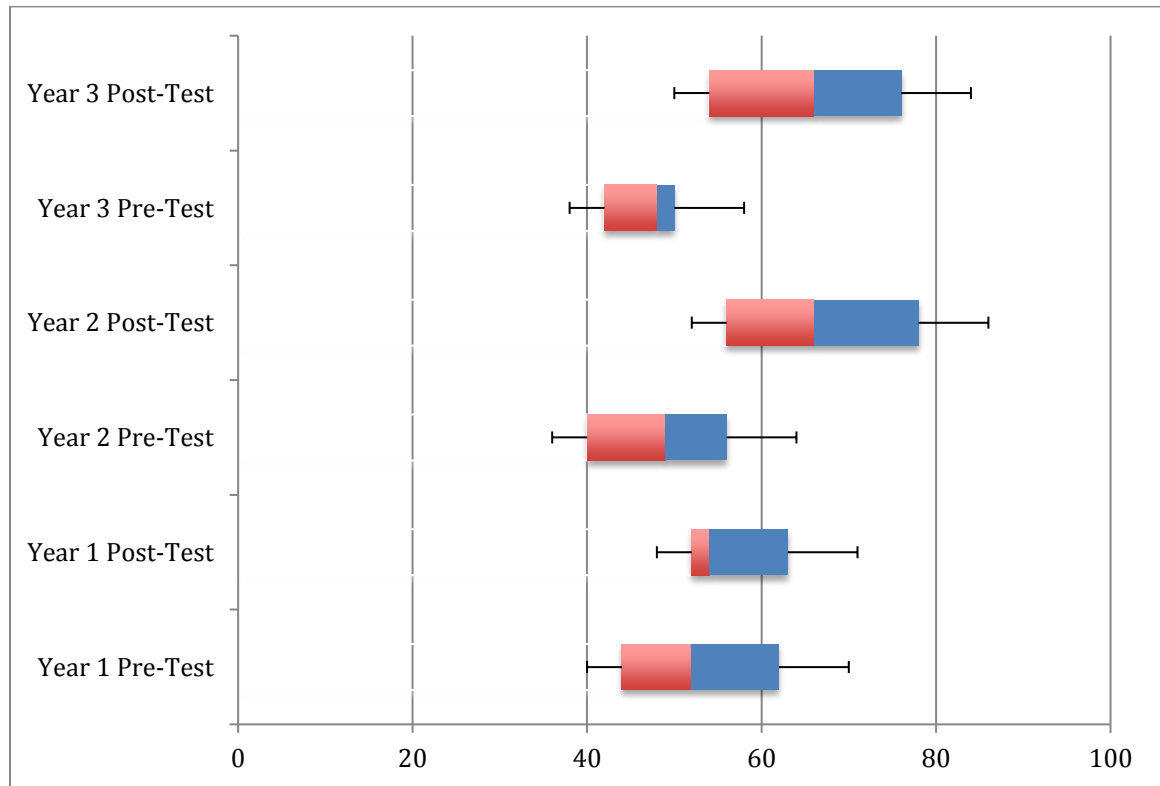


Figure 3. Quarterly Assessment Pre- and Post-Scientific Concepts Test, Box and Whisker Plots for the pre- and post-quarterly assessment, ( $N=24$ ).

The final piece of data accumulated from this research was the frequency of zero interval statistics data (Figure 4). The total frequency of zeros reported for the treatment units decreased 5.4% from 10.8% in year one to 5.4% in year three. Year two of the total frequency of zeros for the treatment units showed an increase to 13.7%, which was 2.9% more than the control of year one. A closer look at the break down of the total zeros into individual types of assignments showed the frequency of zeros for vocabulary assignments at 19.0% in year one, 17.5% in year two, and 7.0% in year three. The frequency of zeros for common classroom activities showed a similar trend with a



frequency of 5.6% in year one, 4.5% in year two, and 2.4% in year three. The review category of the frequency of zeros showed a year one frequency of 7.9%, an increase in year two to 23.7%, and an overall decrease in frequency of zeros to 6.8% in year three.

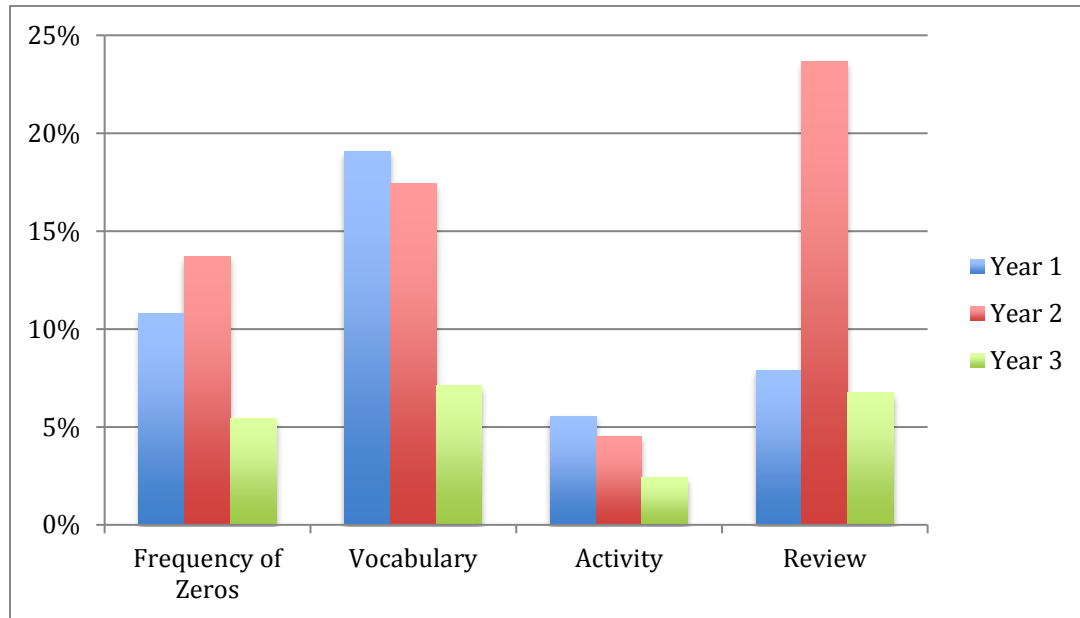


Figure 4. *Frequency of Zeros Comparison*, The frequency of zeros compared for various assignments for all years included, ( $N=24$ ).

### INTERPRETATIONS AND CONCLUSIONS

This study provided evidence that the use of the iPad for science instruction and completion of classroom assignments was successful in reducing the frequency of zeros and increasing science literacy in the seventh grade science classroom setting. I found that with the inclusion of options for students to complete assignments on their iPad, more students were likely to complete their assignments in the areas of vocabulary and classroom activities. In contrast, the category for concept review did not show such a clear relationship. Year two showed a tremendously higher frequency of zeros for the review category, which makes me question if there were other circumstances that could have influenced this value. Regrettably, I did not record the circumstances or happenings

that occurred at the time of the year two review that could have caused an unusually high number of zeros. For this reason, I feel that a general trend of all three years and all three categories should be assessed without looking specifically at one outlier such as the year two review category. The results of this general trend indicate that the treatment year, which included a total integration of the iPad for instruction and assignments, showed a large decrease in the number of zeros accepted by students in all categories. The frequency of zeros in year three was 5.41%. This is less than half the percentages reported for the year one control group with 10.80% and the year two blended instruction group with 13.7% zeros accepted. These findings are similar to those of Paur (2012) who stated that a motivated learner is more likely to complete their work. In this case the motivation was allowing the learner to chose iPad options for completion of assignments. According to the surveys, students claim they will try to complete their work no matter the type of assignment given whether it is paper worksheets or iPad alternatives, but the data reveals a definite advantage for the use of the iPad for assignment completion.

When looking at shifts and general trends associated with students' attitudes about zeros, students remained mostly consistent with their views concerning the acceptance of zeros. However, a shift occurred in attitude indicating that more students were aware by the end of the treatment units that zeros do have an overall effect on their grade. The results of the survey indicated that 14% of the students changed their view of how zeros affect their overall grade as seen from 30% disagreeing in the pre-treatment survey to only 16% disagreeing in the post treatment survey. The results show that students are more aware and conscious of the fact that zeros will affect their overall grade and will have an effect on their comprehension of science concepts and skills.

Similar to the trends seen in the zero survey, the general trends associated with students' attitudes about iPads remained fairly consistent when comparing their pre-treatment and post-treatment thoughts. The largest shift existed in their thoughts about the usage of apps for instruction. A large shift was indicated in students' belief from *agree* that the use of the iPad is a good way to learn science to *strongly agree*. Following the year three treatment, with total inclusion of the iPad used for classroom instruction, students could see a strong connection when looking at the benefit of using the apps associated with the iPad for instruction.

In regards to student comprehension of science concepts and skills, I found that the normalized gains for the year two blended instruction and the year three total iPad integration were very close. With the year two normalized gains at 0.35 and the year three at 0.39, no real determination can be made as to the effectiveness of total iPad integration when compared to the blended approach of instruction. Comparatively, I found that the use of the iPad is a benefit to student comprehension of science skills, but the degree to which the iPad is used as a classroom tool is not important. Whether it is a blended approach with the iPad complementing a traditional curriculum using paper worksheet, or the inclusion of total iPad usage, the increase was so similar that no real advantage could be determined. However, the advantage can be seen between year one when no iPad usage was implemented compared to year two and year three when iPads were included. According to this research, the iPad offers a positive advantage to the enhancement of a science curriculum and the retention of science concepts and skills. These findings are very similar to those of Boles (2011), Murphy (2013), and Prensky

(2001) who claimed with the inclusion of technology into current science curriculum student comprehension of science literacy would increase.

### VALUE

The process of undergoing an action research capstone project has lead me to believe two important shifts can be used to complement my existing curriculum for excellent science instruction in my classroom. The first is the use of the iPad and technology allow an observable advantage for students when offering assignment completion options. The second is the iPad and the use of technology offer an advantage for students with the use of applications (apps) to enhance the learning process of science concepts and skills. These shifts can be utilized to enhance my current curriculum to reduce the number of zeros accepted by students on daily classroom assignments and to boost the comprehension of science concepts and skills necessary for a successful science course. My goal is to create an environment in which each and every student can experience success in the areas of their overall grade in science and also in the comprehension of science which will allow them success on state level science testing and success in sciences at the high school level and beyond.

The iPad and the use of technology offer an advantage for students when offering assignment completion options. Since my district has adopted a one-to-one iPad initiative and every student has an iPad at their fingertips, we as teachers should use this technology to give students options for completion of assignments. My action research indicates that an observable decrease in zeros results when students are given iPad alternatives for completion of assignments. This idea resonates with Boles (2011) who states it is imperative that educators create opportunities using digital platforms and

social networking within the learning environment. I will continue to offer iPad alternatives such as Quizlet or Flashcard for vocabulary assignments as well as various other alternatives such as Class Kick for completion of activities and concept reviews. With the advantage indicated through my research, my goal is to eliminate the acceptance of zeros by students for assignments. With a variety of choices for assignment completion, students will have a greater sense of control and will hopefully feel more motivated to achieve the goal of 100% completion of assignments.

The iPad and the use of technology offer an advantage for students with the use of apps to enhance the learning process of science concepts and skills. Through this action research capstone project, I have seen the benefit of enhancing curriculum with a digital component. My goal is to continue offering classroom communication through a learning management system such as Edmodo or Google Classroom. Through these apps, students have a common gathering place for all classroom announcements that can be accessed from anywhere Wi-Fi is available. Students can have access to all classroom materials, assignments, discussions, videos, deadlines, and help for homework using such systems. This app alone can continue to impact a reduction in the number of zeros accepted by students and also assist in the development of content specific skills allowing students to have continuous access to classroom concepts. In addition, my goal is to continue to offer a variety of curriculum-specific apps for the enhancement of each unit of instruction. The advantage of the integration of apps for education was highly visible through this research and should be utilized to continue to improve my classroom curriculum and culture. My goal is to utilize interactive apps and websites to enhance all aspects of my

curriculum to produce scientifically literate students as they move on to the next level of their education.

I can definitely see the implications that the iPad has for science education, but a question that continues to resurface in my mind, “Would other areas of study see similar results?” This could most certainly be a new action research project in the near future that could spread to the site and district level. Expanding upon this research from my science class, one could reasonably ask if the same general trends exist for other science classrooms, other subject areas, or various grade levels. Implementation of this research to an entire site or district level would entail a great amount of cooperation from all stakeholders. It would take a considerable amount of training to get all teachers adequately trained in the apps that are available for assignment completion and to get them to a level of comfort where they are able and willing to allow students to complete tasks using the various digital applications. My immediate goal is to offer the results of my research to small group meetings as a portion of our professional learning communities in order to enlighten teachers at our site as to the effectiveness of using the iPad for instruction and assignment completion. If an interest in learning about various applications exists, I will then facilitate small-scale professional development opportunities to give teachers the tools to be able to allow students to use the iPad in an effective way. I think teachers will welcome the digital tools that will allow for a greater amount of flexibility and collaboration as we move forward with larger class sizes and greater levels of diversity in our classrooms.

As a classroom teacher, I have concluded that the use of the iPad for instruction and assignments is a good way to get this generation of digital natives motivated in a

topic and to reach them on their individual level. My students have technology in their hands every hour of every day, and with the use of this technology, I can enhance their learning experience. For future units I will continue to enhance the curriculum with new and innovative digital components that will connect students to the scientific concepts. As for assignments, I have learned that students prefer a choice as to the nature of their completed work. For most assignments, I can dually offer completion alternatives. For the less technology savvy student, a paper or interactive notebook may be an alternative that they can complete. For the true digital native, applications that allow the student to complete assignments using the iPad such as Classkick offer the same teaching power as the paper alternative while allowing students some choice in their completion of assignment.

In summation, this action research has brought me to realize that the iPad is only one tool that can increase student motivational levels not to accept zeros and to increase the comprehension of scientific concepts and skills. I have seen that the use of only one tool will show only small to moderate gains. However, if we couple the use of the iPad with a variety of teaching strategies, the benefit could greatly increase our gains. As a teacher conducting this research, I have changed my perception of the use of technology from a mindset of more is better to a slightly less aggressive approach of blending the good from past generations of quality science teaching with the benefit of the use of new technologies. As Sir Isaac Newton stated, “We are only standing on the shoulders of giants.” I am able to offer quality science education by standing on the shoulders of those great teachers that have mentored me and passed down their successful curricular components.

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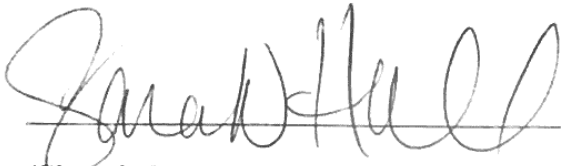
APPENDICES

APPENDIX A

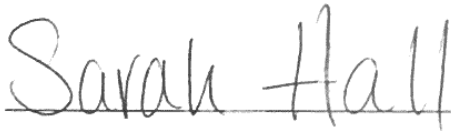
ADMINISTRATIVE INFORMED CONSENT EXEMPTION

## Exemption Regarding Informed Consent

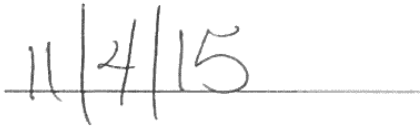
I, Sarah Hall, Principal of Woodward Middle School, verify that the classroom research conducted by Tina Rogers is in accordance with established or commonly accepted educational settings involving normal educational practices. To maintain the established culture of our school and not cause disruption to our school climate, I have granted an exemption to Tina Rogers regarding informed consent.

A handwritten signature in cursive script, appearing to read "Sarah Hall", written over a horizontal line.

(Signed Name)

A handwritten name in a simple, blocky script, appearing to read "Sarah Hall", written over a horizontal line.

(Printed Name)

A handwritten date "11/4/15" written over a horizontal line.

(Date)

APPENDIX B  
IRB EXEMPTION LETTER



INSTITUTIONAL REVIEW BOARD  
For the Protection of Human Subjects  
FWA 00000165

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

Chair: Mark Quinn  
406-994-5721  
mqquinn@montana.edu  
Administrator:  
Cheryl Johnson  
406-994-6783  
cherylj@montana.edu

**MEMORANDUM**

TO: Tina Rogers and John Graves  
FROM: Mark Quinn, Chair *Mark Quinn*  
DATE: November 16, 2015  
RE: "The Effects of Using the Ipad to Zap Zeros and Increase Student Comprehension of Science Concept"  
[TR111615-EX]

The above research, described in your submission of November 13, 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:

- (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 C

CONTENT SPECIFIC APPLICATIONS USED FOR INSTRUCTION AND  
ASSIGNMENT COMPLETION DURING THE HEREDITY UNIT



iPad Application	Classroom Usage
Ameobasisters.com	Used for curriculum and assignments concerning asexual reproduction, mitosis, and chromosomes. Students were able to connect with comic style videos explaining these life processes and complete activities aligned to the content and characters within the teaching videos.
Karyotyping Lite	Used for curriculum and assignments concerning chromosomes and genomes. This app required students to complete a karyotype by grouping homologous chromosomes. Once a complete karyotype was established, students were asked to determine the sex of the individual as well as if the individual had a normal set of chromosomes or an abnormality such as monosomy or trisomy.
Gene Screen	Used for curriculum and assignments concerning genes, chromosomes, and mutations. This app featured a virtual tour of the human body going all the way into the human cell showing the chromosomes, and finally ending up with the model of DNA. The diploid number of chromosomes was highlighted as well as what makes up a gene and a mutation. As the student progressed through the presentation, sexual reproduction was illustrated to show how two haploid gametes meet to form a diploid organism. Lastly the workings of the Punnett square was diagrammed and students were able to explore the usage of the Punnett square using a blank Punnett square feature. We used this last feature in conjunction with our CPO Crazy Trait activities which allowed students to predict the genetic outcome of various cross breeding experiments.
iCell	Used for curriculum and assignments concerning the prokaryotic cell, animal cell, and plant cells. This app was used as an introduction to our Heredity Unit to reacquaint our students with cells and the organelles within cells.
NOVA Embryo Identification	Used for curriculum and assignments concerning the comparison of embryological development. Students were asked to predict the organism for which each embryo would result. Embryos were examined at several stages through the gestation period.

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learn.genetics.utah.edu	Used for curriculum and assignments concerning the size of life, genes, chromosomes, stem cells, genetics, and heredity. This app is an interactive website that allows students to interact with the content as they progress through the curriculum. Formative assessment is conducted at multiple points throughout the presentations.
Snurfle Meiosis	Used for curriculum and assignments concerning sexual reproduction. This app allowed students to independently walk through the processes that form gametes. Imbedded within the presentation were multiple formative assessment opportunities that required students to return and review material that they did not answer correctly.
Human Genome	Used for curriculum concerning chromosomes and genomes. This app allowed students to choose a trait and view which chromosome or chromosomes that trait was located in the human genome. We were able to explore polygenetic traits as well as sex-linked traits as an extension of the content within this application.

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APPENDIX D

CONTENT SPECIFIC APPLICATIONS USED FOR INSTRUCTION AND  
ASSIGNMENT COMPLETION DURING THE EARTH AND SPACE UNIT

iPad Application	Classroom Usage
Moon Preview	Used as a resource for the phases of the moon as we reported and drew a model of the moon every day for 30 days.
Sky View	Used as a resource to find and view constellations as we explored the constellation of the day.
Sky Map	Used as a second resource for finding and viewing constellations and celestial bodies in our night sky.
Space Journey	Used to view the scale, motion, and composition of our solar system. Also used to explore the properties of planets, dwarf planets, and moons within our solar system.
Pocket Universe	Used to give students a sense of our place in the universe and our solar system. This was a great tool for showing the tidal lock feature of our moon and earth. As a bonus, students found that this app offered a virtual tour of the sky as seen from their back yard.
NASA	Used to view photos from NASA the dealt with discussions such as sunspots and the aurora borealis.
Google Earth	Used to explore the surface of the moon as well as various landing sites and mission that NASA has highlighted within the website. Students were able to see the exact areas that were explored with actual photos from those studied areas. Students were also able to use this data to predict a possible location for a lunar station that would provide the necessary elements needed for short term survival within a moon colony.
Gravity 2.0	Used as an approved science app that students could investigate upon completion of daily activities. This app allowed students to explore how the masses of various objects in our universe have varying amounts of gravity. Also they were able to investigate how varying rates of gravity changed the motion of object.
Solar System Lite	Used to feature a look at our place in the universe and our solar system. Also a comparison of revolutions

could be established from a view of our solar system in motion. In addition planets and moons could be compared as to size with an interactive size comparison. Lastly we used this app to reinforce why Pluto is not considered a planet by reviewing the definition of a planet and then investigating the five dwarf planets.

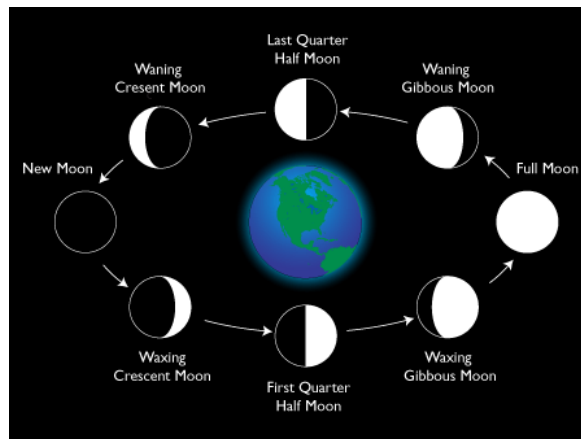
APPENDIX E  
QUARTERLY ASSESSMENT

## 7th Grade Science Quarterly Assessment

### Multiple Choice

Identify the choice that best completes the statement or answers the question.

- \_\_\_\_ 1. During which phase does the Moon receive sunlight only on the side facing away from Earth?



a. Waning Gibbous	c. Waxing gibbous
b. New Moon	d. Full Moon

- \_\_\_\_ 2. In a Punnett square, a capital letter (T) stands for a \_\_\_\_\_ allele.

a. dominant	c. recessive
b. heterozygous	d. sex-linked

- \_\_\_\_ 3. During each \_\_\_\_\_, the Sun is directly over either the Tropic of Cancer or the Tropic of Capricorn.

a. solstice	c. season
b. equinox	d. moon phase

- \_\_\_\_ 4. The process of a liquid changing into a gas is called \_\_\_\_\_.

a. sublimation	c. vaporization
b. condensation	d. deposition

- \_\_\_\_ 5. The quality of pond water can be determined by identifying the number and types of organisms found living in the water. Which piece of equipment will best help students identify some of the organisms?

a. pH paper	c. Microscope
b. Pan balance	d. Binoculars

- \_\_\_\_ 6. The density of a material is \_\_\_\_\_.

a.	how much the material weighs
b.	the mass of a unit volume of the material
c.	how much space the material takes up
d.	whether or not the material floats in a liquid

\_\_\_ 7. When designing an experiment, everything should be the same except for the \_\_\_.

a.	data	c.	dependent variable
b.	independent variable	d.	control

\_\_\_ 8. The number of chromosomes in a sex cell of an organism is its \_\_\_\_\_ chromosome number.

a.	one	c.	RNA
b.	haploid	d.	zygote

\_\_\_ 9. Chloroplasts are found only in organisms that are able to...

a.	hunt for prey	c.	grow to a larger size
b.	migrate to other ecosystems	d.	generate their own energy

\_\_\_ 10. If an object's density is less than that of the fluid it is in, it will \_\_\_.

a.	sink	c.	melt
b.	float	d.	boil

\_\_\_ 11. A student suspects that there is a relationship between the amount of sunny weather in a given state and the amount of solar energy used by its inhabitants. In order to find out if this idea is correct, the student will need which information for each state?

a.	The location and type of solar cells used in that state	c.	The percentage of days that there is enough sunlight to power a solar water heater
b.	The number of sunny days per year and the amount of solar power used per year	d.	The efficiency of solar technology used in that state

\_\_\_ 12. Human sweat is the direct result of which life function?

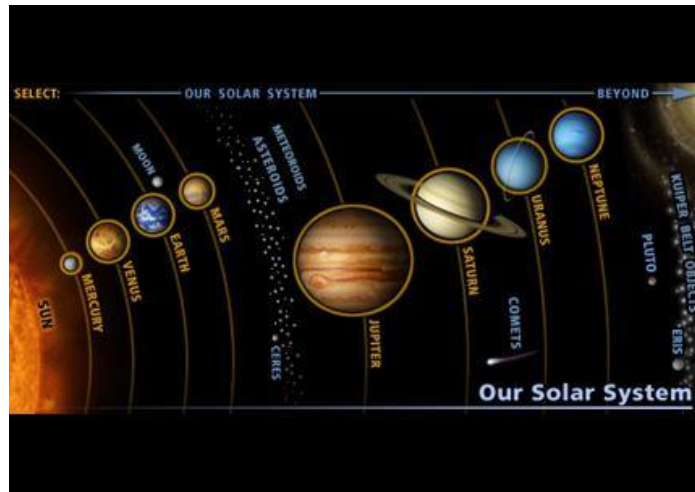
a.	Digestion and disease prevention	c.	Waste removal and temperature control
b.	Respiration and cellular growth	d.	Reproduction and cellular transport

\_\_\_ 13. Steel is a(n) \_\_\_.

a.	mixture	c.	alloy
b.	liquid solution	d.	gaseous solution

\_\_\_ 14. Earth is different from the other planets in our solar system because it...





a.	orbits a star	c.	has collided with meteorites
b.	makes up the majority of the mass of our solar system	d.	has oceans and lakes

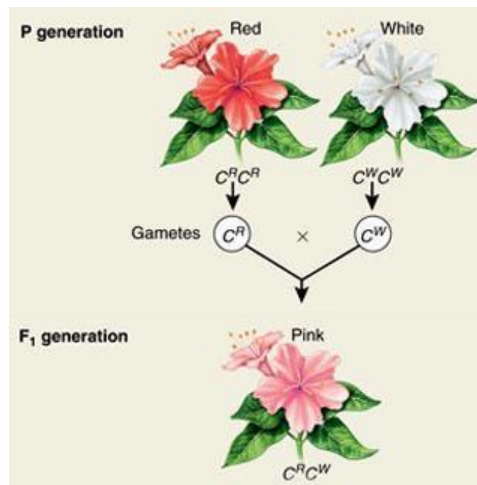
15. All of these can be inherited by people EXCEPT –

a.	eye color	c.	language
b.	blood type	d.	height

16. Clouds are formed when millions of drops of water become suspended in the air. Which of the following is a step in the process of cloud formation?

a.	Formation of carbon dioxide	c.	Expansion of cold air
b.	Hydrogen	d.	Condensation of water vapor

17. Experiments with four o'clock flowers which use purebred red and white flowers always produce pink flowers as their offspring. This trait is an example of \_\_\_\_\_ dominance.



a. heterozygous	c. incomplete
b. homozygous	d. recessive

\_\_\_ 18. The combination Tt represents a \_\_\_\_\_ genotype.

a. heterozygous	c. purebred
b. homozygous	d. sex-linked

\_\_\_ 19. Which characteristic is used to classify frogs into a different phylum from squid, snails, and jellyfish?

a. Frogs have backbones	c. Frogs breathe oxygen
b. Frogs live on land	d. Frogs are predators

\_\_\_ 20. A student predicts that similar ice cubes will melt faster in a microwave than in a pot on the stove. How should this hypothesis be tested?

a. Identify and record the temperature of each ice cube before each trial	c. Measure and compare the volume of the pot and the microwave
b. Determine the volume of liquid that is made by each ice cube	d. Observe and record the time for each ice cube to completely change to a liquid.

\_\_\_ 21. Flammable materials, like alcohol, should never be dispensed or used near...

a. an open door.	c. another student.
b. an open flame.	d. a sink.

\_\_\_ 22. What should an experimenter do after forming a hypothesis?

a. draw a conclusion	c. test the hypothesis
b. analyze the data	d. recognize the problem

\_\_\_ 23. A group of cells that work together to do one job is called a(n) \_\_\_\_\_.

a.	organ system	c.	tissue
b.	one-celled organism	d.	organ

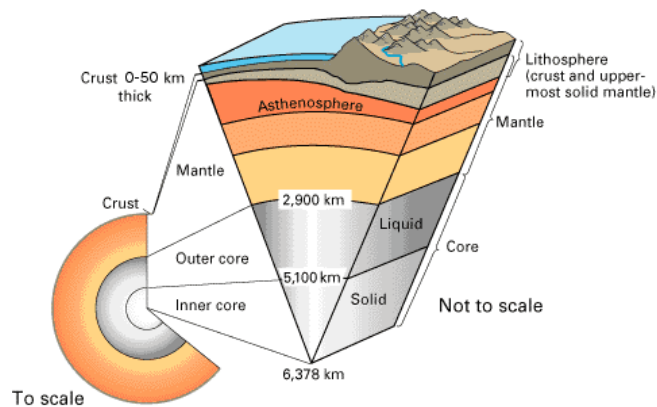
\_\_\_\_ 24. Black bears roam over large territories. What effect would building shopping centers in these territories have on the bears?

a.	Stabilize the black bear population	c.	Promote an increase in black bear reproduction
b.	Introduce a new bear population to the area	d.	Reduce the black bears' habitat

\_\_\_\_ 25. The higher the temperature of matter, the \_\_\_\_ the particles are moving.

a.	slower	c.	faster
b.	farther	d.	closer

\_\_\_\_ 26. The outermost, rigid layer of the Earth, consisting of the Earth's crust and part of the upper mantle is the...



a.	biosphere	c.	atmosphere
b.	lithosphere	d.	asthenosphere

\_\_\_\_ 27. Your heart is an example of a(n) \_\_\_\_\_.

a.	tissue	c.	cell
b.	organ	d.	organ system

\_\_\_\_ 28. Human sex cells have \_\_\_\_\_ individual chromosomes.

a.	13	c.	33
b.	23	d.	46

\_\_\_\_ 29. Raisins in cereal is an example of a \_\_\_\_\_.

a.	homogeneous mixture	c.	solvent
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b.	heterogeneous mixture	d.	salt
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30. A lab group measured how far two rubber bands stretched when attached to 100-gram masses. Five measurements were made for each rubber band. What is the range of the data collected for rubber band B?

Rubber Band	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
A	3.7 cm	3.9 cm	3.7 cm	3.4 cm	3.6 cm
B	2.5 cm	2.7 cm	2.8 cm	2.7 cm	2.7 cm

a.	0.3 cm	c.	0.5 cm
b.	2.7 cm	d.	2.8 cm

31. Students conducted an investigation to determine if unknown liquids were acids or bases. What was the independent variable in this investigation?

Sample	Indicator	Color Change	Identification
Unknown 1	Litmus Paper	Red	Acid
Unknown 2	Litmus Paper	Pink	Acid
Unknown 3	Litmus Paper	Pink	Acid
Unknown 4	Litmus Paper	Blue	Base

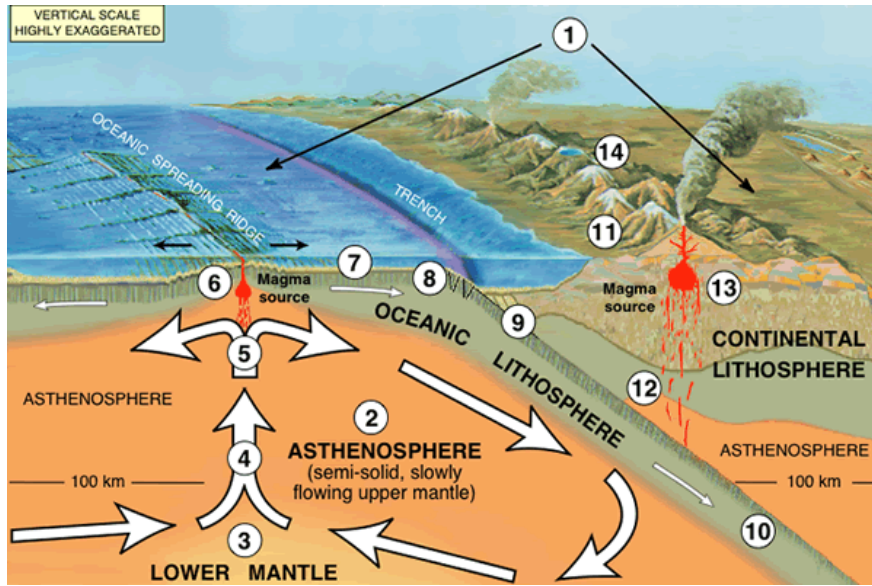
a.	Identification	c.	Color Change
b.	Indicator	d.	Sample

32. In the water cycle, evaporated water \_\_\_\_\_.



a.	precipitates as rain or snow	c.	becomes groundwater
b.	runs into lakes, streams, and oceans	d.	condenses into clouds

33. If you used the theory of plate tectonics to predict the most likely place for the next earthquake and volcanic eruption, you should predict that it is most likely to



a. along boundaries of colliding lithospheric plates	c. In the interior of any continent
b. where one has not happened in at least 10 million years	d. Where one lithospheric plate is being subducted beneath another lithospheric plate.

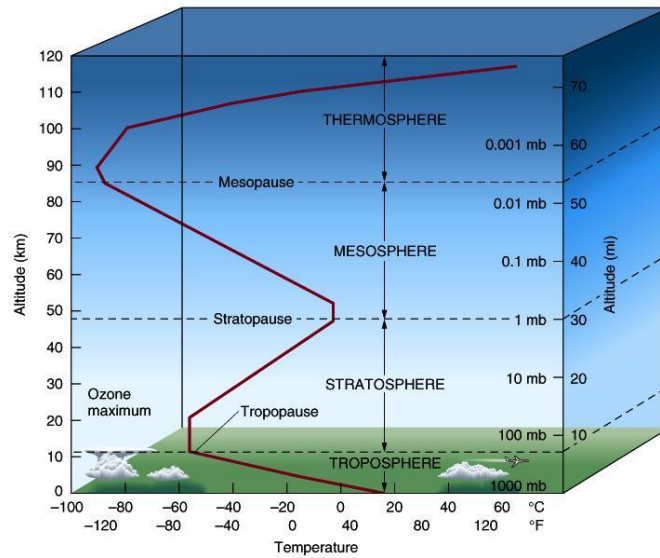
34. Earth's axis is \_\_\_\_.

a. tilted	c. vertical
b. curved	d. horizontal

35. Francis wonders where his dog is getting through the fence. He found a spot behind a bush where the fence is rotted away and predicts this is where his dog is escaping. What should be his next step?

a. form a hypothesis	c. infer
b. test the hypothesis	d. draw a conclusion

36. The \_\_\_\_ is the layer of the atmosphere nearest to Earth's surface.



a.	mesosphere	c.	stratosphere
b.	troposphere	d.	ionosphere

\_\_\_ 37. An example of physical change involving more than one substance is \_\_\_.

a.	evaporating	c.	burning
b.	rusting	d.	dissolving

\_\_\_ 38. \_\_\_ is the only substance that exists as a solid, liquid, and gas in Earth's atmosphere.

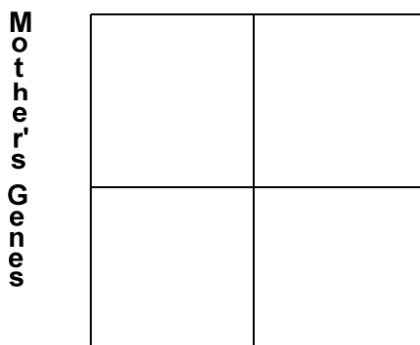
a.	Nitrogen	c.	Water
b.	Ozone	d.	Radiation

\_\_\_ 39. At the end of meiosis, \_\_\_\_\_ cells have been produced from one cell.

a.	two	c.	four
b.	three	d.	five

\_\_\_ 40. Which breeding experiment would produce the **MOST** genetic diversity in a trait that displays a co-dominant pattern of heredity? Use the Punnett square to help determine your answer.

**Father's Genes**

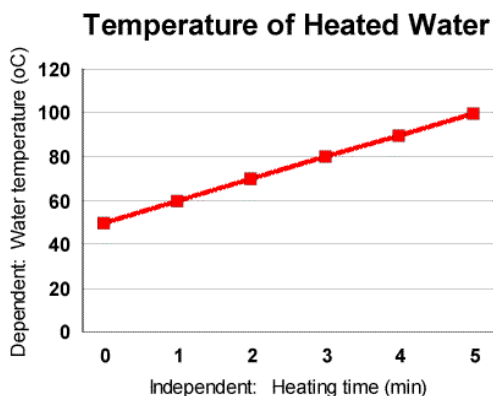


a.	TT x tt	c.	Tt x tt
b.	Tt x Tt	d.	TT x Tt

\_\_\_ 41. An example of a change of state is \_\_\_.

a.	evaporating	c.	burning
b.	rusting	d.	dissolving

\_\_\_ 42. The line graph shows heating data for water. What information does the graph show?



a.	How the time changes each month	c.	How much heat was added to the water
b.	How the temperature of the water changed over time	d.	What kind of heat was added to the water.

\_\_\_ 43. Robert Hooke looked at a piece of cork under a microscope. The little boxes he saw in the cork are called...

a.	chromosomes	c.	cells
b.	nuclei	d.	genes

\_\_\_ 44. Using the table below, which substance would float in water?

SUBSTANCE	DENSITY ( G/CM <sup>3</sup> )
AIR	0.0013
WOOD (OAK)	0.85
WATER	1.00
ICE	0.93
ALUMINUM	2.7
LEAD	11.3
GOLD	19.3
ETHANOL	0.94
METHANOL	0.79

a. Gold	c. Lead
b. Aluminum	d. Oak Wood

\_\_\_ 45. Which of these is not a physical property of matter?

a. density	c. ability to burn
b. mass	d. texture

\_\_\_ 46. Which is an SI metric unit of measurement that is used to record the heat transfer of a solution in a classroom investigation?

a. Liter	c. Newton
b. Volt	d. Degree Celsius

\_\_\_ 47. Earth completes one \_\_\_ each year.

a. revolution	c. solstice
b. rotation	d. phase

\_\_\_ 48. You are heating a substance in a test tube. Always point the open end of the tube

a. toward yourself.	c. toward another classmate.
b. toward your lab partner.	d. away from all people.

\_\_\_ 49. The process of a solid changing directly into a gas, without ever becoming a liquid is called \_\_\_.

a. sublimation	c. vaporization
b. condensation	d. deposition

\_\_\_ 50. During a(n) \_\_\_, Earth's tilt is not toward or away from the Sun.

a. solstice	c. solar eclipse
b. revolution	d. equinox



APPENDIX F  
STUDENT ATTITUDES ABOUT ZEROS SURVEY

STUDENT ATTITUDES ABOUT ZEROS					
<i>Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way.</i>					
For each statement below, check which box mostly resembles your opinion.					
Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Taking a zero is acceptable as long as it does not happen often.					
Taking zeros on daily assignments will cause me to not learn the science concepts needed for this grade level.					
Zeros do have an effect on my overall grade.					
If I take zeros on daily assignments, I will not be prepared for the unit test.					
It is ok to take zeros on daily assignments as long as I score well on tests.					

APPENDIX G  
STUDENT ATTITUDES ABOUT IPADS SURVEY

STUDENT ATTITUDES ABOUT IPADS					
<i>Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way.</i>					
For each statement below, check which box mostly resembles your opinion.					
Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The iPad is a great device for playing games, but I do not see how it could be used for learning science.					
Using apps on the iPad is a good way to complete assignments.					
I would be more likely to complete assignments if offered options on the iPad instead of paper worksheets.					
Activities on the iPad can help me learn science better than regular paper worksheets.					
The iPad is a distraction and causes me to not get my assignments completed.					

APPENDIX H  
STUDENT INTERVIEW

STUDENT INTERVIEW

*Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way.*

1. How have you used the iPad for science assignments and instruction?
2. What do you like about using the iPad for assignments and instruction?
3. What do you not like about using the iPad for assignments and instruction?
4. If given an option for daily assignments on an iPad, would you be more likely to complete the task?
5. Do you feel you would learn more if a teacher used the iPad for instruction in the classroom?
6. Is there anything else you would like me to know?