

IMPLEMENTATION OF A 1-to-1 LAPTOP INITIATIVE IN
A PHYSICAL SCIENCE CLASSROOM

by

Gregory M Dyk

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 2015

©COPYRIGHT

by

Gregory Dyk

2015

All Rights Reserved

TABLE OF CONTENTS

INTRODUCTION AND BACKGROUND	1
CONCEPTUAL FRAMEWORK.....	6
METHODOLOGY	14
DATA AND ANALYSIS.....	26
INTERPRETATION AND CONCLUSION	61
VALUE.....	64
REFERENCES	67
APPENDICE.....	69
APPENDIX A: Learning Styles Tests	70
APPENDIX B: Video Project Rubric	72
APPENDIX C: Video Project Questionnaire	74
APPENDIX D: Institutional Review Board Form.....	77
APPENDIX E: Pre 1-to-1 Report	79
APPENDIX F: Quizlet Quiz Example.....	94
APPENDIX G: Quizlet Survey.....	96
APPENDIX H: Five Question Gizmos Quiz Examples	98

LIST OF TABLES

1. Action Research	3
2. Treatments.....	16
3. Examples of Required Terms.....	18
4. Days/Weeks Using Quizlet.....	36
5. Student Responses after Completing	49
6. Top Five Online Discussion Topics.....	57

LIST OF FIGURES

1. Student Mean Scores per Week34

2. Number of Days Studied and Student Quiz Scores on Week 9 Quiz37

3. Likert Survey: Quizlet is the Best Way to Study39

4. Student Responses: What Kind of Resource is Quizlet in
Helping Learn the Material?42

5. Student Scores from Five Question Quizzes after Completing a Gizmo.....47

6. Mean Scores for Each of the Six Gizmos Quiz Scores.....48

ABSTRACT

In addition to cracking open a book, writing ideas down on paper, studying with flashcards, or openly discussing ideas around a table, how willing and motivated are students to actually using their computers to complete certain classroom requirements? There is no doubt students like the idea of having their own personal laptop; but how can a laptop change the way students learn? Being 1-to-1 does not mean the previously mentioned methods of student learning behaviors are no longer part of a classroom routine; however, with the addition of computers into the classroom, each teacher needs to ask themselves: What instructional changes can be made to best utilize student laptop use and how can students be motivated to use the laptop as a tool to meet the course requirements? The purpose of this paper is to highlight multiple ways of incorporating laptops into a physical science classroom. In the final analysis, twenty-three students used their laptops to study and learn individually as well as in a group setting. The majority of these students found laptops to be an effective tool in the learning process.

INTRODUCTION AND BACKGROUND

These days, no matter which direction you turn, it seems someone is looking at some form of a flat screen. It would seem the Ancients were correct after all in that the world is indeed flat! Using devices like phones, tablets, laptops, and televisions, people today spend hours focusing many of their senses and cognitive behavior on some variation of a screen. It remains to be true that the use of technology in each of our lives is nothing new. For each of us, young and old alike, technology has always had an impact on the way each of us interact with the world and the people around us. Nonetheless, what is different about technology today is the fact that it is not only in the hands of all my students, but it has become, for many, their sense of identity and lifeblood. In their mind, they just can't seem to live without today's devices. Yet, as this form of technology has swept and changed the way students in their personal lives operate, think, and experience their world, researchers emphasize the fact that the least likely place to find the widespread use of flat screen technology is in today's classrooms. Being immersed in technology they deem necessary for survival, students do not find this new invasion of gadgets and "smartness" has yet to hit today's classrooms with the same effect. At least this is true for my students. From my classroom door on, the technology my students cleft to so dearly, like phones and laptops, was no longer in their reach. At least this was true up until the beginning of the 2014 school year.

Beginning in the fall of 2014, the school where I teach, Southwest Minnesota Christian High School (SWC), required incoming freshmen to own a laptop computer for the classroom. Because of this 1-to-1-laptop initiative, I was required to incorporate

laptop technology in my freshman physical science class. The Administration of SWC has not given any clear path to follow concerning this implementation, leaving these decisions up to each individual teacher. After reviewing research, this freedom is indeed the preferred path many schools take when attempting to implement the 1-to-1 initiative.

Now that students are required to have laptops in hand, what does a 1-to-1 laptop-equipped classroom look like? Using this question as the initial launching point, I have been focusing on ways for students to implement their laptops in a science classroom as my Action Research Project (AR). Specifically, this study is examining the integration of laptops into the daily classroom routine. It is not my intent to teach each of my students to be technologically savvy. Instead, I plan to have students use their laptop as an educational tool for the process of learning, growing, and discovering. With these ideas in mind, my AR Project was born and twenty-three freshmen began the 2014 school year with a brand new MacBook Air from Apple.

To begin to understand if computer based learning through multiple classroom applications can influence student outcomes and my teaching styles, I have collected student input and testing outcomes concerning the 1-to-1 initiative to help answer my Action Research question. Ultimately, I am striving to find ways that these laptops can be used as a tool to enhance my teaching, improve science knowledge, deepen a passion for science, and further each student's education. To accomplish these goals, I have put together the following research questions as found on Table 1.

With these questions in mind, I started looking at both the material to be taught in physical science and the students I would be teaching. I researched methods on how best

to incorporate laptop technology, reviewed a study regarding the types of learning styles each of the incoming twenty-three freshmen had participated in, and held two group interviews with a few of the incoming freshmen. In addition, I evaluated the only form of computer-based teaching I had used in the past.

Table 1
Action Research Questions

Primary AR Question	What are the effects of a 1-to-1 laptop initiative in a required Freshmen Physical Science class?	
Sub Questions	#1	What are student preconceived attitudes of the 1-to-1 concept?
	#2	How can the 1-to-1 laptop initiative enrich each individual student of the science content?
	#3	Can a 1-to-1 laptop initiative enrich group projects in the science content?

Another area of importance in finding direction for implementation of the 1-to-1 was getting to know each of the twenty-three students' individual learning styles. At the beginning of each year, SWC's Resource teacher, Mrs. VanderAa, evaluates the learning style modality of all the freshmen. This evaluation is based on six different tests and defines each student as either an auditory, visual, or kinesthetic learner (Appendix A). From the overall scoring on these tests, each student's particular learning style was calculated and defined. The results of the assessment found over half of the incoming freshmen, 61%, were determined to be *Visual Learners* (14 out of 23). The *Tactile Learners* made up 30% of the class (7 out of 23), and 9% were scored as *Auditory Learners*. With this in mind, it would seem that the majority of these students are wired to learn best by watching and participating in hands-on type activities as opposed to

lectures and worksheet assignments. Laptop usage would be tailored to fit these learning styles.

Once I realized students were in favor of using laptops in the classroom and there was a heavy influence of visual learners within the incoming class, I needed to find appropriate methods to bridge course content with laptop usage. I chose to include two web based educational platforms. The first is called Gizmos and the other is Quizlet. Gizmos was chosen because this online simulation gives students the opportunity to experience a lab like activity that plays-out on their laptop screens. Students are able to perform virtual experiments, manipulate variables and materials within the simulation, and repeat experiments when needed. Gizmos require students to not only participate in certain scientific procedures but also to make predictions, write hypotheses, and interpret test results. These experiments can be performed during a class period or outside of the normal classroom times. It should be noted that these simulations were not meant to replace traditional classroom labs. Rather, they have been implemented as another method of teaching the curriculum that ties in directly with the laptop concept and the learning styles of the students.

Lastly, I have had the opportunity to use a computer to facilitate teaching in the classroom even before students were required to have laptops. Prior to the announcement, I was able to experience firsthand the role a computer can play in a student's education. In one of my science classes, I was introduced to computer based learning by a couple of students. They showed me how Quizlet, a computer based website that is designed to assist students with content review, was able to help them study for quizzes and tests.

After researching Quizlet, I shared it with the school's resource teacher, Mrs. VandeAa. With her help, we were able to download some course content and offer this online method of practice to a student that was consistently failing my weekly biology quizzes. Within a short period of time this same student went from failing to passing. In fact, she went from scores that were in the 20-30% range to getting every quiz question correct, not just on a particular quiz, but for the rest of the year! Not only was she passing each test with perfect scores but she was also enjoying the method of study Quizlet had to offer and suddenly found that a lot of required terms may seem daunting but with consistent practice and focused study, she could be successful.

Just as this particular student found success, I felt Quizlet could benefit my physical science students. On the first day of class, I required each freshman to sign-up for this computer based study aid. In addition to the success of the student mentioned above, another reason I felt the freshman could learn by using Quizlet was because it offered multiple ways for them to study. As visual and kinesthetic learners, students are able to manipulate flashcards, play competitive games, and take practice tests. There is even an option to have the material spoken to the student. This allows auditory learners to both read and hear the material.

From the beginning, it was clear that I was required to implement laptops in my physical science classroom. In the end, my students were able to guide me in the direction these laptops needed to go. Now that the students had spoken, it was time to discover what researchers had to say in regards to the concept of laptops in the classroom.

CONCEPTUAL FRAMEWORK

I felt it was necessary to research articles that discussed reasons why the use of laptops in certain schools was successful. Judy Parr and Lorrae Ward (2011) wrote an article that described how the teacher's laptop has become the focal point to many of the classroom's activities. This article is a result of a longitudinal study that traces a 1-to-1 laptop implementation in New Zealand. A second article, by Mark G. Storz and Amy R. Hoffman, is a study of a school beginning the implementation of a 1-to-1 program. Even though the two studies were thousands of miles apart (New Zealand and Northwestern US), they both came to many of the same conclusions.

As stated above, both of these studies focused on start-up 1-to-1 programs. In order for a 1-to-1 concept to gain any traction and then become seamlessly integrated in the classroom, it is imperative that teachers are competent, confident, and continually learning how best to use laptops in their classroom. One of the best ways to start is to ensure that each teacher is given a laptop of his own. Having access to a computer 24 hours a day 7 days a week allows for experimentation, which can lead to enhanced knowledge and personal professional growth. If teachers can infuse computers into their daily lives, they begin to operate them with greater confidence while gaining necessary skills for their professional lives. This in turn leads to seeking out ways of incorporating computers in the classroom. Keep in mind, each teacher has the potential to use his/her laptop in diverse and exciting ways. Yet, it is important that each teacher has a clearly articulated and structured methodology in which to impact student learning via technology. In addition, both articles stress the importance in allowing teachers to take

risks and try new things. School administrators also need to provide teachers with what they need in regards to resources, training and time to learn and implement.

The implementation of a 1-to1 plan does not happen overnight. Indeed, it is a process that needs to be developed over time. Through practice, reflection, and planning, the use of laptops in the classroom will become more and more focused. Clearer focus and direction will ultimately lead to laptops that are part and parcel of the classroom. As stated in the Parr and Ward (2011) study, “Laptops had become, to a large extent, an invisible part of these teachers’ toolboxes” (p. 71). One thing that is also certain, once the laptop has been introduced, the classroom will no longer look, feel, or operate as in the past. The old way of doing things will forever be replaced by classroom structures and norms where students own the means to be portable in their learning, reaching beyond the classroom walls and their own preconceived ideas by touching all parts of the globe and all methods of thought and understanding. At the touch of a button, the whole world is at the tip of a finger. The teacher to student relationship, learning environment, communication and accessibility of ideas has forever been changed.

Just because teachers are told that they will be given laptops and are instructed to implement them into their classroom does not mean each teacher will takeoff with the concept or have classrooms that flourish with this addition of technology. In contrast, the results of a two-year study at a private middle school highlight the inconsistency of laptop implementation. Researchers Mark Windschiti and Kurt Sahl (2002) followed, interviewed, and discussed laptop use with three middle school teachers. After much community discussion and debate, the laptop initiative at this school was put into place.

A year before laptop usage was to begin in the individual classrooms, teachers were given their own personal laptop computers in order to become familiar with them in their personal lives as well as explore ideas for the classroom. As in the Parr/Ward and Storz/Hoffman articles, the administration took necessary steps to help breed success in each of the teacher's classrooms. In addition, this middle school also had widespread parental support, a cohesive professionally developed plan, frequent teacher workshops and weekly staff meetings to discuss computer issues. They even hired a technological point person to oversee the laptops implementation as well as maintain support and offer assistance when needed.

Each of the three teachers was set to embark on the laptop journey. Even though they had the same marching orders, at the end of the two-year study, it was shown that the laptop use in each of these three classrooms varied greatly. The reason for the differences stemmed from three main areas, according to the authors Windschiti and Sahl. The most influential reasons for success or failure of laptop implementation and daily use were not grounded on a teacher's technological background, training or attitude towards technology. What mattered the most hinged on each individual teacher's philosophical belief in learning and teaching. These core areas were the biggest indicator of how often laptops were viewed, how laptops were actually used and for what purpose. The three important areas of the core beliefs were:

- 1) a teacher's belief system regarding computers and technology
- 2) a particular teacher's concept of what good teaching looks like

3) a teacher's perception on the role technology needs to play in the lives of his students

With this article and those above, one major point continues to be emphasized. To effectively implement a 1-to-1 laptop initiative, each classroom teacher must acknowledge and define, through honest scrutiny, his pedagogical beliefs. If a teacher's belief regarding learning and teaching is fixed upon a traditional classroom where the teacher is the center and director of activity and assumes the role as the only bastion of knowledge, the implementation of a 1-to-1 laptop will not be successful. In other words, the teacher will be giving-up a portion of the classroom autonomy and pass it on to his students and be ready to act as a guide and co-learner. The teacher also must be willing to let the classroom extend beyond the classroom walls, allowing for research and communication with sources outside of a teacher's control. In addition, teachers will need to allow students to work in collaborative groups and explain their thinking and learning to peers. Thus, the role of the teacher must change. This new role no longer places the teacher as the center of the room- the hub by which all information is directed out.

Since each of the articles I have read so far emphasizes the fact that students in a 1-to-1 classroom will need to break out of the traditional style of learning and the traditional classroom setup, thus following classroom methods that resemble a more student directed learning. If each student this year will be using a laptop in my classroom, I knew it would be good to look specifically how each of my students will learn best. Two articles that helped in highlighting today's student were written by Stacey M. Meyer (2011) and by Thelma M. Gunn and Maurice Hollingsworth (2013).

The first article by Meyer is a study that guides the reader through the steps and reasons as to how and why today's teachers need to have a fuller understanding of who their students are. The author's intent was to make sure the classroom teacher is doing everything possible to allow each student to succeed by getting to know each student's preferred learning style. The Learning style test called the Dunn and Dunn Learning Style Inventory (LSI) was administered and analyzed. The LSI was made up of 5 categories and 21 elements. Once the results were in, the data was used to teach students about their individual learning preferences or styles. Then students were given study tools and taught learning techniques corresponding to their type of learning. Lastly, the authors checked to see if students adjusted their methods of learning to actually fit their individual style. This concept is closely linked to the methodologies presented by many teachers who have incorporated a successful 1-to-1 program.

Using Learning Style tests like the Dunn and Dunn Learning Style Index, I would like to begin each new school year by reviewing with students the results of their tests through formal individual discussions. The work of Mrs. VanderAa at the beginning of the year informs students of their learning style modality. Once the preference is determined, each student is shown how best to use his learning style as well as given resources to help apply his learning style to different classroom procedures. The intention is to allow students to use their gifts in a way that can help them succeed. Since laptop implementation requires a high degree of self-directed learning, if students discover their learning styles, they can adapt their learning in regards to best computer practices.

While the Meyer article focused on individual student learning, the second article by Thelma M. Gunn and Maurice Hollingsworth (2013) moves the spotlight back on the teachers. Well, sort of! I chose this article because it serves as a powerful reminder that the more I put into practice the use of classroom laptops and strive to pursue my own professional development, the more embedded computers will become and the more successfully students will learn. There are many ways teachers can continue to improve their craft of teaching. There is no single method all must follow, but this article makes it clear that the look of 21st Century classrooms will be different. How best can teachers envision and direct this change? With the help of peers, students, research, workshops, and administrators, changes are being made as classrooms are being shaken and retooled.

These are excellent resources, but the need for self-reflection is also very important. Teachers must pose questions like: How do I know if I am improving? How do I know what learning styles I actually engage? How effective is the laptop for my students? How often do I use a laptop? These are all great reflective type questions that demand honest answers. In the article, Gunn and Hollingsworth offer an extensive survey that teachers can take at the end of each school year to help in the reflection process. Also, within the article, it was stressed that today's students learn vastly different than students in the past. Traditional methods of learning and teaching and the traditional roles of teacher to student have been revolutionized and are no longer sufficient. In addition, the 21st Century has seen the rise of technology and the dependence so many of us has on technological gadgets. Yet, today's classrooms are trying to play catch-up in their attempts to implement technology at school. To better prepare today's students for the

future and give guidelines on how effective teachers are in using technology, a new approach to learning needs to take place. This new approach allows students the freedom to explore and discover not only how to learn but also the depth new learning methods need to go in expanding a student's method of knowledge building, retention, and to be effective problem solvers. Even though the 21st Century teacher has been taken out of the limelight in regards to classroom presence, the attitude and practices of the classroom teacher ultimately decides the level(s) of student success within the classroom.

The final two articles I reviewed were studies of in-class methods of using laptops for the purpose of replacing a formal lab activity with a virtual lab. The first study by Hilmi A. Lahoud and Jack P. Krichen (2010) offers some general guidelines regarding virtual labs based on their survey analysis. The second article by Rebecca K Scheckler (2003), critically examines the pros and cons of using virtual labs in a biology classroom.

From the beginning, both articles mention that no matter how advanced, detailed, or creative a virtual lab or simulation becomes, technology cannot replace both the classroom teacher and authentic, hands-on laboratory activities. In addition, Hilmi and Krichen point out that most students still prefer to learn and experience science through hands-on, classroom labs. However, in today's technological world, there are times when using a virtual lab can be advantageous. When reviewing virtual labs for classroom use, the best rule of thumb, according to Scheckler, is to seek out those that are weighted heavily in active engagement. Some considerations include: How true is the model to the biological system under study? What is being manipulated and how are the tools represented? Does the lab allow for interaction with other students? Are there elements of

uncertainty and speculation built into the lab? Also, the teacher should note what is included and excluded in the model because it is impossible to include every component or every detail. Hilmi and Krichen also add that students prefer virtual labs that have a high degree of usability. In other words, the computer-based lab should tie easily to other components of the lab like hands-on materials, the typing out of questions, and the scientific dialogue necessary in simulating the actual lab experience.

In reality, do virtual labs have what it takes to replace face-to-face classroom labs? Scheckler does offer some advantages to using a virtual format. A virtual lab activity can be repeated both for understanding as well as review. No different from the old filmstrips, *QuickTime* movies that augment a virtual lab are realistic and show plenty of detail. In terms of using dangerous materials, computer based labs offer a safe alternative for students to run experiments. Virtual labs can also project long term outcomes into shortened time periods; for example, the complete life cycle of a tree or the movement of tectonic plates can be witnessed in a relatively short period of time. Built into the labs there can be tutorials and glossaries, reviews of background concepts and terms, as well as discussion forums set up with real world scientists and access to research data.

In closing, using data from student surveys and classroom observations, each article offers some concrete examples of virtual labs that meet the needs of the student in administering authentic activities that are hands-on yet remain computer based.

METHODOLOGY

Pre 1-to-1 Interviews

Once the announcement that the 1-to-1 had been approved and slated to begin in the fall of 2014, I wanted to hear first hand the thoughts of the same students who would be piloting the 1-to-1. In the spring of 2014, while still in the eighth grade, I interviewed eight of this year's freshmen. These focus group interviews were the first major step in my Action Research Project. The focus group questions were meant to gather data about student readiness, expectations, and attitudes about using a laptop computer. It was a starting point for both the students and me.

Both interviews took place in the office of Mr. Pfeifle, the Principal of Edgerton Christian Elementary School (ECES). In all, there were four boys and four girls. The boys came on Wednesday, March 12 and the girls followed on Thursday, March 13. Participants were selected by one of the eighth grade teachers based on the student's availability at the given time and a desire to participate.

I did not know any of the students or their academic background prior to the interviews. Once the interviews were over, I sat down with one of the eighth grade teachers, Mrs. Mittelstadt. She told me four of the students were high academic achievers (three boys and one girl). Three were average or B range students (two boys and one girl) and the last had just recently joined the school. Before enrolling at ECES, this student had been home schooled. There was not much information regarding her academic status; however, there was a concern with her behavior socially. In class, she tended to be very vocal, loud, and lacking discernment regarding social cues and certain situations. This

behavior was not evident while in the focus group, nor did I sense any negative undertones from her peers.

Lastly, each of the eight students comes from two parent homes. Mrs. Mittelstadt considered each of the families to be middle to upper class families. She mentioned that three of the families own their own business; two of the father's have professional careers, and three families own a family farm. Seven are white and one boy is of African American decent.

I chose the focus group interviews for a number of reasons. Since my knowledge and experiences with this class is very limited, I felt a focus group would seem less intimidating to the students than individual interviews. For example, I wanted female responses as part of the data and individual interviews could be overwhelming to some if not all the girls, especially since we do not know each other. In talking with the principal, Mr. Pfeifle concluded that students at this age level would offer more information in a focus group setting because they would be more willing to talk as well as feed off each others' comments. Due to the content, it also seemed appropriate that a group of boys and a group of girls would be able to share similar experiences concerning computer usage both in and out of school. According to Mrs. Mittelstadt and Mr. Pfeifle, the natural grouping of boys to boys and girls to girls is still very strong for this particular class of eighth grade students.

Treatments

Following the interviews, I was able to use the collected data from the interviews to begin researching methods to bridge course content with laptop usage. I felt this was

the most effective_way to successfully integrate a 1-to-1 implementation of laptops into the classroom. Since then, I have designed ways in which these devices could be used. I planned to organize different treatments and a treatment schedule that includes laptop usage to accomplish the goals found in each of my Sub questions. For a complete list of the treatments, see Table 2: Treatments. This way, I hoped to gain a clear picture of the role laptops have played in the overall learning experience of my physical science students.

Table 2
Treatments

QUESTIONS	CLASSROOM TREATMENT	FREQUENCY	DATA COLLECTION	
			Qualitative	Quantitative
Sub question #1: What are student preconceived attitudes of the 1-to-1 concept?	Focus Group Interview	-Boys- Spring 2014 while in the 8th grade -Girls- Spring 2014 while in the 8th grade	-The two Focus Group Interviews	
Sub question #2: How can the 1-to-1 laptop initiative enrich each individual student of the science content?	Quizlet	-10 question Quiz last day of each week -Data based on 1st Semester (18 Quizzes)	-Questionnaire -Linkert style survey	Quizzes
	Gizmo	-6 assigned Gizmos -First 9 weeks of 2nd Semester	-2 Group Interviews	5 Question Quiz per each Gizmo
Sub question #3: Can a 1-to-1-laptop initiative enrich group projects in the science content?	Online Group Projects	-2 Projects -First 9 weeks of 2nd Semester	-Questionnaire -Likert Survey -Online group discussions	

Quizlet

One of my teaching goals for all the classes I teach is the memorization of terms that are deemed crucial to the content we are studying. Thus, each of my classes has its own unique set of material to be studied that is term related. Biology and anatomy students study Greek and Latin prefixes, suffices, and root words; chemistry students key on the Periodic Table, and physical science students focus on key terms found in each unit of study. The content may be different between classes but the overall framework is the same. With a goal of having students memorize specific science terms to gain a deeper level of understanding of the physical science material, my first classroom modification revolved around subquestion number two: How can the 1-to-1 laptop initiative enrich each individual student of the science content?

The treatment used to explore this question had students using a laptop to help study the terms. While using the laptop, I required all twenty-three physical science students to sign-up for Quizlet, an online study website where I downloaded all the terms and definitions students were responsible to learn. (Note: Each student was required to setup an account on Quizlet, but they were not required to use it.) As the applied treatment, Quizlet was meant to be used outside of classroom time and students had the independence to use Quizlet as they saw fit. Thus, from the first day of school and continuing every three weeks after that, a new set of terms was added to Quizlet. On the first day of school, students were given twenty-one terms to learn. The last day of each week, they were quizzed on these terms. After three weeks, fifteen new terms were added to the twenty-one. For the next three weeks, students were quizzed on thirty-six terms.

For weeks seven, eight, and nine, students were quizzed over forty-nine terms. Once registered, students could access each of the required terms and the new terms that would be added. I focused on using terms that were part of the unit we were studying (see Table 3 *Examples of Required Terms*). The number of terms for each unit averaged around fourteen. As the semester progressed, the terms accumulated, so by the end of the first semester the list of terms totaled eighty-five.

Table 3
Examples of Required Terms

Term	Definition
1) Boyle's law	For a given mass of gas at constant temperature, the volume of the gas varies inversely with pressure
2) Empirical formula	Gives the simplest whole-number ratio of elements in a compound.
3) miscible	Capable of mixing
4) precision	How close a series of measurements are to one another
5) sublimation	A change directly from the solid to the gaseous state without becoming liquid

The quizzes the students took on the last school day each week consisted of ten random questions. Students had a choice between a matching or a fill-in-the blank quiz. Since the matching quiz was an easier quiz, any student that elected to take this style of quiz had a 10% reduction in their overall score. Quizzes were printed on paper and scored immediately so that every student was made aware of his or her results.

Since Quizlet was the only source where students had access to all the required terms, the success or failure on each weekly quiz should be a strong indicator of the

effectiveness of Quizlet. Each week the scores on the ten questions quizzes were compiled. After nine weeks and then eighteen weeks, class scores were averaged as well as individual scores. In addition, an overall breakdown of grade frequency was graphed. The grades were averaged and grouped by percentages. Lastly, students were asked to complete a Likert style survey. The survey focused on students' perceptions and attitudes in using Quizlet. I looked to find if students found Quizlet successful, and if they preferred using this form of studying. Using the scores from the quizzes and students' comments from the survey, a good mix of quantitative and qualitative data was gathered.

Gizmos

As scientists in training, students in all science classes perform experiments. Traditionally, labs were hands-on activities that took place in a specific classroom during class time. Usually, students worked with a partner or partners as they manipulated lab equipment to answer science based questions through experimentation. Along with traditional labs, science teachers also used demonstrations to help teach new, important and difficult topics. With the onset of computers in the classroom and the 1-to-1 concept, the potential for labs and demonstrations to be performed on a computer by individual students or student teams has become a reality. However, is this form of instruction beneficial to the student? Can virtual labs be used to enhance traditional methods of teaching? I hoped to be able to answer these questions as I employed both the traditional hands-on lab and physical demonstrations with simulated labs that teach hard to understand concepts that are available with animations and computer generated activities

that can, for example, recreate past experiments and/or present experiments that would be impossible to perform in a high school lab.

With these goals in mind, the second major area on which I will be focusing for Sub question #2 is the use of *Gizmos*, a website designed exclusively for Math and Science teachers that has an extensive library of interactive online simulations. These simulations are meant to enhance current classroom content with challenging inquiry type activities requiring students to create hypothesis, perform experiments, compare data, and answer post-lab questions as they weave through online simulations and lab like activities.

Gizmos were chosen because this online simulation gave students the opportunity to experience a lab like activity that played-out on their laptop screens. My students were able to perform experiments like acceleration and terminal velocity when they dropped different objects off the Tower of Pisa. They could also manipulate variables and materials within the simulation. Examples of this was when they designed, built, and tested trebuchets on castle walls and used trial and error to discover Archimedes' Principle using a boat, water, and weights. When we studied the freezing point of water and the use of levers, Gizmos experiments allowed for the repeatability of experimentation when needed. Gizmos required students to not only participate in certain scientific procedures like testing circuits, but also to make predictions, write hypotheses, and interpret test results. These experiments could be performed during a class period or outside of the normal classroom times. I chose to have students work through two simulations per unit. The simulations were introduced during class time, usually on a

Monday. It should be noted that these simulations were not meant to replace traditional classroom labs. Rather, they were implemented as another method of teaching the curriculum that tied directly with the laptop concept and the learning styles of the students.

As the Gizmo labs were completed, I used two different methods to collect data when evaluating the Gizmos. The first, post lab assessment quizzes, gathered quantitative data. Each quiz was made up of five questions. In all, the quiz data consisted of six different Gizmos offered during the first half of second semester. The second method was a sit down group interview with ten students. I performed two group interviews of five students each, one male group and one female (representing 43% of the freshmen class). These post interviews used the same students as the pre-interviews that were completed almost a year ago with the addition of one additional male and one additional female student. The group interviews gathered feedback on student perceptions regarding the use of Gizmos. The intent was to find out whether or not the Gizmos proved to be useful tools in helping students understand the curriculum and was a method of learning students enjoyed.

Group Projects

For Sub question 3, students were placed in assigned groups. Since there were two group assignments to be completed, groups were rearranged for the second project. The first project was to create an online PowerPoint poster. The groups were allotted three weeks to complete this task. After shuffling the groups, the second project asked the newly assigned groups to produce a video. This project was also three weeks long. For

both assignments, all the work was to be completed using a laptop outside of the normal classroom times. Yet, the goal of these types of projects remained similar to traditional group projects where a group of students work towards completing a content driven task. For the two described projects, what set the traditional apart from the online was in two areas. First, since every student had his or her own laptop, there needed to be a certain level of communication that was done on the computer. Second, every aspect of the final product had to be computer generated. The Poster Project was assigned during the month of January and was used to help teach Newton's Laws. The Video Project centered on kinetic and potential energy. It was assigned in March. What follows is a brief outline of the two projects.

What is a PowerPoint poster? It is a one page PowerPoint presentation. This electronic presentation was put together on a Word document. These online posters were then printed to the size of 2ft x 3ft and displayed on the classroom wall. Carrying the theme of Newton's Three Laws, the goal in making the poster was to apply each of Newton's three Laws to specific historical events. Since we focused on Newton's three Laws of Motion, each law would focus on one event and each Law could only be used once. The student groups were to find specific historical events that dealt directly with Newton's laws. The three events had to fit the following requirements: one had to be a current event, the second, a historical event that happened in America during the 1800's and the last event, a Biblical story. Students researched the events and wrote summaries. Within the summary, they needed to discuss how Newton's Law applied to the individual events. Thus, each group discussed three stories using each of Newton's three Laws.

Students could design their poster as they wanted. Nonetheless, every poster was built with three columns- a column for each historical event.

To start the project, students were randomly divided into two person groups. Since the class consists of twenty-three students, there was one group of three. Upon completion of the project, each student was asked to privately complete a survey. The survey consisted of two parts. First there was a Likert style survey consisting of four questions. Following the Likert portion of the survey, students were asked to answer two short and fundamental survey questions: 1) What did you enjoy the most? 2) What did you enjoy the least?

The second online group project was the Video Project. This was also a three-week group project. Students were asked to create a video to teach the senior physics class about simple machines and their relation to potential and kinetic energy. As before, a major emphasis was placed on communication with laptops and a product that was computer generated (Appendix B). Unlike the Poster Project, students were placed into much bigger groups totaling four groups in all. Three of the groups were made-up of six students and one group consisted of five. After the videos were completed, students were surveyed with a Likert Style questionnaire as well as two general questions regarding their overall experience using laptops. Since students had to communicate online, I also followed their online discussions and used surveys to better grasp their attitudes when working alongside others group members online (Appendix C).

Summary of Treatments

The Treatments and Instruments used to answer my primary Action Research question included interviews that looked to answer Subquestion #1. The interviews took place at the end of these students' eighth grade year. The data was used as a way of discovering student preconceptions of laptop use and their actual thoughts of the way a year's worth of using laptops for physical science could look. Next, Subquestion 2 had students using two online computer based platforms: Quizlet and Gizmos. Terms quizzes were given weekly and two Gizmo sessions were incorporated into each unit of study. Data regarding Quizlet was collected each week throughout the school year. I collected Gizmo data during the third quarter (January-March 2015). The treatment and instruments for Subquestion #3 was from two-group project assignments designed specifically for laptop usage. One group assignment had students design a PowerPoint Poster. The second group project had students putting together a video. These were also assigned during the first half of the second semester.

Demographics

Because each freshman has a laptop, my research focused on the freshmen physical science class of 23 students. This class of fifteen females and eight males meets every afternoon during seventh period, a forty-seven minute class period. Twenty-two of the students come from a two-parent home. Each of the represented families would be considered middle to upper class. Six students live on a family farm, eight families have either a dad or mom that is a small business owner and three families have a least one parent that holds a white-collar position. Twenty-one students are Caucasian and two

students are African American. To the best of my knowledge, none of the students are on an Individual Education Plan (IEP) or medication, but two students do spend first period with the Resource teacher, Mrs. VanderAa. This is an additional study hall where Mrs. VanderAa holds students accountable for homework and helps them prepare for the upcoming school day. Academically, none of the students are failing physical science. On the week ending November 21, 2014, there were two students in the 60% range, four in the 70%, six in the 80%, and eleven in the 90%. The overall class mean is 88.7% and the Median is at 89.7%. Thus, the majority of the freshmen in physical science perform at a B or better, 17 out of 23. Lastly, 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 D).

To insure validity, data collection through triangulation was used for each of the sub questions. Sub question #1 relied on two focus group interviews. The core questions remained the same for both interviews and transcripts were made. Sub question #2 had students answer questionnaires, fill-in a Likert style survey, quiz scores were collected on JMC (Student Record Management Software used at SWC), and two group interviews were instituted. Following many of the same procedures, Sub question #3 also had questionnaires and a Likert survey students were asked to complete. In addition, online group discussions were recorded, placed into transcripts, and analyzed. Two colleagues were asked to help with the project. First, Mrs. VanderAa reviewed the questionnaires and Likert surveys offering suggestions and modifications to the wording of the questions. Mrs. Talsma, a freshmen English teacher, proofread the document.

DATA AND ANALYSIS

Data Introduction

The data from each subquestion was analyzed differently. Subquestion one had students participate in group interviews. Data from the second subquestion was more individualistic in nature. Here, individual results were based on individual usage. The amount of time spent studying for a weekly terms quiz and the attention given during a Gizmo session had a direct impact on individual student results. Subquestion number three was put into place during the second semester. Since the third subquestion dealt more with group work, students were asked to review their Online Discussion results both in an individual rubric and in the survey questions. This data was collected during the third quarter and completed with others in their class as they studied the terms. With the objective of enriching student learning of the physical science content, I looked to see if the laptop helped in overall quiz scores. Thus, I had been tracking the scores each student received on a weekly quiz. In addition, students were asked to fill out periodic questionnaires, three per semester, that related to the quizzes, amount of time spent studying, and overall attitudes in regards to using a computer based program like Quizlet to study.

Pre 1-to-1 Interviews

What follows is a summary of what was learned from the student focus group interviews that took place in the spring of 2014. At the time, the students that were involved in the interviews were in the eighth grade (Appendix E).

Overall, individual students were strongly in favor of the 1-to-1-laptop initiative for their freshmen year. When asked, all eight students had only one comment, a resounding “YES!!!!” The reasons why differed but the overall theme was that they all perceived computers as a powerful tool that can help better educate them, improve school attitudes, and prepare them for college and the work force.

Girl 3: Some kids will want to learn instead of just sitting there and twiddling their thumbs.

Mr. Dyk: Why will they want to learn rather than twiddle?

Girl 3: They are on a computer, why wouldn't they want to learn?

Girl 2: Computers are the future! I love being on it and they teach me a lot of stuff.

Each student reported having at least one computer at home with high-speed Internet access. It was also noted that there is rarely the issue of having to share computer time with a sibling and/or parent. Overall, when outside of school, the boys spent a lot more time on a computer compared to the girls. On average, the boys spent 4.25 hours on the computer per day (Boy 1- 5hrs; Boy 2- 4hrs; Boy 3- 5hrs; Boy 4- 3hrs). The girls all said they usually spend less than an hour on a computer per day. According to their responses, the girls tend to use the computer and Internet more for the purpose of school related activities as opposed to the boys desire for entertainment.

Mr. Dyk: What do you spend a lot of time doing on computers?

Girl 4: In computer class whenever we type our papers, we know how to save everything and do most stuff on computers.

Mr. Dyk: Most stuff, saving things... typing things, what else?

Girl 1: Yes, typing things and like using Open Office and Microsoft making slide shows and movies

Girl 2: Mostly at home I play games if I have time after chores and homework.

Girl 3: Just if I have homework I will do homework on it like typing and researching.

Mr. Dyk: What do you spend a lot of time doing on computers?

Boy 1: YouTube and playing games

Boy 2: YouTube. Playing games

Boy 3: Same

Boy 4: Playing games and YouTube!

Also, the boys felt they had a high level of familiarity working a computer. On a scale of 1-10 (10 the highest), the boys averaged 8.25 (9-Boy 1; 9-Boy 2; 8-Boy 3; 9-Boy 4) and the girls averaged 6.625 (7-Girl 1; 7.5-Girl 2; 6-Girl 3; 6-Girl 4). Interestingly, each of the boys claimed that they did not know more than their parents in regards to computer knowledge. As for computer use, each of the boys said that they spend the majority of time surfing the web especially watching YouTube videos and playing games. Minecraft was the game of choice for three of them. The only girl to play games was Girl 2 who likes to play Barnyard. YouTube was the number one site the boy students would go to for the purpose of watching others play games, learning how to master a game, and watch highlights of sports like the NFL and Nascar. What stood out for me regarding computers in the classroom was that students had little idea of what to do or what could be done with a computer. They all claimed to use computers for research, typing papers and for taking Accelerated Reader tests. Even though ECES has a computer cart with MacBook Airs, these laptops are being utilized mostly as a research tool. It seems most computer related assignments given in middle school involved surfing the web or researching. For anything more than basic research, students had little experience of using computers to further their school work in a deeper, more meaningful way as is evident in the following responses. Take special note of the responses especially Girl 2.

Mr. Dyk: What areas do you expect to use the laptop next year?

Girl 2: Typing

(long pause)

Mr. Dyk: Like learning how to type? Learning the keyboard?

Girl 2: Yeah...

Girl 1: Researching things on it

Girl 4: Things like all assignments and papers.

Mr. Dyk: So you think the pencil is going to be thrown away? The paper thrown away?

Girl 4: No, I think it is good to have some on paper, some on laptops, certain assignments.

Mr. Dyk: What do you think?

Girl 3: Yes, I think the same thing they all said.

Mr. Dyk: Any other areas?

(long pause)

Girl 1: No.

Mr. Dyk: That's like a \$1,000 to get rid of a pencil.

Girl 3: Like in Soc., researching topics, like history and things like that

Girl 2: Having assignments on paper is not that bad to me.... It is like the same thing.

Girl 4: Yeah, it's not that much different.

Wow! As shown earlier, students are really excited about using and/or owning laptops but when it comes to education, they have very little idea on how they can be used in the classroom. Girl 2 even goes so far to admit that computers are not that big of a deal; they really are not any different to the way things have been done before. As for the boys, their responses were not that much different.

Mr. Dyk: What areas do you expect to use the laptop next year?

Boy 3: Like typing your reports and pages that you do for stuff

Mr. Dyk: What kind of stuff?

Boy 3: Well, like if you have to type an essay you can just type it and e-mail to your teacher.

Boy 1: Take notes...

Boy 4: Like science notes the teacher makes us take notes on something. This is a better way because I might actually be able to read it.

Boy 1: Play some games in it- not at school! Just after school.

All: Yeah!

Mr. Dyk: Anything else? Any other ways you may use the laptop?

Boy 4: Maybe searching the web to get information on something to type an essay.

The boys repeat the theme of using a computer for typing and research. The only difference is that the boys plan to play games when outside of school. In all, these responses should not be much of a surprise since the eight students interviewed have not experienced a 1-to-1 classroom.

Nonetheless, the following responses shed a different light on the 1-to-1. The following question was asked: “Do you think the laptops will make a difference in your education?” Girl 4 made the following comment: “Well, obviously you will learn how to use computers more, so in the future if you need to for your job, you would know what to do. Knowing how to use them will let you get a good job.” One last comment by Boy 1 when asked the same question reveals a similar attitude, “My dad uses a computer all the time. He had to learn it on his own and still has problems. If we can learn how to get the most out of computers in school we will be much better off because other kids are also learning how to use computers.” What is striking regarding the last two comments is that these students see a computer as something they need to learn how to use, learn how to understand. Yet, the focus of the 1-to-1 laptops is to use a laptop to better learn the subject matter. This perception of the computer runs complimentary to the purpose of the 1-to-1 program.

If the 1-to-1 is to be successful, this writer believes it is imperative that students first understand the purpose of the laptops. They are not simply replacing pencil and paper. Rather, it needs to shown that a laptop can deepen a student’s understanding of the subject matter. These students also want to have fun, and they want to be active participants in their education. What follows are ways I introduced students to the

educational use of computers. As is evident in their responses, students found these methods to be good ways to weave laptops into the classroom.

This discussion started with asking students how they could use laptops in science. Boy 3 suggested notes and Boy 4 said for essays and typing up lab reports. This was all the boys could offer. I asked if they could do a lab on computer. This got them talking!

Boy 1: Probably

Boy 2: Like computerized dissection of maybe a cat

Boy 4: I would rather open up a cat!

All: Yeah!

Boy 2: But, we could do both. Start with a computer and then use a real cat.

Boy 4: We wouldn't break as much stuff and it could be less expensive.

Mr. Dyk: How about games?

Boy 3: Maybe like science games the teacher wants you to play. I would like that.

Boy 1: Me too!

Boy 3: There are games you can play to help with things like math and words. There probably games for science.

Mr. Dyk: Is it a game?

Boy 3: Sort of but it is a learning game.

Mr. Dyk: Would it be helpful?

Boy 4: Yeah probably plus it would be fun.

Boy 1: And I would probably pay more attention because if I am taking notes now it is errrr, I can't learn taking notes.

Mr. Dyk: So, laptops could help keep things more entertaining, more focused?

All: Yeah!!

One of the girls, Girl 3, had this to say about games. "School will be better because it will be more fun, like it is boring sometimes. Like in math, if we could play more games, learning games, it would help us, be more fun, we would want to learn more if it was more fun." It seems that students have the mindset that fun leads to better learning. It is not the purpose of this paper to examine this idea; however, computer-learning games could lead to greater student participation and increased practice of reviewing the

material. Is it fun? Maybe, maybe not, but it is a vehicle for engagement when done effectively and thus should not be overlooked or taken lightly.

The last idea I proposed was blogging or forum type discussions. This is a way of holding a discussion where all the responses are typed and able to be read by the whole class. Rather than hearing what a student has to say, the class can read the response. The boys were much more hesitant towards the idea than the girls. However, Boy 4 stated, “I guess it could be better because the quieter kids might, like they don’t want to talk during class but might want to type it out.” The rest of the boys fully agreed. As for the girls, the following discussion took place.

Girl 2: Yeah, you would be able to read what people say and know what they mean.

Girl 1: That would be cool. That would be fun.

Girl 4: It would help us learn because it is more than just in school, it is extra stuff like homework. Additional stuff to do outside of school.

Girl 3: And you actually have to think and respond, actually

Girl 4: If someone is too quiet or shy to answer in class, so they have to online.

Girl 3: It would be great!

All: Yeah!!!

In looking back at the responses of the focus groups and the time spent with these eighth grade students, I was excited to begin exploring ways to implement the use of laptops to spurn the learning process. I believed these students would be open to new ideas and methods that could deepen their understanding in physical science. Who knows, they might even have a little fun during the process.

Learning Styles Survey

Another area of importance in finding direction for implementation of the 1-to-1 was getting to know each of the twenty-three students’ individual learning styles. At the

start of the 2014 school year, SWC's Resource teacher, Mrs. VanderAa, evaluated the learning styles of all the freshmen. This evaluation was based on six different tests and defined each student as either an auditory, visual, or tactile learner. From the overall scoring on these tests, each student's particular learning style was calculated and defined. The results of the assessment found over half of the incoming freshmen, 61%, were determined to be Visual Learners (14 out of 23). The Tactile Learners made up 30% of the class (7 out of 23), and 9% were scored as Auditory Learners. With this in mind, it seemed that the majority of these students were wired to learn best by watching and participating in hands-on type activities as opposed to lectures and worksheet assignments. If implemented properly, laptop usage could be tailored to fit these learning styles.

Quizlet

One of the biggest reasons I felt the freshman could learn by using Quizlet was because it offered multiple ways for students to study. As visual and tactile learners, students were able to manipulate flashcards, play competitive games, and take practice tests. There was even an option to have the material spoken to the student. This allowed auditory learners to both read and hear the material.

With different forms of practice, students using Quizlet had a computer based method of study at their fingertips. If used, it was an efficient way for students to gauge how well they knew the material. On the last day of each week, students were given a ten question quiz over the

required terms. A computer randomly selected the quiz questions. Appendix F contains a copy of what the quizzes were like. Following the ninth time students had taken a quiz; I passed out a survey with the purpose of gaining insight on how students study for the weekly quizzes and if a computer based method of studying like Quizlet was beneficial (Appendix G). With the survey, I was attempting to see if there were parallel threads concerning student results from taking the weekly quizzes and using a computer based method of study. By comparing student results with methods of study, the survey was looking to answer the following questions: How are students studying? Is Quizlet being used? Does Quizlet have an impact on student results?

On the first day of school, students were given twenty-one terms to learn. Thus, when one looks over the data in Figure 1, it is important to understand that every three weeks, the amount of terms students were responsible for increased. When seen this way, it is noteworthy that the

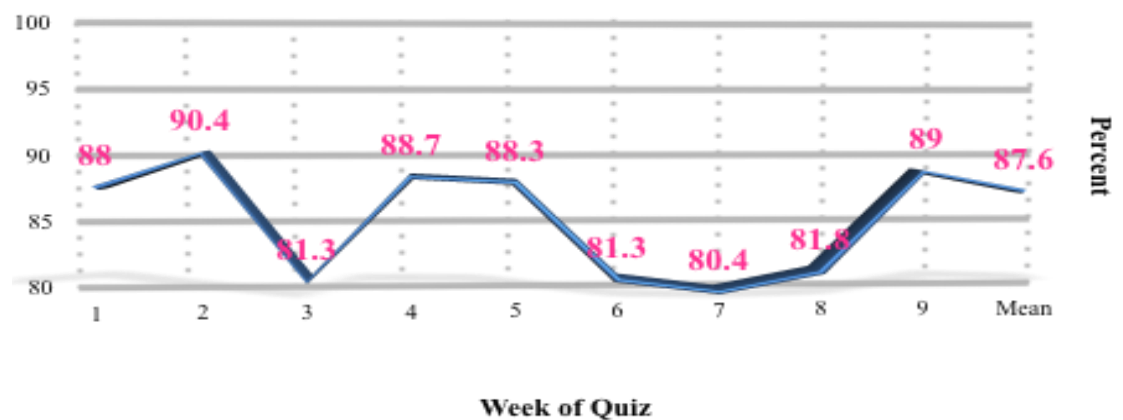


Figure 1. Student mean scores per week over first nine weeks, ($N=23$).

final quiz given, week nine, showed the second highest overall average, 1.3% less than week two. Continuing to look at the graph, the overall mean for the nine weeks was at 87.6% for the twenty-three students in physical science. The overall data shows for the first quarter that overall student averages were very high. Even with additional terms every three weeks, the class still maintained very respectable overall averaged scores. This was impressive considering the amount of material students were responsible to learn outside of regular classroom time.

On the survey, students responded to numerous questions regarding studying for the weekly quizzes and the use of Quizlet. Even though the class as a whole did very well throughout the nine-weeks as seen in the 87.6% mean, Table 4 breaks down the amount of days students used Quizlet. The majority of students used Quizlet and 65% of the students used it at least two or more times per week. The majority of students spent 2-3 days per week studying (43%). Zero days, one day, and four-five days of studying all had four responders totaling 17% for each category. At 4% was one student who studied everyday. Even though this student was the only one in the *everyday* column, this student's overall result did not reflect the above-mentioned high scoring trend. It should be noted, this student does not place in the top overall academic one-third of the class, and finishing with an average score of 85% over the nine weeks is a big accomplishment for this student. It is interesting to note that the three students who did not use Quizlet to study are also not in the top half of the class.

Table 4
Days/Weeks Using Quizlet (N=23)

		Number of Days/week using Quizlet				
		6-7	4-5	2-3	1	0
Number of Students		1	4	10	4	4

Along with Figure 1 and Table 4, I have also included Figure 2. The data for Figure 2 was also taken from the student questionnaires and is both an indicator and a predictor of the success each student would have with regards to number of days per week they used Quizlet. Since Table 4 is a broad look at the overall number of days per week a student studied on Quizlet, Figure 2 looks more intently at individual scores and days spent on Quizlet. From the overall data about class average scores for the nine weeks, student average was very high. Even still, there is clearly a trend in the overall days studied and overall success on the quizzes. What is evident in all cases except the *everyday* studier, is that statistically one has a better chance of learning the terms when using a computer based method of learning. The more days a student had studied, the higher the overall average in outcome was seen. Figure 2 displays the actual student scores based on the number of days per week studied. It is clearly shown that the more days a student spends during the week using Quizlet, the higher their score turned-out being. Thus, one could predict that more days studied the higher quiz scores will be. The four students who responded by stating they spent zero days studying using Quizlet averaged a 70%.

other than trying to review with other students just before class begins. “I do not study for the quizzes.” “I don’t study. I just remember talking about them in class.” “I forget about the quizzes and try to study with (name) before class begins.”

Regarding the other responses, there seemed to be two common themes that revolve around the fact that Quizlet helps a student study. The first theme is that a computer based study aid like Quizlet helps because it makes studying easier. Of the twenty students that used Quizlet, twelve used the word “easy” in their response. The following two responses are examples of this general theme. “Makes it easy to study my words and understand them.” “Makes me memorize terms easily and quick.”

The second overall theme was that Quizlet is a fun way to study. Eleven students used the following words or phrases in their response: “fun,” “entertaining,” “games,” and “like using it.” Below are a few actual responses.

“I remember the words better, has great features, and it is fun.”

“It is an easy way to study because it makes studying fun.”

“I can study using games.”

“It is a way to study that is exceptionally entertaining.”

“For me, it is hard to study normally. Quizlet makes it fun.”

For the second question regarding the use of Quizlet, students were asked if Quizlet is the best way to study? From the survey, none of the students circled either *Disagree* or *Strongly Disagree*. Even the students that claimed to not use Quizlet did not rule out this method of study. The majority of students circled *Agree*. (See Figure 3 for a more detailed look at the data.) This majority, nine students or 39% of the class,

responded in the Explain section that Quizlet was fun, easy, has games, is not boring, and that Quizlet helps sometimes. In all, these students found that Quizlet was a method of study that was different, competitive, and useful. Two examples of responses are:

“There are a variety of ways to study, so I don’t get bored.”

“Makes studying fun, competitive, and motivating.”

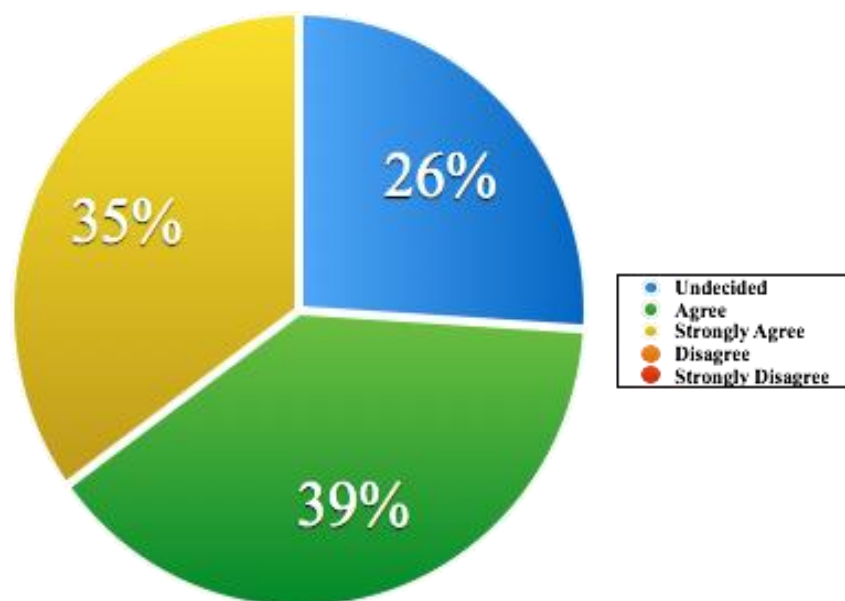


Figure 3. Likert Survey: Quizlet is the best way to study, (N=23).

These students certainly agree that Quizlet is a very engaging way to study because of its many features and computer based way of learning. These statements are also examples of the rest of the responses in this category.

Six or 26% of the students circled Undecided. These students were not sure if Quizlet was the best way to study. The following are quotes from four of these students.

“Helps sometimes, but not always.”

“No other way to study. Quizlet makes the flashcards for me”

“Quizlet is not completely boring, but I do not like using the computer to learn.”

“I like using paper better, but Quizlet does help me study.”

What seems to stand out for these students is that they see the benefits of using this form of studying but tend to still want to use more traditional methods. These students are not completely sold on the use of computers as the best way to study. The final eight students (35%) circled Strongly Agree. These students tended to see Quizlet as a very effective, entertaining, fun, and convenient way to study terms. Five students mentioned the use of electronic flashcards. They like to use the traditional flashcard method of studying but found using computer based flashcards as efficient and easy because they did not have to make the flashcards. One student summed it up by stating, “Studying without having to make the notecards myself is very convenient.” One other theme that these eight students seemed to express was that a computer-based way of learning is preferred. “I think Quizlet is the best because I can study anywhere and anytime.” Another response along the same idea is that “there are a variety of ways to study. I like the games and flashcards and the practice test helps a lot.” Lastly, another student mentioned that when using a computer to study they do not need to worry about losing their study material. “Quizlet is on my computer, and so I don’t have to worry about leaving my flashcards at school or losing them.”

Being able to study anytime using different forms of study and having all the material downloaded by a teacher making it readily available are the major features these students found helpful when using a computer based method of study like Quizlet.

What if Quizlet was not available? Would students be doing as well on the quizzes? For student responses, I broke them down into three categories: *Same*, *Better*, or *Worse*. Zero students responded that they would be doing *Better* without Quizlet. Four students felt they would be doing the *Same* and the remaining students (19) stated that they would be doing *Worse* without being able to use Quizlet. For students that claimed *Same*, there were two interesting reasons. The first is evident after reviewing the overall data. If a student is not using Quizlet, this question does not have any relevance. There is no way to gage *Better* or *Worse*. Similarly, one student offered an interesting perspective. “My scores would be the same because I do not use Quizlet. But if I used Quizlet, I think my scores would be much better.” It seems this student either realizes the benefits of using Quizlet or has come to the conclusion that if he/she used Quizlet he/she would at least be spending some time actually studying the material. The majority of students, nineteen out of twenty-three predicted they would be doing *Worse* if not for the use of Quizlet. The following quotes sum-up the reasons students gave.

“Horrible because I don’t have the sit down in me to do actual studying, but with Quizlet I can study anytime and anywhere.”

“Probably worse because Quizlet is great help. It lets me study in different ways.”

“40-50% because I would not study as much because using my computer is more fun.”

For the majority of students, they see the benefits of using a computer-based method of study. In addition, the overall student scores show that using Quizlet does

make a difference. After nine weeks of studying terms and taking quizzes, the majority of students found Quizlet to be a very important component to their success.

At the end of 2nd Quarter and after students were able to see their overall grade for the last nine weeks based on one quiz per week, students were asked to complete a Likert style survey. The questions dealt with the effectiveness of Quizlet as an online resource to help students study. One question went right to the heart of the matter: What kind of resource is Quizlet in helping learn the material? As the data in Figure 4 shows, 43% gave the highest rating possible by circling the number three. Another 48% of the students circled the number two, just one number sequence below Great. Thus, 91% of the students believe Quizlet is a very useful resource.

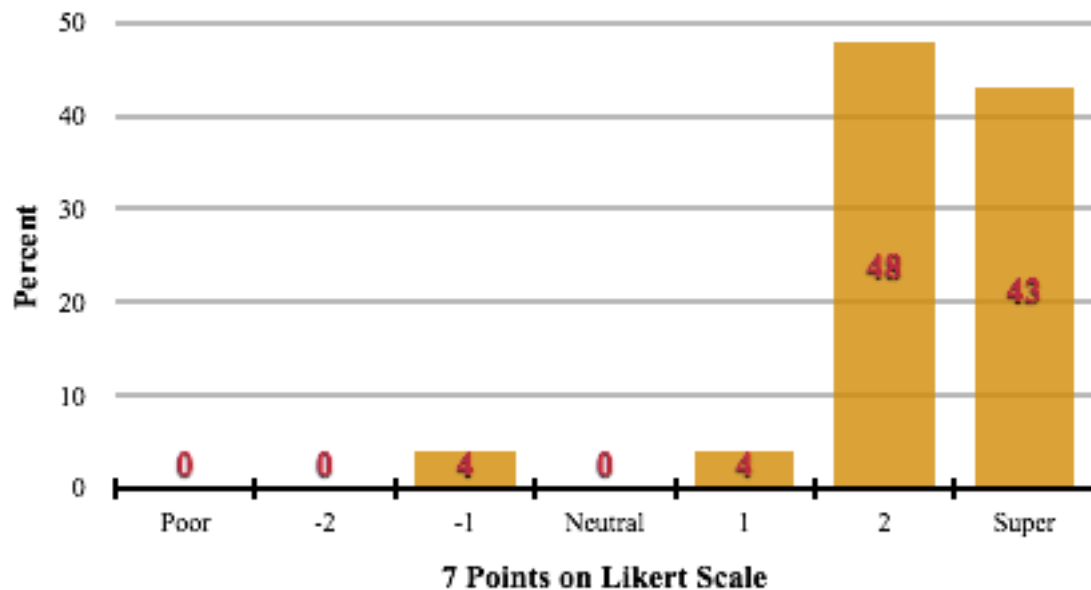


Figure 4. Student responses to Likert Survey: What kind of Resource is Quizlet in Helping Learn the Material?, ($N=23$).

The other major question to take note of is the role Quizlet played in each student's success. 30% of the students did note that Quizlet played a major role. The average score of these 30% was slightly above 95%. In fact, all but one score (87%) was greater than 90. This was not bad considering students were required to know eighty-five terms by the end of the first semester.

Gizmos

The data for the Gizmos used two focus group interviews and six post lab quizzes. Looking back over the responses to the interview questions, I felt the first question would help initiate the discussion of Gizmos, but I also wanted to know if students actually found the Gizmos to be easy or difficult. From my experience, the more difficult assignments tend to be the ones students complain about the most, especially if it is a type of assignment that is repeated over and over. Over the course of third semester, there was no complaining or outcry in doing any of the six assigned Gizmos. The class actually coined Mondays as "Gizmo Monday" since they had seen the pattern as it developed over the semester.

Question number one asked if students found the Gizmos to be challenging. The male students were mixed but the majority of them implied that there was a learning curve to overcome, especially at the beginning of the year. One student said, "At the beginning they were challenging, but as the year went on I thought they got easier." One other very interesting response was, "Some were harder than others and some were easier than other ones were, a little bit more challenging, presented a challenge but it was fun."

Challenging or not, the responses from the interviews made it clear that the males had no problem embracing the use of Gizmos. As for the girls, they found Gizmos to be easy as long as there was an understanding of the material. Since Gizmos are based on individual work, following instructions is very important. One female noted, “For the most part they were pretty easy because they kind of explained it to you and stuff.” As long as a particular Gizmo was understandable, students had very little problem completing the task.

The second question had students evaluate if the Gizmos helped them learn the material. Each male and female student interviewed stated that the use of the Gizmos did help them learn the material. One of the attractive features of a simulated lab is the pictures and games attached to the method of completing the exercise. Multiple students mentioned this feature. “Yeah cause it shows you a picture and, like, yeah...” as this student was interrupted by a peer who made it clear that the Gizmos did help learn the material. “Yeah, cause you kinda play like little games I guess and it would be more fun for kids to learn and they could learn it easier.” These comments are consistent with how Gizmos are designed. As for the philosophical, the following student quote cuts right to the heart of the matter. “I think it helped a lot because it is more hands on for the tactile learners. It’s a lot easier because it’s more hands on stuff, as most classrooms are just auditory and visual. This presents a tactile way for the tactile learners to learn.” So not only do students appreciate the visual aspect of a Gizmo but also the ability to interact with the simulation using one’s hands adds to the overall success of a Gizmo. Lastly, one other student commented that this method of experimentation removed any dangerous

situations that a traditional lab might have because, “It allows you to experiment with different situations in a digital environment, so it’s not the danger of doing it in real life but then you can do it digitally on a computer without having to worry about any effects, negative effects.” From the interviewed students, there was a deep sense of effectiveness in learning the material that a Gizmo could offer.

If a computer based simulation like Gizmos is able to offer audio, visual, and tactile ways for students to engage the material, then how does a Gizmo compare to a traditional lab format? Students were asked to give feedback by comparing a computer-based simulation with a hands-on lab. Some of the differences students noticed were that a Gizmo sets-up very quickly. Another difference was found in the individualistic nature of a computer-based lab. Gizmos did not offer the social aspects inherent in group based labs. This was a negative aspect to using a Gizmo as was made evident by the following comment, “Ah, it could be bad because you would not be in groups, so you would not be able to, like, get ideas from other people maybe.” Having to work alone also left a void in the overall explanation of a particular simulation. Not having the recourses of other students or the help of a teacher, working through an assigned Gizmo, could be a frustrating experience. “Yeah, I would say that when you are working with it all the materials are in front of you instead of on a screen. It’s a lot easier that way because you can walk through the steps rather than push a button and it does it for you. Like, you can go through it easier, the steps and learn it and understand it better. You can ask questions about it where if you are by yourself doing the Gizmo on the computer it is not as easy to do that.” Four of the five girls found traditional labs to be easier. The most positive

response was the freedom a Gizmo could offer. “I do like it that you can do it at home rather than just do it at school and have to just do it at school only.”

The final question simply asked if the use of Gizmos was worth it. The overwhelming response was “Yes.” Each student commented that the Gizmos were worth it. Some of the reasons were found in the fact that Gizmos offered the flexibility in moving at your own pace, the ability to do the work either at home or a school, and a method of learning appreciated by the both the visual and tactile learners. This point was made clear when a student offered the following statement, “Yeah, I think it was very beneficial because, like I said, it is a more tactile thing. For other kids it is visual too, so it helps in two areas. I say over all it was very beneficial to have the Gizmos.”

One student managed to see both sides of the argument. She stated that the use of both the simulated lab and a traditional lab could greatly increase one’s knowledge of the material. “If you do a Gizmo packet and like a traditional lab, and if you do both of those, at least on one of those you would pick something up on how you did it.”

The reasons may have been varied, but the overall theme from the group interviews was clear- Thumbs-up to Gizmos! Now, with that said and student perceptions discussed, how did the students perform on post Gizmo quizzes?

The day after a Gizmo was assigned, we would discuss the simulation as a class. We would review the objectives of the Gizmo and answer any student questions. Then, students were given a five-question quiz that was based on the material found in the Gizmo. These were multiple-choice quizzes where students had four answers to choose from. Appendix H has two of the quizzes students were asked to complete. The results

from the six quizzes can be seen on figure 5. Since the maximum number of correct answers was five for each quiz, the graph shows how many questions students got correct for each of the quizzes. For example, Quizzes 2 and 6 had the highest number of students with zero wrong (11 each). Quiz 5 had 12 students finishing with only one questions wrong. No students got every question wrong. The overall scoring was very consistent for each of the six quizzes. Out of twenty-three students, the class mean for all the quizzes was 84%. Figure 6 gives the mean scores for each of the six quizzes. Considering the class mean for all the assessments during third quarter was 86%, students would seem to be correct in stating that the Gizmos did help them learn the material. From the interviews, this

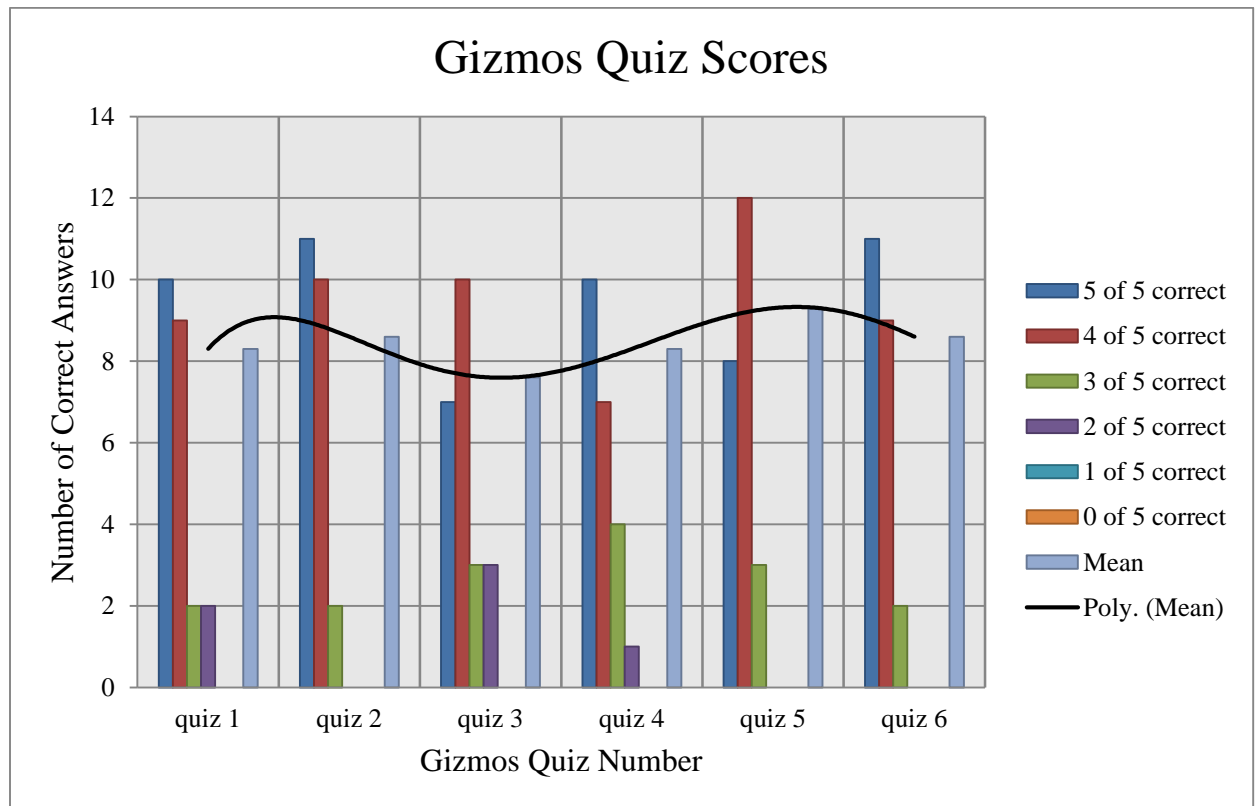


Figure 5. Student scores from Five Question Quizzes after completing a gizmo, (N=23).

student came to the following conclusion when asked, “Did the Gizmos help you learn the material?” “I think the Gizmos were worth it because, I mean, a lot of us learn from them, like, (sic) got to understand the material more. I don't know, I just think doing the Gizmos was worth it, like, got to learn more things about them, yes.” One last statistic that is a good indicator of the overall success of the students working with this online simulation is that 83% of students either had perfect scores (5 out of 5) or only one wrong (4 out of 5) on a quiz. Considering the complexity of the quizzes and the newness of the material, the quiz results supported how the students verbalized the effectiveness of Gizmos.

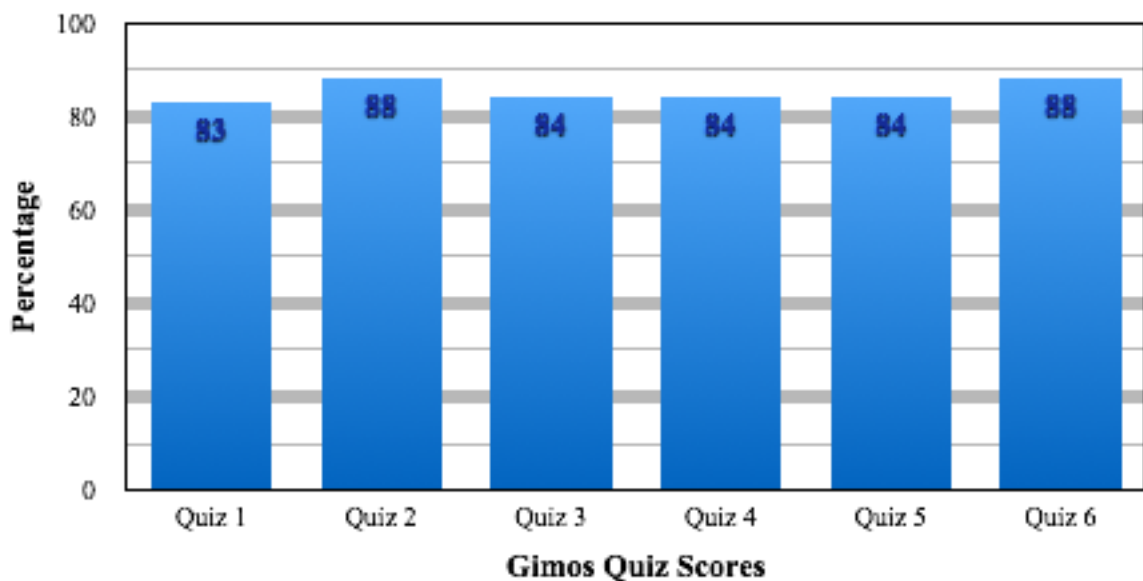


Figure 6. Mean scores for each of the Six Gizmos Quiz scores, ($N=23$).

Group Projects

Online Group Projects were a new approach to each of the twenty-three students. Having to place everything on a laptop was more challenging than previously thought

even though students had little difficulty researching online. They could get their hands on any piece of literature they needed and downloading a poster template saved them a tremendous amount of time. However, staying on task and contributing to the group was a challenge for some and using the computer was not so easy for others. Hoping to gain a pulse of student attitudes, I formulated two types of surveys. For one, a questionnaire, asked two simple survey questions after the project was finished.

- 1) What did you enjoy about the poster project?
- 2) What did you dislike about the poster project?

The second survey technique employed a Likert scale. This survey offered five possible responses from *strongly agree* to *strongly disagree*. Students had four questions to answer (Table 5). Both the questionnaire and Likert scale were administered following completion of the two projects.

Table 5
Student Responses after Completing Group Projects. (N=23)

POWER POINT POSTER					
Topic	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Group Input from discussion was beneficial	1	3	8	9	2
I enjoyed the cooperative learning project	1	1	6	10	2
With this project I gained a greater understanding of the science content	0	1	3	16	2
My group worked well during the project	1	3	10	6	3
POTENTIAL AND KINETIC ENERGY VIDEO					
Group Input from discussion was beneficial	0	0	5	12	6

 POWER POINT POSTER

Topic	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I enjoyed the cooperative learning project	0	3	8	9	2
With this project I gained a greater understanding of the science content	1	1	1	13	7
My group worked well during the project	0	0	6	12	5

Poster Project

When reviewing the data based on survey question number one, a few themes rose to the top. To begin with, the most important item students liked about the online group project was they were able to work with another individual. Fifteen of the twenty-three students responses mentioned having partners in a positive light. Some were simple and direct comments like, “I liked the partner I had. We worked very well together.” To more specific comments like, “I liked my partner. She was responsible, a pleasure to work with and got her work done. I got it done quicker and had less work to do because there was more than just me.” Along with those ideas, a student passed this on, “That we had partners because partners help me focus on one thing, so I can learn it.” Another student mentioned the following; “I liked working with other people. It teaches me to learn how to tolerate people more, and it helped because I got it done quicker and had less work to do because there was more than just me.” From the Likert scale, eleven students either agreed or strongly agreed to the benefits of working with a partner. Six students remained neutral and only four students commented negatively. Having partners

was beneficial to the overall success of the project as well as a welcomed component to how the project was set-up.

The second most notable response was how the use of a laptop brought a real professional look to the final product. Eleven students carried a theme of how the overall project looked when finished. “I liked how the poster looked when it was all done. Our poster was unique and very professional looking.” Another student’s response was, “I also liked that you could research some things online and put everything together online. We could play around with how we wanted it to look, change fonts and color. I liked making this kind of poster.” One last example follows along the same theme. “I liked that we made the poster on computers. We didn’t have to deal with the actual paper poster, and everything was easier to keep track of. It was more organized and easy to make. I hope we can do another poster project this year.” After the posters were completed, a local print shop made them into 24” x 36” wall posters. Seeing their work on the wall added to the professionalism and overall pride felt by the students. There were many “wows” and students hanging around looking at other group’s posters and discussing the content. Hung posters also brought exposure to this project that extended outside the classroom walls. Peers, teachers, and parents were able to see the finished products.

The third item mentioned by students dealt directly with using laptops for research. At times, there was the convenience of being able to continue working and researching outside of the normal school hours. Eight students noted that they enjoyed using their own laptops for finding stories, writing and being able to work more on their own schedule. The two following responses sum up this general theme of thought. “It

was fun searching for the different stories needed for the project. It was fun looking up the current news events and Bible stories. I did not have to go to the library or search through the newspaper. The computer made research much easier.” The second student gave the following response, “I also liked that you could research some things online and put everything together online. I was able to work on it when I wanted and share ideas on Schoology.”

As for the dislike question, by far the number one response, seventeen out of twenty-three students wrote about was having to communicate using Schoology. From the responses on the questionnaire, the problem seems to be two fold. First, these students lack the experience and discipline in using this format of communication. “We have to have discussions online when it would be way easier to text.” Another student added, “Everything has to be communicated over Schoology. I never think to go on Schoology as my first priority.” Having grown to use things like twitter and texting to communicate, students did not take kindly to using something they saw as inconvenient and clunky. “I always forget to go on Schoology. I don’t go on my computer that often and neither did my partner.” Not using Schoology was the first issue. The second was found in the inability to dialogue when using Schoology. When comparing to texting and tweets, Schoology is not always readily available, does not give instant feedback because students are not always in front of their laptop, and Schoology relies on all parties staying abreast of the communication and then making sure to respond in a timely manner. “I did not like going on Schoology. No one goes on Schoology. How am I supposed to communicate if there is no one there?” The next response reiterates the frustration. “I am

never on Schoology at the same time as my partner. We don't get to talk back and forth and share ideas. Since my partner never checked, I did my own thing." Without an open line of communication, three students mentioned that they felt they had to do the bulk of the assignment as is evident in the following response. "I did most of the poster myself. I couldn't count on my partner to do anything. If I gave him something to do, he wouldn't have done it anyway since I was not able to talk to him online because he never would go online." Schoology takes both responsibility and time to use. Rather than being informed of a response, students had to deliberately go online and see if there were any postings. Thus, to be effective, students had to go online. "It is kinda hard to communicate well with my partner when neither of us go online. I would prefer to do it alone. That way I know it is done." Overall, students enjoyed working on this project, but disliked having to communicate with Schoology.

Video Project

Like the Poster Project, student responses to making the video showed a high level of satisfaction in working with others. This was evident in the Likert scale where seventeen students agreed or strongly agreed that their group worked well together. In fact, not one student survey showed disagreement with the statement. The questionnaire also saw the same results. The following quote sums it up well. "My partners and I were all willing to help out to get a good grade and no one slacked off. Everyone had a part." Actually, when reviewing all the student responses to the survey question asking what they liked the most about this project, seventeen of the twenty-three students mentioned their group. For some, this was due to the camaraderie between group members. The next

three quotes give evidence of this. “My group because they were really fun.” Another student wrote, “I had people in my group that I enjoyed working with. We worked well together and everyone did their part.” Lastly, this short comment sums up the theme of what many had written. “My group, they were fun and we laughed a lot.”

Another dynamic that helped make working in groups such a positive experience was the confidence the students had in their group members. From the seventeen group responses to the question above, twelve of those responses focused on the strength of their group. The following quotes help support this idea. “Our group was cooperative so the video went smoothly.” “Getting a good group. They were all super responsible and compatible.” “Everyone had their own part and things got done well.” Lastly, “I liked my group because they got their stuff done and had good ideas for the video.” Like the poster project, these students saw merit in working with others according to the Likert survey. Eighteen students felt the group input was beneficial to the success of the project. With a score of 8.1, students saw the positive role in working with others. Even though this was an assignment that focused heavily on using laptops outside of class, it was great to hear of how much face-to-face interaction there was amongst group members. Students still needed to come together, work alongside their peers, and physically participate.

Having a positive working experience within each of the groups was a great thing, but what impact did this have on the use of the laptops? Again, one of the goals of this project was for students to use their laptops as part of the communication process. With this in mind, there seemed to be a shift in student attitude towards using Schoology. Dubbed by one student as “the new Southwest Facebook,” the idea of using Schoology as

the one platform for all discussion posts seemed to be catching-on with many of the students. Over the three-week span, there were a total of 788 discussion entries posted. That comes out to an average of 37.5 posts per student or 12.5 posts per student per week. In contrast, the Poster Project had a total of 129 posts with an average of 5.6 posts per students or 1.9 posts per week over the same amount of time. Why such a jump? For the first time, it seemed students found educational value by communicating online using Schoology and many students actually commented that they enjoyed using this method of communication. “Everyone commented on Schoology frequently.” “Everyone in my group participated. In other projects some people didn’t participate, in this one, everyone did both on Schoology and by working on the video.” When asked how they viewed their own contribution to the group, one student was quoted as saying, “I thought I helped plan what we would do in the video, and I contributed a lot in the online discussion just like my group partners did.” Why such a reversal in attitudes as well as overall use in regards to Schoology? Unlike the Poster Project, students were required to go online and use Schoology. From the beginning, students were told the requirements for the project. One requirement was that they had to go online and make four posts per week. Of the four posts, three had to be done on separate days. At the end of each week, I visited each student and went over the postings with him or her. After reviewing their input for the week, I was able to answer questions, offer advice and direction. I also gave them a score based on the rubric requirements. As the number of posts sky rocketed, so did the overall attitudes of the students. Holding students accountable with clear expectations helped them understand that using just one platform like Schoology for all their postings can be

beneficial to both the group as a whole and each of the individuals. In the end, it may not be as easy to communicate as texting or a phone call but if set-up properly, a discussion forum platform like Schoology can be a great center piece for discussions, questions, and learning.

As attitudes towards Schoology changed, another major issue still needed to be addressed: was Schoology instrumental in helping students create a successful video? After assessing each video based on a rubric, each of the four groups scored extremely well with a class average of 94%. Each video was very creative and informative and each student was able to meet the online requirements. The scores would serve to be part of the evidence that this project was a success. How did the students perceive their own learning? Again, in review of the Likert Survey, twenty out of twenty-three students checked agree or strongly agree to gaining a greater understanding of the science content with this project. Some of the positive responses were, “I got to have a better understanding of potential and kinetic energy in a fun and non-classroom way.” Another quote was, “I am a kinesthetic and visual learner and this was an awesome way to combine both.” One last quote states, “I enjoyed the discussions on Schoology. It was great we could work on it online. We all communicated great and helped each other.”

Since a high level of online traffic was documented, and students found this method of communication to be both successful and even delightful, I wanted to know what they were actually communicating online. I reviewed the students’ postings and narrowed down their discussions into five categories that the majority of posts seemed to gravitate around. Table 6 has a list of the five discussion topics. In reviewing each of the

posts, I was struck by the fact that the topics followed the content of the assignment from beginning to end, and how the students used their posts to organize the content of the project. Below, I have included some examples of the discussions to help illustrate the online chatter in the development of the videos. I choose to include data from Summary Points one and two.

Table 6
Top Five Online Discussion Topics (N=23)

Summary Points from Online Discussion
1. Deciding of what individual jobs would be
2. Content of the video
3. How the content would be used in the video
4. When and Where filming would take plac
5. Wrapping up the project

Summary point one had students decide on the role of each group member. One of the groups had one person make the selections. “Here are the jobs. Hunter- Filmer; Tate- Editor; Parker- Abstract; AJ- Writer and Summarizer; Sam- The Drawer.” The other three groups used a combination of discussing and deciding how each would participate. Some people said what parts they wanted; and other people’s jobs were decided for them.

Student 1: Camerman, Summarizer, Editor, Scriptr maker, Star of this thing, the researcher, art director, the jobs are limitless.

Student 2: If no one has the researcher I could do that if no one else wants to? And Zuzu is gonna be the camera women??

Student 1: Yes Ashley, would you mind being the crazy teacher?

Student 3: So lets go over this again... Me: Summarizer; Zuzu: Camera women/script maker? (I’ll see what she thinks about that one), Ashley: Main actor, Shayla: ????, Annika: ????, Sarah: she said she would act, but I don’t know what she’s thinking otherwise.

Student 4: I can do the research Hannah!! unless someone else wants to

Student 5: Put me wherever

Student 1: I am already working on the script and can also film it since I am writing it.

Student 6: Me too! I'll take whatever is left

This group had members bring ideas to the discussion and others willing to be placed in the needed slots. The posts show that all members were part of the discussion and each had the opportunity to choose their role(s).

One last group also opens the conversation with one person taking the initiative to give each member their choice. What follows is members "signing-up" for their task.

Student A: so we should pick our "jobs"... someone needs to run the video, I can write the abstract of the project, we need someone to write a summary, help make the graphs and tables, and probably someone to organize what we are going to do through out the video- a director- and maybe someone who can help with the simple machines- finding a video of making one?

Student B: I can write on the whiteboard though out the video unless someone else is cuz I feel like we'll have to do that for a lot of stuff.

Student C: I will be the person who puts the video together

Student D: I can kind of be the director like film everything; I can also just help everyone else like the person who is making the graphs...

Student E: I can make the graphs and tables if no one else is

Student F: I can do the summary

The approaches may have been different, but each of the three groups used the online discussion forum to fill the necessary slots to get the project going. Each member of the group had a say in the decision process and was part of the discussion.

The second Summary point had students looking into the content of the videos. Again, what follows are snippets of the discussions that took place within two of the groups. Take special note of the openness of the discussions, participation by each member, and the high level of respect for ideas.

Student 1: A list of simple machines we would use are an inclined plane, wheel and axle, lever pulley, wedge, and screw.

Student 2: We could use simple machines as one of our terms!

Student 3: We could use potential and kinetic energy and maybe a third class lever as terms

Student 1: Great ideas! I looked up experiments on kinetic and potential energy, and I found this popsicle one. Look it up and let me know what you think. I don't know how it works though.

Student 4: We also have to decide what experiment we would use in the video, and how we could make a graph and table out of it. I will look at the popsicle one and let you know what I think.

Student 5: We could use that lab we did yesterday for a simple machine because I'm pretty sure an inclined plane is a simple machine. The popsicle experiment is pretty cool to and I think we can make it work for the video.

Student 6: So I looked up some examples of what we have to show, and these are some things I came up with.... For potential energy- a yoyo (anyone have one?), Kinetic energy- this is easy, just anything like bouncing an basketball, Simple machines: some small things like a knife (not sure if I can bring that to school) for a wedge, and just a jar for an example of a screw, a scissors would be both a wedge and a screw. So if we want to use these examples then all we'd need to bring from home is a KNIFE, YOYO, JAR (maybe Mr. Dyk has some).

What progressed through the discussions was a willingness to introduce ideas and share information. Students respected the work of others and their ideas. Students also stayed on task, researched, and took the responsibility of bringing to school necessary materials. There was even the ability to share a video online allowing each member of the group the ability to view and comment on it. A second group also showed this level of respect for each member and the desire to work on the project collectively.

Student A: So is this all about potential and kinetic energy?

Student B: Yes

Student C: Yeah. We have to explain how they work

Student D: for one of our machines I think we should use an incline plane. We could do it how we did it in class today. I feel like this would be an easy machine to build and use...

Student A: We should do a slingshot for potential energy

Student C: So I think we should use a pendulum as one of our simple machines because that is something easy that we can easily explain. I can make it this weekend

Student D: I will try to remember to bring a screw and screwdriver thing that my brother has and then we can use that as a simple machine.

Student C: I think we should a slingshot because it will not only explain what we need it to, but also because we can launch something cool and it will interest out viewers!

Student E: I have a white board that we could hold up and write the term and definition on because he said we can't use slides. Then after showing the term we could show the simple machines that we have?

Student F: Lever and inclined plane are some of our vocab words so we could maybe do those and have some of our terms done- we need 5 total and then more for extra credit

Student B: I think for the video we should have some acting parts and some with the white board.

Student C: I am making the arrows that we are using for the video just in case someone was wondering. We wanted to laminate them so we could use dry erase markers, correct?

After going through the discussions for the video project, I was struck by the ability that an online forum can have in bringing the teacher into the mix of any group. In a way, I had become an extension of each group capable of listening in on the ideas, questions, and input from each group member. If needed, I could also include my own comments and answer questions. Traditionally, teachers moved around the room able to take part in only one group discussion at a time. Now, when structured properly, teachers can participate in all project discussions even when they happen simultaneously and outside of the classroom.

INTERPRETATION AND CONCLUSION

When looking back over the introduction and implementation of a 1-to-1 classroom, I can say with confidence that the 1-to-1-laptop initiative has been a success. Students really enjoyed having their own laptop computer and many are still giddy about this privilege. Plus, it would seem the deck was stacked in favor of laptops because of the high percent of visual (61%) and tactile (30%) learners. Yet, many of these same students

also realized laptops have had a positive impact on their overall learning in the physical science classroom. What follows are some of the effects of a 1-to-1 laptop initiative.

Starting with Sub Question #1, it was evident from the student focus groups that even when these students were in eighth grade they were looking forward to using a laptop in the classroom. The interviews made it clear the each individual student was in favor of the 1-to-1 laptop initiative and very excited to begin. When asked, all eight students had only one comment, a resounding “YES!!!!” The reasons differed but the overall theme was that they all perceived computers as a powerful tool that could help better educate them. With this in mind, I felt it was important to find the appropriate methods to make this happen in my physical science classroom.

Building off of the student perceptions of computers in the classroom, Sub Question #2 focused on two methods individual students could use to engage the classroom content and better equip them to learn the material with a laptop. The first method was with Quizlet. The other method was with the lab simulations known as Gizmos.

Since one of the requirements in physical science is the learning of terms, every three weeks a new list of science content terms was given. This list was added to the previous list of terms. On the last day of each week, students were quizzed over the terms. The only study method I offered was Quizlet, a computer based study program. Each of the terms was downloaded and students could use the study techniques Quizlet had to offer. Over all, student quiz scores were outstanding as was evident in the nine-week average of 87.6% for all students. One of the surveys found that 87% of the

students did use Quizlet whereas 13% do not. Interestingly, the three students who responded with a *No* were also the only three students that did not pass the quiz taken on week nine. Their scores were 44%, 60%, and 50% for a 51% average. The other twenty students averaged 88.7% on the week nine quiz. When surveyed after 18 weeks of terms and quizzes, 91% of the students believed Quizlet was a very useful resource. Of the 91%, those that indicated Quizlet played a major role in their success had an average score over the entire semester that was slightly above 95%. This is not bad considering students were required to know eighty-five terms by the end of the first semester.

It is expected in a science classroom that students would participate in labs. What if a portion of these labs were actually performed online? The results from using Gizmos, an online lab simulator, showed both positive student attitudes and high quiz results. From student surveys, it was clear that online simulations are both challenging and engaging. Students liked the fact they could repeat experiments, work at their own pace, and continue with the simulation outside of school. The simulations still demanded student involvement through the manipulation of online tools in the testing process. Gizmos were able to engage the tactile learners because they were hand-on as well as engage the visual learners because of the graphics. Finally, the post-lab quizzes also showed positive results. After performing six online labs using Gizmos, the class mean for all the assessments was 86%. In addition, after six quizzes, 83% of students either had perfect scores (5 out of 5) or only one wrong (4 out of 5) on all their quizzes. From the interviews, one student summed in up well. "I think the Gizmos we're worth it because, I mean, a lot of us learn from them, like, got to understand the material more. I don't know,

I just think doing the Gizmos was worth it, like, got to learn more things about them, yes.”

Sub Question #3 was interested in how laptops could be used in group work. Using two group projects, students found they could learn the science material collectively. In these group projects, the overall student product had to be computer generated and students needed to use a discussion forum to complete the task. Both the posters and videos were well done. Eleven groups designed posters with an average score of 94%. There were a total of four groups for the videos. The average scores for the videos were 96%. When it came to the online discussions, the poster project saw very few online postings (129 over three weeks). In contrast, the video project had 788 postings in all over the same time span. In addition, the video postings did a much better job of including all group members, keeping students informed, engaging ideas and keeping students on task. Each student had a voice and was able to contribute not only to the discussions but also in the decision making process. For the teacher, I found that well designed projects that ask students to use an online forum are an excellent way to stay engaged with each group as well as stay in-tuned with each student.

In closing, the intent was to bring a new technological device into the classroom to broaden each student’s educational experience, make use of technological changes, and improve teaching. The computers were also to aid independent learning from studying terms, to investigating scientific processes, to building deeper relationships between peers and a classroom teacher. Looking back, I firmly believe each of those intentions was met.

VALUE

Every school year, new challenges and goals come along tied to ideas, unforeseen outcomes, improved methods of instruction, greater understanding, deeper levels of learning and sometimes, predictable results. This year's physical science classroom has been that kind of year. When looking back over a year's worth of listening, researching, planning, discussing, implementing, and following a 1-to-1 laptop initiative, the most important thing I learned was that the call for me as a teacher remains the same: challenging my students to grow in knowing, loving, and serving God and others. A laptop does not change this fact. Nonetheless, a laptop in each of my students' hands has transformed the way my students learn the science material, how I teach, and how we learn from each other. From what I have learned so far, many of my students have been able to realize that a computer is more than a device to play games or communicate with others. Rather, a computer can also be a powerful tool that has the potential to allow students greater understanding of themselves and the world around them. Through new types of study techniques and simulations, students have gained greater confidence in their abilities to learn. The success of so many students in regards to the weekly terms quizzes and the ability to interface and manipulate objects like atoms on a computer screen has changed the way I present concepts and how the concepts are discussed in class

For the majority of this study, laptops in my physical science class had students working outside of the normal classroom time slot. Whether students were studying for the weekly terms quizzes, being introduced to a new concept with a simulation, or

piecing together a project, the computers certainly have the potential to help each student better understand the required physical science material. With laptops, the core curriculum and requirements remain the same. What has changed with the introduction of the 1-to-1 is the methods both teachers and students can use to teach, study and learn. Not all students either prefer or find laptops to be useful but for the majority of these students their lack of success was not in the methods but their lack of input. Three keys I have found to make a 1-to-1 program beneficial to those willing. First, the use of the laptop needs to be part of a student's daily routine. Second, students need to experience success. Lastly, students need to have clear instruction and expectations. Like all good teaching, organization and clear communication of expectations is paramount. For each of the projects and methods of study listed above, what has become much clearer for me is the impact computers have on today's students and the expectations each of them have in regards to a laptops place in the classroom. If today's classrooms can blend subject matter content with teachers following good teaching practices and students working towards a common outcome with laptops, tomorrow's students will benefit greatly.

For next year, the biggest area I would like to improve upon is to find ways to create a greater sense of community when using laptops. The last group project, the video project, showed that students could share their thoughts, offer creative ideas, hold each other accountable, and ensure a successful final product when they work together. Can students apply community-oriented principles to other areas of learning like studying for tests, writing lab reports, and discussing classroom content? I hope to work in some new ideas and procedures to foster a stronger sense of community. In closing, I have every

intention in using the treatments like Quizlet and Gizmos next year. Since success was also found when students worked in groups, I also plan to continue assigning group projects. Lastly, I plan to use additional methods of implementing laptops in the classroom. As a physical science class, we have been working hard at getting comfortable with using laptops and I firmly believe that continued work and ideas will only further advance the positive effects of laptops in the classroom and the learning these devices can add.

REFERENCES CITED

- Advanced Circuits. (n.d.). In *explorelarning.com*. Retrieved from <http://www.explorelarning.com/index.cfm?method=cResource.dspView&ResourceID=509&ClassID=2611600>
- Gunn, T. M., & Hollingsworth, M. (2013). The implementation and assessment of a shared 21st century learning vision: A district-based approach [Electronic version]. *Journal of Research on Technology in Education*, 45(3), 201-228.
- Lahoud, H. A., & Krichen, J. P. (2010). Networking labs in the online environment: Indicators for success [Electronic version]. *Journal of Technology Studies*, 36(2), 31-40.
- Meyer, S. M. Learning styles and study habits: Teaching students to take control of their own learning [Electronic version]. *Rising tide*, 4(2011), 3-39.
- Parr, J. M., & Ward, L. (2011). The teacher's laptop as a hub for learning in the classroom [Electronic version]. *Journal of Research on Technology in Education*, 44(1), 53-73.
- Potential Energy in Shelves. (n.d.). In *explorelarning.com*. Retrieved from <http://www.explorelarning.com/index.cfm?method=cResource.dspDetail&ResourceID=399&ClassID=2611600>
- Scheckler, R. K. (2003). Virtual labs: a substitute for traditional labs? [Electronic version]. *International Journal of Developmental Biology*, 47(2/3), 231-236.
- Storz, M. G., & Hoffman, A. R. (2013). Examining response to a one-to-one computer initiative: Student and teacher voices [Electronic version]. *Online Research in Middle Level Education*, 36(6), 1-18.
- Windschitl, M., & Sahl, K. (2002). Tracing teachers' use of technology in a laptop computer school: The interplay of teacher beliefs, social dynamics, and institutional culture [Electronic version]. *American Educational Research Association*, 39(165), 165-205

APPENDICES

APPENDIX A
LEARNING STYLES TEST

Basic Training Learning Style Evaluations

Name _____

Berghuis Learning Styles Test #1: (Circle one)

Visual Auditory Tactile/Kinesthetic Combination _____

Berghuis Learning Styles Test #2: (Fill in the graph with what your results showed)

Visual 

Auditory 

Tactile/Kinesthetic 

Berghuis Analytic/Global: (Fill in the graph with what your results showed)

Analytic 

Global 

Berghuis Multiple Intelligences: (Fill in the graph with what your results showed)

Linguistic 

Logical-Mathematical 

Spatial 

Bodily-Kinesthetic 

Musical 

Interpersonal 

Intrapersonal 

APPENDIX B
VIDEO PROJECT RUBRIC

Potential/Kinetic Energy Online Project (Video Project)

Individual Name _____

Group Names _____, _____, _____, _____, _____	Points earned per Maximum		
Kinetic Energy	/5		
Potential Energy	/5		
Time Deductions			
Number of simple machines used in video	/2		
Extra Credit: Additional simple machines			
Abstract	/3		
Summary- 5 points with evidence	/5		
Originality	/5		
Number of Physical Science terms used in video	/5		
Extra Credit: Additional terms			
Data Table based on an experiment	/3		
Graph from data table	/3		
Extra Credit: Additional graph (based on experiment)			
Discussion deductions			
Individual			
Job title (turned in on time 3/13)	/1		
Job description (turned in on time 3/13)	/1		
Online Discussion	<u>Week 1</u> /1	<u>Week 2</u> /1	<u>Week 3</u> /1
Description of 3 most important contributions (turned in on time 3/26)	/3		

Total Points _____

Final Score _____

APPENDIX C
VIDEO PROJECT QUESTIONNAIRE

Online Potential/Kinetic Project Questionnaire

- A. I enjoyed the Potential/Kinetic Energy online cooperative learning projects.
 1) Strongly Disagree 2) Disagree 3) Neutral 4) Agree 5) Strongly Agree
- B. By completing the video, I gained a better understanding of simple machines, potential and kinetic energy
 1) Strongly Disagree 2) Disagree 3) Neutral 4) Agree 5) Strongly Agree
- C. I wish I could have worked independently rather than in an online cooperative learning group
 1) Strongly Disagree 2) Disagree 3) Neutral 4) Agree 5) Strongly Agree
- D. I feel that my full learning potential is lost when I am forced to work with others
 1) Strongly Disagree 2) Disagree 3) Neutral 4) Agree 5) Strongly Agree
- E. I do my best work, get better grades, and understand the material better when I work with others
 1) Strongly Disagree 2) Disagree 3) Neutral 4) Agree 5) Strongly Agree
- F. I do my best work, get better grades, and understand the material better when I work alone
 1) Strongly Disagree 2) Disagree 3) Neutral 4) Agree 5) Strongly Agree
- G. Overall, how effectively did your group work together during the Poster Project?
 1) Poorly 2) Adequately 3) Well 4) Extremely Well
- H. What did you like the most about the online poster project? Why? Offer 2 items
 1)
 Why?
 2)
 Why?
- I. What did you like the least about the online poster project? Why? Offer 2 items
 1)
 Why?
 2)
 Why?
- J. Offer 2 ways online group projects in physical science can help improve the teaching of physical science material?
 1)

2)

Post Questions:

A. I feel that online cooperative learning projects help me in learning the physical science concepts

- 1) Strongly Disagree 2) Disagree 3) Neutral 4) Agree 5) Strongly Agree
Why?

B. What is the most beneficial part of a group project?

C. So far, how would you rate your participation in the online project? (1 very low- 5 very high)

- 1 2 3 4 5
Why?

D. Has the input from your group members in this project increased? Offer 2 specific examples

from the discussion forum as to reasons Why or why not?

E. Has the input from group members been beneficial to the project? Yes or No

If YES- offer 2 reasons why.

1)

2)

If NO, offer 2 ways to help make other group partners contributions beneficial.

1)

2)

APPENDIX D
INSTITUTIONAL REVIEW BOARD FORM



INSTITUTIONAL REVIEW BOARD
For the Protection of Human Subjects
FWA 00000165

960 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
 mquinn@montana.edu

Administrator:
 Cheryl Johnson
 406-994-6783
 cherylj@montana.edu

MEMORANDUM

TO: Gregory Dyk and Walt Woolbaugh
FROM: Mark Quinn, Chair *Mark Quinn CJ*
DATE: December 1, 2014
RE: "The Use of Laptops in a Physical Science Classroom" [GD120114-EX]

The above research, described in your submission of November 26, 2014, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

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

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

APPENDIX E
PRE 1-TO-1 REPORT

Student Interviews

I conducted two interviews. Both interviews took place in the office of Mr. Pfeifle, the Principal of Edgerton Christian Elementary School (ECES). In all, there were four boys and four girls. The boys came on Wednesday, March 12 and the girls followed on Thursday, March 13. The interviews took place on two consecutive days beginning at 2:30 each day. Four eighth grade students participated each day. The only requirement I asked regarding interviewees was that they would be going on to Southwest Minnesota Christian High School (Southwest) next fall. With this made clear, participants were selected by one of the eighth grade teachers based on next years' requirement, the student's availability at the given time, and a desire to participate. I did not know any of the students or their academic background prior to the interviews. Once the interviews were over, I sat down with one of the eighth grade teachers, Mrs. Mittelstadt. She told me four of the students were high academic achievers (three boys and one girl). Three were average or B range students (two boys and one girl) and the last had just recently joined the school. Before enrolling at ECES, this student had been home schooled. There was not much information regarding her academic status; however, there was a concern with her behavior socially. In class, she tended to be very vocal, loud, and lacking discernment regarding social cues and certain situations. This behavior was not evident while in the focus group nor did I sense any negative undertones from her peers. Lastly, each of the eight students comes from two parent homes. Mrs. Mittelstadt considered each of the families to be middle to upper class families. She mentioned that three of the families

own their own business; two of the father's have professional careers, and three families own a family farm. Seven are white and one boy is of African American decent.

I choose the focus group interviews for a number of reasons. Since my knowledge and experiences with this class is very limited, I felt a focus group would seem less intimidating to the students. For example, I wanted girl responses as part of the data and individual interviews could be overwhelming to some if not all of the girls, especially since we do not know each other. In talking with the principal, Mr. Pfeifle, he concluded that students at this age level would offer more information in a focus group setting because they would be more willing to talk as well as feed off of each other's comments. Due to the nature of the content, it also seemed appropriate that a group of boys and a group of girls would be able to share similar experiences in regards to computer usage both in and out of school. According to the Mrs. Mittelstadt and Mr. Pfeifle, the natural groupings of boys to boys and girls to girls is still very strong for this particular class of eighth grade students.

Beginning in the fall of 2014, the school where I teach, Southwest Minnesota Christian High School (SWC), will be requiring all of the incoming freshmen to have in their possession a laptop computer. Known as a 1-to-1 classroom or one laptop per student, I am required to include the necessary means to incorporating laptop technology in my Freshmen Physical Science class. The Administration of SWC has not given any clear path to follow in regards to this implementation leaving these decisions up to each individual teacher. The focus group interviews are the first major step in my Action Research Project. The focus group questions are meant to gather data in regards to

student readiness, expectations, and attitudes in regards to using a computer. In addition, I plan to use the data collected regarding student knowledge of computers and areas of interest when using computers by these students to begin researching and building the most effective ways to improve the success of a 1-to-1 implementation of laptops for next school year.

After reflecting on the time spent with both groups and reviewing their responses, it is evident that the eight students I was able to spend time with have a high respect for school, education, and each other. During both sets of interviews, students spoke positively of their school, teachers, homework, and fellow classmates. They appreciated their teachers because these students felt the teachers found interesting ways to make school more fun all the while using effective methods to teach. For example, one of the first questions I asked is below. Take note of how each student responds and there is agreement amongst the group that their teachers do a good job of making class time enjoyable and educational.

Mr. Dyk: Think about in class, what kind of classroom experience helps you learn the best?

Boy 4: If the teachers are like more fun to us, try to get us involved more.

Mr. Dyk: OK, try and get you involved. Can you think of ways they try to get you more involved?

Boy 4: Like...ah....

Boy 2: If you're like doing a review, like play games.

Boy 1: Yeah

Boy 4: You can have a hands-on experience with whatever you are learning about too

Boy 2: Just like reviewing in class. Learn something new then find ways to teach us again by doing something fun.

Mr. Dyk: So, some good ways to get you involved. You guys seem to say that you don't want to just sit there.

All: No

Boy 4: We want to be involved.

Boy 3: That's what are teachers try to do. Keep us involved. Not just sitting there but using our hands and working through problems with interesting activities and stuff like that.

Boy 4: and having fun.

Mr. Dyk: Think about in class, what kind of classroom experience helps you learn the best?

Girl 1: One on one.

Girl 2: When the teachers like explain things to you instead of giving you an assignment and then having you learn it on your own.

Mr. Dyk: How do your teachers teach?

Girl 4: They really make sure we know it before moving on.

Girl 2: They like really explain things well and want to help.

As is evident above, throughout the interviews each student was involved in the conversations. They also maintained proper manners and posture throughout the time spent together. They respected each other's speaking time by not interrupting or speaking over another student. We sat around a round table. Going around the table, Student 1 was at my left followed by Student 2, Student 3, and Student 4 who was seated on my right side. For some of the questions, the responses would proceed in a sequential order based upon seating arrangements. Other questions would be asked in a more open forum style allowing students to "jump-in" and answer at their own discretion. At times, humorous comments were offered but the interviews rarely swerved off track. In all, both sets of students were a joy to be around.

I had a list of fourteen focus questions for the boys and nine focus questions for the girls (See Appendix). After reviewing the audio of the boys, I felt five of the original fourteen questions could be eliminated. From these focus questions, I also prepared potential probing questions that could be asked if a deeper understanding was needed. The boys' interview lasted 22:02 minutes and the girls was 15:31 minutes. Overall, each

individual student is strongly in favor of the 1-to-1-laptop initiative for next year. When asked, all eight students had only one comment, a resounding “YES!!!!” The reasons why differed but the overall theme was that they all perceive computers as a powerful tool that can help better educate them, improve school attitudes, and prepare them for college and the work force.

Girl 3: Some kids will want to learn instead of just sitting there and twiddling their thumbs.

Mr. Dyk: Why will they want to learn rather than twiddle?

Girl 3: They are on a computer, why wouldn't they want to learn?

Girl 2: Computers are the future! I love being on it and they teach me a lot of stuff.

Each student reported having at least one computer at home with high-speed internet access. It was also noted that there is rarely the issue of having to share computer time with a sibling and/or parent. Overall, when outside of school the boys spend a lot more time on a computer compared to the girls. On average, the boys spend 4.25 hours on the computer per day (Boy 1- 5hrs; Boy 2- 4hrs; Boy 3- 5hrs; Boy 4- 3hrs). The girls all said they usually spend less than an hour on a computer per day. According to their responses, the girls tend to use the computer and Internet more for the purpose of school related activities as opposed to the boys desire for entertainment.

Mr. Dyk: “What do you spend a lot of time doing on computers?”

Girl 4: In computer class whenever we type our papers we know how to save everything and do most stuff on computers.

Mr. Dyk: Most stuff, saving things... typing things, what else?

Girl 1: Yes, typing things and like using Open Office and Microsoft making slide shows and movies

Girl 2: Mostly at home I play games if I have time after chores and homework.

Girl 3: Just if I have homework I will do homework on it like typing and researching.

Mr. Dyk: What do you spend a lot of time doing on computers?

Boy 1: YouTube and playing games

Boy 2: YouTube. Playing games

Boy 3: Same

Boy 4: Playing games and YouTube!

Also, the boys felt they had a high level of familiarity working a computer. On a scale of 1-10 (10 the highest), the boys averaged 8.25 (9-Boy 1; 9-Boy 2; 8-Boy 3; 9-Boy 4) and the girls averaged 6.625 (7-Girl 1; 7.5-Girl 2; 6-Girl 3; 6-Girl 4). Interestingly, each of the boys claimed that they did not know more than their parents in regards to computer knowledge. As for computer use, each of the boys said that they spend the majority of time surfing the web especially watching YouTube videos and playing games. Minecraft was the game of choice for three of them. The only girl to play games was Girl 2 who likes to play Barnyard. YouTube was the number one site the boy students would go to for the purpose of watching others play games, learning how to master a game, and watch highlights of sports like the NFL and Nascar. What stood out for me regarding computers in the classroom was that students had little idea of what to do or what could be done with a computer. They all claimed to use computers for research, typing papers and for taking Accelerated Reader tests. Even though ECES has a computer cart with MacBook Airs, these laptops are being utilized mostly as a research tool. Since students feel strongest in their web searching abilities, assignments given by middle school teachers that allow them to surf the web makes sense. For anything more than basic research, students had little background of using computers to further their school work in a deeper, more meaningful way as is evident in the following responses. (Take special note of the responses especially Girl 2.)

Mr. Dyk: What areas do you expect to use the laptop next year?

Girl 2: Typing

(long pause)

Mr. Dyk: Like learning how to type? Learning the keyboard?

Girl 2: Yeah...

Girl 1: Researching things on it

Girl 4: Things like all assignments and papers.

Mr. Dyk: So you think the pencil is going to be thrown away? The paper thrown away?

Girl 4: No, I think it is good to have some on paper, some on laptops, certain assignments.

Mr. Dyk: What do you think?

Girl 3: Yes, I think the same thing they all said.

Mr. Dyk: Any other areas?

(long pause)

Girl 1: No.

Mr. Dyk: That's like a \$1,000 to get rid of a pencil.

Girl 3: Like in Soc., researching topics, like history and things like that

Girl 2: Having assignments on paper is not that bad to me....It is like the same thing.

Girl 4: Yeah, it's not that much different.

Wow! As shown earlier, students are really excited about using and/or owning laptops but when it comes to education, they have very little idea on how they can be used in the classroom. Girl 2 even goes so far to admit that computers are not that big of a deal; they really are not any different to the way things have been done before. After their freshmen year, this would be a great line to repeat back to this class and have them reflect on whether this still holds true.

As for the boys, their responses were not much different.

Mr. Dyk: What areas do you expect to use the laptop next year?

Boy 3: Like typing your reports and pages that you do for stuff

Mr. Dyk: What kind of stuff?

Boy 3: Well, like if you have to type an essay you can just type it and e-mail to your teacher.

Boy 1: Take notes...

Boy 4: Like science notes of the teacher makes us take notes on something. This is a better way because I might actually be able to read it.

Boy 1: Play some games in it- not at school! Just after school.

All: Yeah!

Mr. Dyk: Anything else? Any other ways you may use the laptop?

Boy 4: Maybe searching the web to get information on something to type an essay.

The boys repeat the theme of using a computer for typing and research. The only difference is that the boys plan to play games when outside of school. In all, these responses should not be much of a surprise since the eight students interviewed have not experienced a 1-to-1 classroom. However, the following responses shed a different light on the 1-to-1.

The following question was asked: “Do you think the laptops will make a difference in your education?” Girl 4 made the following comment: “Well, obviously you will learn how to use computers more so in the future if you need to for your job you would know what to do. Knowing how to use them will let you get a good job” One last comment by Boy 1 when asked the same question. “My dad uses a computer all the time. He had to learn it on his own and still has problems. If we can learn how to get the most out of computers in school we will be much better off because other kids are also learning how to use computers.” What is striking regarding the last two comments is that these students see a computer as something they need to learn how to use; learn how to understand. Yet, the focus of the 1-to-1 laptops is to use a laptop to better learn the subject matter. This perception of the computer runs contrary to the purpose of the 1-to-1 program. This paradigm will need to be addressed!

If the 1-to-1 is to be successful, this writer believes it is imperative that students first understand the purpose of the laptops. They are not simply replacing pencil and

paper. Rather, it needs to be shown that a laptop can deepen a student's understanding of the subject matter. These students also want to have fun and they want to be active participants in their education. What follows are ways I introduced to the students that computers could be used. As is evident in their responses, students found these methods to be good ways to weave laptops into the classroom.

This discussion started with asking students how they could use laptops in science. Boy 3 suggested notes and Boy 4 said for essays and typing up lab reports. This was all the boys could offer. I asked if they could do a lab on computer. This got them talking!

Boy 1: Probably

Boy 2: Like computerized dissection of maybe a cat

Boy 4: I would rather open up a cat!

All: Yeah!

Boy 2: But, we could do both. Start with a computer and then use a real cat.

Boy 4: We wouldn't break as much stuff and it could be less expensive.

Mr. Dyk: How about games?

Boy 3: Maybe like science games the teacher wants you to play. I would like that.

Boy 1: Me too!

Boy 3: There are games you can play to help with things like math and words. There probably are games for science.

Mr. Dyk: Is it a game?

Boy 3: Sort of but it is a learning game.

Mr. Dyk: Would it be helpful?

Boy 4: Yeah probably plus it would be fun.

Boy 1: And I would probably pay more attention because if I am taking notes now it is error, I can't learn taking notes.

Mr. Dyk: So, laptops could help keep things more entertaining, more focused?

All: Yeah!!

One of the girls, Girl 3, had this to say about games. "School will be better because it will be more fun, like it is boring sometimes. Like in math, if we could play more games, learning games, it would help us, be more fun, we would want to learn more if it was more fun." It seems that students have the mindset that fun leads to better learning. It is

not the purpose of this paper to examine this idea; however, computer-learning games could lead to greater student participation and increased practice of reviewing the material. Is it fun? Maybe, maybe not but it is another way to keep subject material in front of students and thus should not be overlooked or taken lightly.

The last idea I proposed was blogging or forum type discussions. This is a way of holding a discussion where all the responses are typed and able to be read by the whole class. Rather than hearing what a student has to say, the class can read the response. The boys were much more hesitant towards the idea than the girls. However, Boy 4 stated, “I guess it could be better because the quieter kids might, like they don’t want to talk during class but might want to type it out.” The rest of the boys fully agreed. As for the girls, the following discussion took place.

Girl 2: Yeah, you would be able to read what people say and know what they mean.

Girl 1: That would be cool. That would be fun.

Girl 4: It would help us learn because it is more than just in school, it is extra stuff like homework. Additional stuff to do outside of school.

Girl 3: And you actually have to think and respond, actually

Girl 4: If someone is too quiet or shy to answer in class, so they have to online.

Girl 3: It would be great!

All: Yeah!!!

In looking back at the responses of the focus groups and the time spent with these eighth grade students, I am excited to begin exploring ways to implement the use of laptops to spurn the learning process. I believe these students will be open to new ideas and methods that will deeper their understanding in Physical Science. Who knows, they might even have a little fun during the process.

Major Patterns in responses:

1. For both groups, there was a very high level of excitement regarding the use of individual laptops throughout the school day. Students knew of this discussion because of parent meetings and parent surveys earlier in the year. When the decision was made to go 1-to-1, they could not believe it was actually going to be a reality next year.
2. Computer usage centered around social media outlets and games. For the boys, YouTube, games, ESPN, and surfing the web were the areas they spent most of their time when on a computer. Students had very limited ideas on how to implement laptops during the school day nor did they know of any other students in other schools that use them.
3. Using laptops to take notes- this was the ONLY suggestion students came up with on their own that showed a direct method of implementing computers with the science curriculum.
4. For me, one of the most surprising things that came out of meeting with these students was that they had only the basic ways on how to use laptops in the classroom. Besides using them to take notes and do research, they could not offer any suggestions on how laptops can help nor offer concrete clear ideas on what the laptop should be used for in a science classroom. What follows is more of the reasons laptops need to be learned and could be helpful. Most felt that if laptops were used properly, they would help with student organization. Another suggestion was that teachers should make sure that when students use computers, the activity is fun. It was clear that Laptops should be used in entertaining ways. Videos games and the ability to listen to music were two additional

suggestions. Since they want to be involved when in class, they want it to be more fun, I was surprised that they did not have more concrete ideas on how to make this happen, especially since there was so much work in educating parents on going to a 1-to-1 classroom next year. There is the potential for a 1-to-1 classroom to change how students engage and learn in the classroom and I think students are up to the challenge of trying to increase learning with laptops.

5. Students could not agree on the effectiveness computers would have on self-control.

However, they did feel that laptops would have a direct impact on classroom behavior and over all classroom quietness.

Interesting outliers

1. None of the students felt they were any more knowledgeable or tech savvy than their parents, on a computer. Since this form of technology has always been part of their life as opposed to the previous generation who have not grown-up with computers.
2. Students are genuinely concerned that those in the class will use the computer properly.

For example, what follows is a discussion of using YouTube videos.

Mr. Dyk: “You guys all like games and you like YouTube. Do you think we could use YouTube in the classroom?”

Boy 3: “You could look up history videos and stuff.”

Boy 4: Like science videos. Like we are learning about earthquakes and I could go look up an earthquake video and learn about it and take notes about it too.

Interestingly, this led to the conversation about using computers properly. Boy 4 added, “When on YouTube, the teacher needs to make sure they are not looking at anything different. Staying on task on YouTube making sure we are looking at the right things.”

Another student, Boy 3, also thought teachers should be proactive in keeping students on task. He thought that teachers could find some download that would help them with this task. “Well, you could make them download so like that if they are doing something else the teacher will be notified.” Boy 1 continued, “The teacher needs to make sure kids are not playing games during class.”

Next Steps

So, what has been learned from the student focus groups? First, students are mentally ready and very excited to be using a laptop. This will certainly help with the transition next year. Plus, ECES has MacBook Aires that these students have used even if in a limited capacity. Having some background with these computers and using them to do research related assignments should help make for a smoother and faster transition. Thus, developing research projects to enhance the curriculum is an important way to include computers. Another key that needs to be taken into consideration for next year is how the laptops will be used. Since each of these students now uses some form of technology as a means of communication, a classroom forum would be a great method to further deepen classroom work, science instruction, and discussions. Allowing a voice for all students is one way to continue keeping all students engaged. Once students were introduced to the idea of instant grades, they also liked the idea of being able to take computer tests and quizzes. Knowing their score right after taking a test seemed to be a positive feature laptops could offer.

Boy 1: if you are doing bad you can look at your grade and see you are doing bad so you can see your grade and try harder or something.

Mr. Dyk: Do you have this now?

Boy 3 “We do, but you need to go home and when you go home you really don’t think about that. If you are at school and the teacher mentions it you can go over the grades with a laptop.

Since students spend a lot of time playing computer games, finding educational games that could raise their level of understanding as well as increase motivation and confidence would be another way to effectively use laptops. Lastly, I think students would find computer based and science related simulations and labs to be another means to increase problem solving skills and student creativity.

Scripted Questions and possible Probes

-Boy material is in both black and blue

-Girl material is in blue

1. What kind of classroom experience helps you learn the best?
2. On a scale of 1-10, how would you rate your familiarity with computers? (10 being very familiar)
3. PROBE- Do you use them at home?
4. What do you like to do on computers? Why do you like to do that?
5. What do you spend the most time doing on computers? Why?
6. How much time do you spend each day on a computer and/or Internet?
7. In your words, what do you think 1:1 means?
8. What area(s) do you expect to use laptops in the classroom?
9. What do you think are the advantages in using laptops?
10. What are some area(s) you would be surprised to use a laptop?
11. What do you think would be the 2 most important areas to use laptop in science? Why do you think that?
12. Do you think the laptops will make a difference in your education? Why or why not? How?
13. Do you think the laptops will make a difference in your attitude towards school? Why or why not? How?
14. Are you excited about using laptops next year at Southwest?
15. What other ideas might you have for me as I begin investigating laptops and student use? What do you see as being important?

APPENDIX F
QUIZLET QUIZ EXAMPLE

Terms Quiz Week 9

Name _____

Directions: For each definition, write in the term.

For each term, write in the definition

1. A unit of pressure equal to one newton per square meter.
2. Protein-
3. The ability of two or more substances to combine and form one or more new substances
4. volume-
5. Polymer-
7. Valence electrons-
8. Empirical formula-
9. Proton-
10. A positively or negatively charged group of covalently bonded atoms

APPENDIX G
QUIZLET SURVEY

Name _____

Date ___/___/___

1) Do you use Quizlet to study Physical Science Terms?

Yes or No

2) How often do you use Quizlet?

- a) I use it everyday
- b) I use 4-5 times a week
- c) I use it 2-3 times a week
- d) I use it 1 day a week
- e) I do not use Quizlet

3) Using one sentence, state why you use Quizlet **OR** why you do not use Quizlet.

4) For me, Quizlet was the best way for me to study for this terms quiz.

Strongly Agree Agree Undecided Disagree Strongly Disagree

Explain

5) What do you like about Quizlet? Why?

6) What don't you like about Quizlet?

7) What was your quiz score for Week #9 _____.

8) At this point in the semester, how well do you think you would be doing on your weekly terms quizzes without being able to use Quizlet? Why?

9) If you do not use Quizlet, how do you study for each week's Terms Quiz?

10) I would recommend Quizlet to another student (Circle one of the responses below)

Strongly Agree Agree Undecided Disagree Strongly Disagree

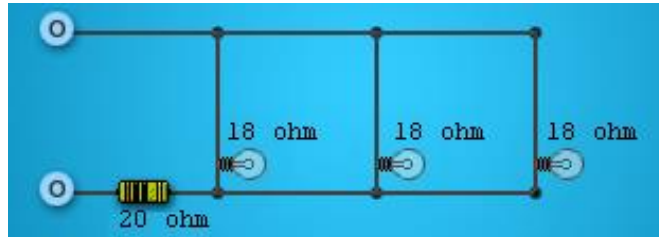
Why?

APPENDIX H
FIVE QUESTION GIZMOS QUIZ EXAMPLES

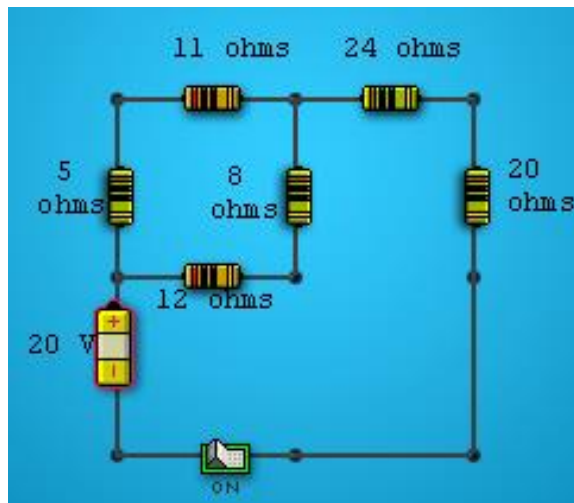
Name _____

Example Quiz 1: Circuits

1. What resistance will the ohmmeter measure in the circuit shown below?



- A. 19 ohms
 B. 26 ohms
 C. 38 ohms
 D. 74 ohms
2. The circuit below is powered by a 20-volt battery. What current is flowing through the on/off switch (when it is on, as shown)?

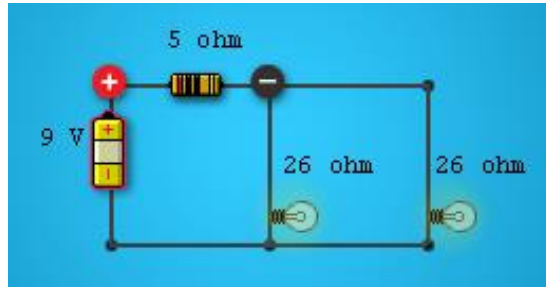


- A. 0.23 amperes
 B. 0.29 amperes

C. 0.32 amperes

D. 0.38 amperes

3. The circuit below is powered by a 9-volt battery. What is the voltage measured by the Voltmeter?



A. 2.50 volts

B. 3.15 volts

C. 4.96 volts

D. 6.54 volts

4. A string of holiday lights is connected to an outlet in a series circuit. When the lights are plugged in, the circuit is overloaded, causing a fuse to blow. Which of the following is most likely to solve the problem and allow the lights to remain lit?

A. Add more lights to the series circuit.

B. Replace several lights on the string with wires.

C. Increase the voltage of the battery.

D. Connect the lights in a parallel circuit.

5. On the circuit below, what is the current measured by the ammeter? Each resistor is 50 ohms, and the battery is 50 volts.



- A. 0.15 amperes
 B. 0.21 amperes
 C. 0.27 amperes
 D. 0.36 amperes

Name _____

Example Quiz 2: Potential Energy

- A 2-kg block rests on a wall that is 3 m tall. What is the gravitational potential energy of the block? The force of gravity on Earth (g) is equal to 9.8 m/s^2 .

1 A. 3 joules	3 C. 29.4 joules
2 B. 6 joules	4 D. 58.8 joules
- An object of mass 1.5 kg rests on a shelf where it has a gravitational potential energy of 7 joules. An object of mass 4.5 kg is placed on the same shelf. What is the gravitational potential energy of this second object?

1 A. 7 joules	3 C. 21 joules
2 B. 10 joules	4 D. 31.5 joules
- An object has a gravitational potential energy of 24 joules when it rests on a shelf 3 m above the ground. What would be its gravitational potential energy when it is lowered to a shelf 1 m above the ground?

1 A. 8 joules	3 C. 22 joules
2 B. 12 joules	4 D. 72 joules
- Object A has a gravitational potential energy of 24 joules when it rests on a shelf 5 m above the ground. Object B has a mass that is three times the mass of Object A. What would be the gravitational potential energy of object B when it rests on a shelf 10 m above the ground?

- | | | | |
|---|---------------|---|---------------|
| 1 | A. 72 joules | 3 | C. 144 joules |
| 2 | B. 120 joules | 4 | D. 240 joules |
5. 15 joules of work are done by forces other than gravity in taking an object from a position 3 m above the ground to a position 8 m above the ground. What is the change in the gravitational potential energy of the object?
- | | | | |
|---|------------------------------|---|-------------------------------|
| 1 | A. It decreases by 5 joules. | 3 | C. It increases by 11 joules. |
| 2 | B. It increases by 5 joules. | 4 | D. It increases by 15 joules. |