

THE EFFECTS OF INTEGRATING TECHNOLOGY
INTO AN 8TH GRADE SCIENCE CURRICULUM

by

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ABSTRACT

The growing need for technological literacy has increased its presence in public classrooms more than ever before. The purpose of this research study was to study the effects of technology integration on student achievement and attitudes toward science and technology. The participants in this 18-week study involved the 86 8th grade students at Winding Hills School in Orlando, Florida. Data were collected using a pre and post vocabulary assessment, weekly vocabulary quizzes, student attitude surveys, student and parent correspondence as it relates to the study such as parent notes and e-mails, and classroom observation notes. Several conclusions were made. The effects of technology on student performance as originally planned was inconclusive in this study. It was found that there was no correlation between typing assignments and student performance. Students felt that technology increased their academic performance. Students had positive attitude towards science class though the percentage decreased during the study. Students enjoyed using technology, saw it as a benefit, felt it helped them with publishing and improved their attitudes towards technology.

Dedicated to Mihoko, Alexcia and Alana

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LIST OF ACRONYMS/ABBREVIATIONS

FCAT	Florida Comprehensive Assessment Test
TOSRA	Test of Science Related Attitudes

CHAPTER ONE: INTRODUCTION

There has been more reliance from our society on technology, and therefore the need for people to become more technologically literate has increased. Our schools have been trying to keep up with the demand for more use of technology in the classroom by wiring schools and installing more computers in hopes that students would increase their academic performance by using technology. In a time of increased demands for student learning gains, teachers feel pressured to integrate technology into their curriculum and instructional methods.

The purpose of this study was to determine the effects of integrating technology into an 8th grade science curriculum on student performance, attitude towards science and attitude towards the use of technology. There are other factors involved which influence the impact technology has on student achievement; such as, the quantity and quality of teacher training and teachers' attitudes towards the use of technology (ACT, 2004; Becker, 2001; Hardy, 1998; McKenzie, 2002b). Research suggests that integrating technology into the classroom curriculum can help motivate students to have a positive attitude towards science and technology (ACT, 2004).

My action research study focused on three major questions:

Question #1 How did the integration of technology into the 8th grade curriculum affect student academic performance?

Question #2 How did the integration of technology affect student attitudes towards science?

Question #3 How did the integration of technology affect student attitudes towards technology?

I asked question number one because I wanted to see if the combination of forms of technology I used in my classroom would affect student performance in a way that could be measured through standardized testing and assessments. Question number two was asked because after years of working with technology integrated into my curriculum, I wanted to see what effects it would have on how my students perceived the science class overall. Finally, question number three was designed to help provide insight to any negative effects technology may have on students. Though our school provided typing lessons to all students as they progressed through the elementary grades some students that have transferred to our school have not had extensive training in typing or computer usage. I was interested in knowing if some students might have felt intimidated or overwhelmed with the extensive use of computers in the classroom.

Rationale

I believe in making learning as fun and exciting as possible. I began my career by performing live educational shows at the Orlando Science Center, and I learned not only how to relax and entertain a large audience of all ages, but also, if I did not make learning fun, my listeners would walk away and do something else. In my classroom, students are not allowed to physically leave like the visitors to my auditorium programs at the Orlando Science Center could. However, I know they can mentally walk out of the room if I am not able to provide activities that encourage participation and in which they can truly become engaged. I thrive

seeing my students getting excited about learning science and I am encourage to provide even more hands-on types of lessons that will increase their excitement.

Once my students are in the classroom, my personal philosophy about teaching is evident as students are engrossed in an environment of “doing science” with a high level of technology integration. Textbooks are only used rarely as a reference tool because I feel students will learn more from hands-on experiences. Along with activities such as fire-activated catapults, building cars powered by a mousetrap, designing experiments to place in a vacuum chamber, and exploring the scientific inaccuracies in the famous story “Goldilocks and the Three Bears,” students are exposed to and use technology on a daily basis. I feel that both knowing how to use and being comfortable with using technology is becoming increasingly important. Students in my classroom use technology in various forms as they import digital photographs into their weekly reflections using Microsoft Word, view lessons as presented through PowerPoint, make tables and graphs using Excel, and research the Internet using WebQuests. Eventually, students make their own multimedia PowerPoint presentations set to music to demonstrate what it is like to learn science in our classroom. For example, a student may make a presentation showing their top five favorite experiments or activities from the year and include captions explaining what was happening during each activity as well as what they enjoyed about each. The minimum ten slide presentation would be automated to play with the music of their choice.

My students have expressed positive feedback to using the above mentioned forms of technology in the classroom as well as to other forms of technology. I wanted to know if by integrating the large amount of technology into the curriculum that I do, if it has an equally beneficial academic impact on the students as it seems to have had a positive impact on student

attitudes towards technology and science. I also wondered if there were any negative attitudes towards the extensive use of technology in my classroom.

The benefits of this study were for me to learn how to effectively use technology when teaching in a way that positively affects student performance in science, student attitudes toward science and student attitudes toward computer usage. I collected data from all four of the 8th grade science classes at Winding Hills K-8 School, classes of which I am the only science teacher. There were 84 students involved in the study.

Significance

“During a period in which technology has fundamentally transformed America’s offices, factories, and retail establishments, however, its impact within our nation’s classrooms has generally been quite modest” (President’s Committee of Advisors on Science and Technology, 1997, p. 6). There is an effort to try and meet society’s need for technological literacy through legislation. The Goals 2000: Educate America Act, which was signed into law in 1994 and amended in 1996, represents an effort to increase student achievement (Office of Elementary and Secondary Education, 1998). The act contains a number of provisions to foster the application of technology with the nation’s elementary and secondary schools (PCAST, 1997). Even with legislation enacted, schools, school administrators and teachers will need a vision and some guidance on how to better prepare America’s future. The National Research Council, in conjunction with the National Science Teachers Association, produced the National Science Education Standards (National Research Council, 1996). These standards recognize the importance of supporting technology integration with resources and policies as well as

emphasize the need for students to access computers with software for supporting investigations in a scientific inquiry environment.

Even with legislation and standards, schools are not using computers effectively (ACT Policy Report, 2004). There is pressure to incorporate computer use into schools (Raaflaub, 2002), but many times computers are being installed without a plan (Edelson, 2001). Policy makers, schools, and the public want to know if it is worth the hype to integrate computer use into classrooms. They want to know if the integration is cost-effective and has the capability of improving student academic performance (Technology Counts '04, 2004; Becker, 2000; Raaflaub & Fraser, 2002).

Another point to consider is the student attitudes towards the integration of technology in the classroom. Studies have found that computer use has a positive affect on student attitudes towards learning and school (ACT, 2004). Not everyone has found working with computers to be a positive addition to the classroom environment (Varank, Tozoglu & Demirbilek 2001) (Lui & Johnson, 1998). For example, some studies have found that if students are intimidated, they are more likely to be focused on their anxiety as opposed to the assignment (O'Hara, 1998).

Assumptions

I approached this study with the assumption that by including technology, primarily computer use, into science instruction that student academic performance and attitudes toward science and technology would improve. I based this assumption on a thorough review of the related literature and my professional experience. I also assumed that students did their best on performance tasks and written responses as well as answered the questions on the science and

technology attitude surveys truthfully. Finally, I assumed that my perspective on technology would not interfere with my interpretation of the data on students which would allow me to view the results in an unbiased manner.

Limitations

There were limitations to this study that affect how the findings could be used by others. One limitation was the population of students at Winding Hills K-8 School may not be a representative population of 8th grade students in general. Another limitation was that not every student participated in every activity used in the study. I anticipated student absences, incomplete assignments, and students out of the classroom during class time for unexpected reasons. Finally, another limitation was time. I had to limit the data collection time to 18 weeks. Students spent the beginning part of that time becoming familiar with classroom technology procedures, and were not able to complete all of the technology related assignments within the 18 week period.

Descriptions

Attitude: Student attitude was looked at in two ways. One way for student attitude to be viewed was towards the usage of technology and another view was toward science class, or science in general. Attitude is a measure of the student's feelings. Attitude was measured through attitude surveys, communication and classroom observations.

Student Performance: Student performance was based on comparing pre and post vocabulary assessments as well as weekly quiz averages for vocabulary terminology. The vocabulary terms consisted of a collection of words that Florida's Department of Education recommends students know in order to be successful with the FCAT 8th Grade Science test (Florida Department of Education, 2002).

Technology: For this study, technology means computer and software use including; Microsoft Word, Microsoft Excel, Microsoft Paint, Microsoft PowerPoint, Internet and multimedia CD ROM research, and WebQuest activities. It includes, to a lesser extent, digital photography, laser printing, digital projection, and saving or accessing files on a classroom server computer via the classroom network.

TOSRA: The Test of Science-Related Attitudes (TOSRA) is an instrument designed to measure distinct science-related attitudes among secondary school students. The TOSRA has been carefully developed and extensively field tested and has shown to be highly reliable (Fraser, 1981).

Overview

Determining the effects students felt about technology integration in the classroom as well as the impact it had on student performance was the primary focus of this study. Chapter two is the literature review which begins by focusing on why it is beneficial to integrate technology into the curriculum. Additionally, the barriers to the successful use of technology are

the first also included. Finally, some specific examples of technology being used to affect student achievement are explained. “In other words, examining computer use or technology, by itself is not enough to determine its effects on student achievement. What seems to be important, however, is the way in which technology is used” (Papanastasiou, Zembylas & Vrasidas, 2003, p. 326). Chapter three is a description of the methods. It includes how I organized my research, the participants involved and how they were selected, the instruments used, the school setting and how the data was analyzed. Chapter four is my interpretation of the data analysis and its relevance to the student attitudes and academic performance. Finally, chapter five contains the conclusion of my thesis as well as my recommendations for further study in relation to technology and academic performance.

CHAPTER TWO: LITERATURE REVIEW

Introduction

Research suggests that technology can help students learn more (Weaver, 2000). “In light of this finding and other research that supports similar assertions, the pertinent question is no longer *whether* to use computers, but rather *how* to use the technology that is at hand to get the best results” (Weaver, 2000, p. 131).

The following pages will explore the history of computer use both outside of the classroom as well as computer use within schools. This section will also discuss some possible barriers to the integration of technology as well as some indications of when the barriers have been overcome. In addition, the ways computers are used in the classroom as well as the relationship with the constructivist philosophy will be reviewed. The research related to the effects technology can have on academic performance will be examined as well as the importance of student attitudes, in general, as it affects their success in the school setting. Further, research on how technology integration in the classroom affects student attitudes towards science class, the subject of science, and technology itself will be discussed.

Computer Use Outside of the Classroom

The use of technology is prevalent in the every day life of children and adolescents in time spent outside of the classroom as computer use starts at a very young age. The U.S.

Department of Education's National Center for Educational Statistics conducted a Computer and Internet Use supplement to the 2001 Current Population Survey which studied computer and Internet use by American children and adolescents aged 5-17. The survey consisted of interviewing 56,000 households and collected information regarding 28,000 5-17 year olds. Computer use is very common for that age group. The center reported 90% (47 million) of children and adolescents use computers. It is also interesting to point out that computer use starts early, as 75% of 5 year olds use computers (U.S. Department of Education National Center for Educational Statistics, 2003).

The statistics show that not only is computer usage increasing, but the use of the Internet by youth is also becoming common. The center also reported that 59% (31 million) of today's youth use the Internet. On a broad scale, approximately 25% of 5-year-olds use the Internet. It is apparent that Internet use increases with age. Research shows that 50% of 9-year-olds and 75% of ages 15-17 use the Internet (USDENCES, 2003). It is also interesting to point out that in the 1990s, boys were more likely to use computers or the Internet. However, a little over a decade later, this study reported no differences between the sexes in overall computer or Internet use. The two most common locations for connecting to the Internet was the home (78%) and school (68%) (USDENCES, 2003).

Children and adolescents age 5-17, 65% use computers at home (USDENCES 2001). The three most common uses at home for computers were playing games (59%), connecting to the Internet (46%) and completing school assignments (44%) (USDENCES, 2003). Kerawalla found that approximately two-thirds of the time children spend on the computers is spent on games. This was believed to be the case because of time restrictions involved with computer use at schools (Kerawalla & Crook, 2002).

Based on the evidence shown, both computer and Internet use are becoming common household activities for today's youth. Computer and Internet usage starts at a very young age and increases with adolescence. It is apparent that computers and technology are an important part of the average American youth's time at home as it aids with both recreation and learning.

Computer Use in Schools

Computer Use in the Classroom

The role of computers in the classroom is expanding. The ratio of computers to students in the public school system has been steadily increasing. Shaw (1998) reports that in the 1983-1984 school year the ratio was 125:1 but has increased to 10.5 in 1994-1995. "One of the earliest insights into the educational applications of technology was that interactive-based systems admit the possibility of individualizing the educational process to accommodate the needs, interests, proclivities, current knowledge, and learning styles of each particular student" (President's Committee of Advisors on Science and Technology, 1997, p. 10). Computer use during the past decade has motivated veteran teachers, provided an opportunity for technological literate teachers to create great classroom experiences and has been able to keep students motivated (McGrath, 1998).

The National Center for Educational Statistics conducted a short survey of public schools in 1999 using the Fast Response Survey System (FRSS). The majority of students aged 5-17 (81%) use computers at school (USDENCES, 2003). They found that almost every teacher reported having computers in their schools (99%). The majority of public school teachers (84%)

had computers in their rooms of which 36% had only one computer, 38% had 2-5 computers in their classrooms, and 10% had more than 5 computers (USDENCES, 2000).

Computer Labs

In addition to computers being placed within individual classrooms, schools have developed computer labs in order to aide in whole class computer use. “About half of all teachers have at least one computer in their classrooms, but most have no more than two, making student computer use by individuals and small groups impractical within most classrooms” (PCAST, 1997, p. 15). Even though the majority of teachers within a school report having one to five computers in their individual classrooms, most of the schools’ computers are located in labs (PCAST, 1997). This is not the ideal situation as it is difficult to share the lab computers due to having to schedule well in advance and typically only for short periods of time (Becker, 2001).

Barriers to Integration

While schools are striving to equip both classroom and labs with computers, several common barriers exist to the implementation of computers into the classroom. Though almost all public schools have computers, the majority of computers found at schools would be considered obsolete by private sector standards (PCAST, 1997). Although the majority of teachers have at least one computer in their classroom, it is believed that this is not enough. In 1999, 78% of public school teachers felt not having enough computers was an obstacle in being able to integrate computers into their lessons (USDENCES, 2000). Hardy found that teachers perceive the lack of hardware and software (availability and quality) to be a major concern (Hardy, 1998).

Even if the teachers were fortunate enough to have a sufficient number of computers, another common barrier would include the need for teachers to have sufficient experience in using them as well as continuous professional development (ACT, 2004; Becker, 2001; Hardy, 1998; McKenzie, 2002b). Hardy (1998) found that teachers are concerned about how to effectively integrate computers into the curriculum. If teachers are to integrate technology they will need adequate training to build their confidence and computer skills (Hardy, 1998). In 1999 82% of public school teachers felt lack of release time to learn technology was a barrier to using computers (USDENCES, 2000). On average, only 9% of the average school's technology budget is spent on training and support while schools that have high levels of technology invest 30%. (US Department of Education, 1996). As teacher's experience with computers increases, their enthusiasm for using computers increases as well (Hardy, 1998).

Not having enough time for computer activities in the classroom is another teacher perceived barrier (Hardy, 1998). In 1999 80% of public school teachers a felt lack of time in the class schedule as a barrier to using computers (USDENCES, 2000)

Finally, according to Shaw (1997), another barrier is the school building itself. Many schools were not originally designed to accommodate networked computers. This can pose a problem as the additional electrical current requirements of computers can force schools to upgrade their electrical systems. In addition, most classrooms not even wired for telephones face the challenge and expense of retrofitting network wiring which can be compounded by the presence of asbestos by many schools (Shaw, 1997).

Working to Overcome Barriers

Even with all of the barriers restricting or limiting computer integration in classrooms, many teachers overcome them and successfully integrate technology into the classroom. Becker (2001) has outlined predictors for frequent technology use by teachers. The first predictor is the level of technical expertise and use of the computers for professional purposes by the teacher. “Of teachers who had computers at home, teachers with the fewest years experience were most likely to use computers or the Internet at home to gather information for planning lessons and creating instructional materials” (USDENCES 2000). Those teachers who see the value in using computers in their job are more likely to have their students using computers. Second, a teacher engaging in leadership roles in the school is also an indicator of successful technology integration. Third, the number of computers in the classroom can help determine the amount of technology integration occurring in a classroom. Finally, teachers who can produce a slide show (PowerPoint or HyperStudio presentation) is a clear indicator of a teacher’s ability or interest in having students use computers (Becker, 2001)

The hurdles to successful technology integration can be overcome. Funding for new computers, software and networks will need to be increased through existing budgets, grants or creative means. Money alone will not solve the problem though. Educators will need to be informed on the value of technology integration, how it can help them in areas such as accountability as well as how technology can help to educate and reach all students. Once educators are aware of the value, they will need training on the best practices for integrating technology as well as a solid support system in place to help with academic and technical concerns that will arise. Technology will become more integrated into the curriculum as years go by, but the question is whether it will be enough to meet society’s needs.

Types of Computer Use in Schools

Another area of concern is the type of computer use in schools. When planning ways to use computers in the classroom, it is recommended to focus on learning with technology and not about technology (PCAST, 1997). An example of having students focus on learning with technology is to give them an assignment of writing a paper or making a computer generated presentation persuading others why they should become involved in protecting the rain forest. As the project progresses, the teacher could show the students different features they could use with the software like importing digital photos as the needs arise.

Teaching, Learning, and Computing (TLC) is a national survey of more than 4,000 teachers from grades 4-12. The survey was made possible from the National Science Foundation and was conducted in 1998. The TLC survey found that more than 60% surveyed seek activities that will help students on standardized test and curriculum standards (Becker, 2001). Only a minority of schools use computers for acquiring information, analyzing ideas and demonstrating and communicating content understanding (Becker, 2001). Approximately, half of public school teachers who had computers available used them for classroom instruction. For example, 61% of students used computers for word processing or spreadsheets to some extent and approximately 50% of students used computers for Internet research, practicing drills, solving problems and analyzing data (Becker, 2001; USDENCES, 2000). Becker (2001) also found that it is more common for teachers of low-ability classes in all subjects than those that teach high ability classes to use computer games for practicing skills. Teachers at schools in the bottom social economic status (SES) quartile are more likely to select remediation and simple reinforcement skills for computer usage.

Constructivism and Computer Use

The classroom atmosphere is an important variable in determining how technology is being implemented and why some teachers are users of technology and others are not (Hardy, 1998). "...The student-centered constructivist paradigm may ultimately offer the most fertile ground for the application of technology to education" (PCAST, 1997, p. 21). PCAST also points out that when using computers, there should be more emphasis on higher-order thinking and problem solving skills and less emphasis on learning isolated facts. Basic skills are learned through real-world applications and not in isolation. PCAST also states that information resources should be made available when they are useful in performing a task. Additionally, the student should assume the role as the active architect of his or her knowledge instead of relying on the teacher (PCAST, 1997). "...Teachers with the most constructivist teaching philosophies are stronger users of computers: They use computers more frequently, they use them in more challenging ways, they use them more themselves, and they have greater technical expertise" (Becker, 2001, p. 11). Becker also states when frequent use of computers does occur in math and science, it is typically for gathering information, writing about it and sharing it, and vocabulary and skill games. Traditional teachers tend to not use technology and cite one or more of the previously mentioned barriers as the reasons.

On the whole, exemplary computer-using teachers overwhelmingly share the constructivist philosophy of teaching (Berg, Benz, Lasley & Raisch, 1998). This is also supported by Becker as he states that constructivists more often have students use computers to present work to the class as well as more often have students use computers of information-gathering (Becker, 2001). Traditional teachers are three times less likely than constructivist

teachers to let students use computers, even when they have five PCs in their rooms (Becker, 1999).

Computer Use and Academic Performance

The big question when integrating computer use into the curriculum is in asking what the effects are of the use of technology on student achievement. “So far the research carried out that examines computer use and student achievement, seems to emphasize that there is a positive correlation between these variables” (Papanastasiou, Zembylas & Vrasidas, 2003, p. 326). The integration of computers with traditional instruction produces higher academic achievement than traditional instruction alone (ACT, 2004). It was also found that students learn more quickly and with greater retention when learning with the aid of computers (ACT, 2004).

Not everyone agrees on the positive effects of computers on instruction. A study by the Educational Testing Service (ETS), as reported by Wenglinsky, showed that students who spent less time on computers actually performed better (Wenglinsky, 1998). The study was also reported to show the drill software had little impact on student performance.

In addition, Papanastasiou et al. (2003) reports that the Third International Mathematics and Science Study (TIMSS) showed that computer use in the classroom was negatively correlated with student achievement. It is reported that those students who claimed they used computers in the classroom the most were those with the lowest achievement.

How technology is used is an indicator of its effect on student achievement. “When we approach the adoption of new tools and practices with discernment, gains in student performance are more likely to accrue” (McKenzie, 2002a, p. 40). Buying lots of computers and technology is

not going to help academic achievement unless there is a sound plan for its use. “Showering fancy equipment and toys on classrooms with smart planning is unlikely to produce gains in student performance” (McKenzie, 2002a, p. 40).

Weaver (2000) examined the National Educational Longitudinal Study (NELS:88) from the National Center for Educational Statistics (NCES) in order to learn about connections use of computers in math and science classes and students’ academic success. The study originally included 25,000 students from over 1000 public and private schools from all over America but that sample size was decreased to 13,120 students at the end of the four year study. Weaver found for technology to have an effect on student achievement, it must be challenging and focused on higher-order thinking skills. Further, teachers must be capable of using it, teaching it and provided with support to aid them in the process. Papanastasiou states that what is important is the way in which technology is used. For example, students who wrote papers, had a computer available at home or in a library, and used word processing were likely to have higher science literacy scores (Papanastasiou et al., 2003).

Publishing

One way in which computers can be used for higher-order thinking skills is through publishing. Computers can be beneficial to learning because they can store and present information in dynamic and interactive formats (Edelson, 2001). The software Microsoft Word and Microsoft PowerPoint provide the user with an opportunity to communicate in a way handwritten methods can not. For example, a student using Word could import photos of himself or herself doing an experiment as well as a graph of the data they have collected. Along with a written conclusion, students would have an opportunity to integrate technology with content

thereby providing another method of sharing what has been learned. Because students are choosing the method and style of expression, they are also taking more ownership of their work and their academic performance.

When students are motivated to work on an assignment, they will show greater achievement. “Motivation is often increased through the desktop publishing and multimedia capabilities of computers” (Behrmann & Jerome, 2002, para. 18). They also state the use of word processing may be the most important use of assistive technology for students with mild disabilities. The benefits of word processing extend to other students as well.

Students can also benefit from using computers as word processors. “Computers improve the quality and quantity of writing. Spelling and grammar supports enable writers to decrease their emphasis on writing mechanics, thus increasing planning time and content generation. Finally, computers make it possible for students who struggle with handwriting to publish neat printed work” (Quenneville, 2001, para. 12).

Organizing and Interpreting Data

Students can use the software Microsoft Excel to sort and organize data. “Computers now play a central role in data collection, data analysis, modeling, and the communication of results in scientific research. Any effort to engage students in authentic scientific practices should reflect this trend” (Edelson, 2001, p. 356). Computer generated spreadsheets and graphs allow students to spend more time analyzing and interpreting the data. The amount of practice in working with spreadsheets and graphs is also increased because the time it takes to assemble them is shorter compared to the paper and pencil method.

Student Attitude When Using Technology

It is important to examine student attitudes as they may contribute to the successful integration of technology into the classroom. The attitudes students have towards technology itself can affect the attitudes towards the content when technology is used. Students like learning with computers, and their attitudes toward learning and school are positively affected (ACT, 2004). It was found that students express more positive feelings when they use computers (Becker, 2000). When O'Hara (1998) had her students using the Internet for an assignment, students exhibited increased stimulation.

When technology is used, it needs to be remembered that not all students have a positive attitude towards technology (Varank et al., 2001; Lui & Johnson, 1998). People with computer anxiety might be more focused on anxiety than the assignment (Papanastasiou, 2003). "...Freedom from anxiety were found to have a linear relationship with computer achievement, and to have a positive effect on computer achievement" (Liu & Johnson, 1998). When technology was used with O'Hara, there was no sign of intimidation, regardless of the level of experience the students had (O'Hara, 1998).

Summary

With the ever-increasing trend for society to welcome technology, students will need to become technologically literate if they are to become successful in their adult life. Computer use is very common outside of the classroom and is increasing at schools. There have been attempts to not only teach students technological skills for the sake of learning technological skills but with hopes of also increasing student achievement in other content areas.

In order for the integration of technology into the curriculum to be successful, barriers must be overcome. Some of these barriers include having the technology available whether in the classroom or a lab setting, planning technology usage, and training the teachers so they reach the level of confidence necessary to include it in their teaching methods.

Once those barriers are overcome, it is important to choose uses for the technology that promote additional student growth. Less emphasis should be placed on using simple drill software and more emphasis should be placed on computer use that requires students to use higher level thinking skills. Students can use computers to assist in publishing in order to aid in their writing skills and their ability to organize and sort data better than paper and pencil methods.

In addition, teachers who hold the constructivist teaching theory of having a classroom environment that is student centered are more likely to integrate technology into the curriculum. By keeping all of these points in mind, technology can be used to increase student academic performance. “When we approach the adoption of new tools and practices with discernment, gains in student performance are likely to accrue” (McKenzie, 2002a p. 40).

Chapter 3 presents the design of this study. A time line for the study as well as the school and classroom setting are given. Within the time line, details on data collection include how students were assessed at the beginning of the study, a description of the activities they were involved with, how data was collected as well as how final assessments were completed. A description of the assessments, quizzes and surveys will also be given.

CHAPTER THREE: METHODOLOGY

The purpose of this study was to determine the effects of technology integration on student performance, student attitude towards science and student attitude towards technology. This chapter outlines the design of the study. The school setting and the participants are described. The instruments used for data collection and how the data from those instruments were analyzed is explained. Finally, the topics of validity, reliability and generalizability are addressed.

Design of Study

“The purpose of action research is to affect teacher’s actions, activities, beliefs, and effects; action research is directed toward both understanding and improving practice (Gay & Airasian, 2003, p. 271). This mixed methodology (qualitative and quantitative) action research was conducted to determine the effects of integrating technology into the 8th grade science curriculum. The study was conducted over an eighteen week period beginning in August 2004 and ending in December 2004.

The purpose of this study was to examine whether my practice of technology integration contributed to improved student performance and attitudes towards science and technology as evidenced in student work and attitude inventories.

Setting

This study was conducted at a K-8 school in a central Florida county. The county is the 5th largest county in Florida and consists of 108 elementary schools and 27 middle schools. There are approximately 38,950 middle school students in the county. Winding Hills K-8 School was the county's prototype K-8 school consisting of elementary grades and middle school grades on one campus.

School Setting

Winding Hills K-8 School is a combined elementary and middle school. Both the elementary and middle schools are located on the same campus and share the same resources such as the office, cafeteria, library and computer lab. The middle school is an academic magnet school, which means students wishing to attend must apply. The majority of the students in the middle school are from the self-contained elementary school. However, there are students from other elementary schools as well. There are 321 students in the middle school with 83.5% of the students having attended Winding Hills K-8 School during their elementary years and 16.5% having attended a different elementary school. With a relatively small population size compared to other middle schools, Winding Hills K-8 School appeals to students wanting more individual attention and a stronger focus on academics. Approximately 13.7% of the middle school students are on free or reduced lunch. The percentage of middle school students who receive support from exceptional student education (ESE) is 9.7%. The middle school's demographics breakdown consists of 71.3% white; 10.0% Hispanic; 9.0% black; 5.9% Asian/Pacific Islander; 1.6% multicultural; and 0.93% American Indian/Alaskan Native.

The school has been named an “A” school by the Florida Department of Education for performance on the FCAT (Florida Comprehensive Achievement Test). According to the Florida Department of Education (2004a), school grades are based on how well students at each grade level have mastered the Sunshine State Standards as measured by the annually given Florida Comprehensive Assessment Test (FCAT). Schools earn points based on three things: how well students are doing, how much progress or learning gains they have made, and how much progress the struggling readers are making.

Classroom Setting

The researcher is the sole 8th grade science teacher. For this study, the researcher used all four of the 8th grade science classes at Winding Hills K-8 School, which covers the entire Winding Hills K-8 School 8th grade population of 86 students. The 8th grade student demographics breakdown consisted of 77.9% white; 5.8% Hispanic; 9.3% black; 2.3% Asian/Pacific Islander; 4.7% multicultural and 0.0% American Indian/Alaskan Native. It was assumed that the four sections had a heterogeneously mixed population of approximately 18-26 students each, however, all data for this research was compiled as a whole and not by class section or period. The student’s ages ranged between 13 and 14 years of age with a mean of 13.5 and a mode of 13. The number of students involved in this study (84) remained the same from the beginning to the end.

Science was taught five times a week for 50 minutes per day with the exception of only 40 minutes on Wednesdays due to the shorter school day. At Winding Hills K-8 School, there is one science teacher for each middle school grade level. All three science teachers share a

philosophy of teaching science which emphasized hands-on activities and little use of traditional textbook based instruction.

The FCAT Science 8th Grade has been administered to all 8th grade students in the state of Florida for the past two years. In 2004, the students at Winding Hills K-8 School achieved the highest average in the county (Florida Department of Education, 2004b). The State of Florida's 8th grade average mean scale score was at 286 (57.2%) in 2004. The county's 8th grade average mean scale score was a 279 (55.8%) in 2004. Winding Hills K-8 School's 8th grade average mean scale score was a 338 (67.6%) in 2004.

My classroom contained 22 computers, of which 21 computers were for student use and one computer was the classroom server computer. The 21 student computers were built/refurbished by myself from donated parts and broken computers. The server computer holds all of the files students create, contains all digital photographs that the students may access for their assignments and handles all printing jobs for the other classroom computers. Assignments are printed using a networked laser printer. Only 12 of the computers can be turned on at once due to electrical circuit limitations in the classroom. When all students use the computers simultaneously, they do so in groups of two or three sharing one computer.

Instruments

My action research study consisted of seven data collection methods: pre and post vocabulary assessments, weekly vocabulary quizzes, pre and post student science attitude surveys, pre and post student technology attitude surveys, parent and student correspondence (as

it relates to the study) such as parent notes and e-mail, classroom observation notes and student reflections.

Parental consent forms were sent home to the parents describing the study and how their student could be involved. The majority of (84 of the 86) students had parental permission to participate in the study. A copy of the Parental Consent form can be found in the appendix (see appendix A).

Students were verbally asked for their permission by reading aloud the Child Assent Script (see appendix B). The number of students who volunteered to complete a survey varied with each survey and survey administration. The inconsistency was due to participation being completely voluntary and students sometimes choosing to not complete the survey.

Pre and Post Vocabulary Assessments

The pre and post vocabulary assessment was a customary classroom assessment in which students match science terms to their matching definitions (see appendixes C, D, E and F). The pre and post assessment was teacher constructed. There were approximately 150 words on the assessment based on Florida Department of Education's recommendation of the terms every 8th grade student should know before taking the 8th Grade Science FCAT test. An additional ten words/concepts were added to the master list by the researcher based on student performance during past years which indicated they needed to review those terms (see appendix G).

The vocabulary assessments were given at the beginning and the end of the research project. The assessments and the timing of the assessments had a dual purpose for this research

as well as fulfilling school requirements. This form of science vocabulary assessment is similar to the assessments the other middle school science teachers in the same school use.

The assessments were divided into two lists. One list represented the words which the students learned by using technology in the classroom for the related assignments, and the other list represented words which students did not learn through the use of technology in the classroom for the related assignments. Before receiving any assignments, students randomly chose which list they could use technology for to help them complete. Each student was assessed on all of the words from both lists.

To complete the assessment, student chose the correct word from a short list to match the given definition. Answers were then marked on a scan-tron form for automatic grading. The score from the list related to technology use and the score from the list related to non-technology were compared to see if students who consistently used technology scored higher those who did not.

Weekly Quizzes

The weekly quizzes were a customary classroom assessment in which students were assessed on approximately 10 vocabulary words each week (see appendixes H, I and J). The weekly quizzes were teacher constructed. The words for each week were organized by science classification or science strand as much as possible. The first ten questions asked students to match the word to a situation or example being described. The remaining ten questions ask students to match the correct word in a sentence based on context clues. The last ten questions had students apply the cloze technique for reading comprehension. This form of assessment was

shown to the other two science teachers at the same school. It was agreed to be similar to their assessments and therefore valid.

Student Surveys

Students completed two different attitude surveys. One survey was used to measure student attitudes toward technology, or more specifically, computer use in the classroom. The other survey measured student attitudes toward science, or more specifically, how they preferred to learn science, how interesting they found science, or how they felt about having a future career in science. Each survey was given at the beginning and end of the research.

The Computer Questionnaire (see appendix K) is a modified copy of the instrument used by the Department of Education's Preparing Tomorrow's Teachers to Use Technology (PT3) project and was modified and permission was granted for its use (see appendix L). The survey was shortened in conjunction with my thesis advisor at the University of Central Florida to only include relevant data to the research which affected the original reliability and validity. The survey consists of 20 questions. The questions range from asking them the average amount of time in a week they spend using a computer at home and at school. The survey also asks them questions about how they feel about using computers and the importance of using computers during instruction. Reliability and validity information is still being researched by the PT3 project.

The Science Questionnaire (see appendix M) is a modified copy of the Test of Science-Related Attitudes (TOSRA). The TOSRA was developed by Dr. Fraser of Macquarie University and has been used both nationally and internationally to measure student attitudes toward science since 1981. The instrument originally had seven sections, but for the purposes of this research, it

was shorted and used with the permission of Dr. Fraser and the help of my academic thesis advisor (see appendix N). The modified version consists of 40 questions which are answered using a Likert scale answer sheet. According to the TOSRA Handbook, the internal consistency reliability was estimated for the unmodified TOSRA scales using the Cronbach coefficient. The values of the reliability coefficient for years 7-10 ranged from .64 to .93 (Fraser, 1981). Since the original version was modified the reliability and validity was affected.

Student and Parent Correspondence

Field notes were kept on student and parent correspondence as related to the study. For example, all e-mails that pertain to the three research questions have been printed and included in data analyses. All e-mails were unsolicited.

Researcher Observation Notes

The researcher kept field notes documenting the activities in the classroom which related to the study as well as student's comments about those activities. Dates and times of various uses of technology in the classroom have been recorded. The field notes were taken during the period after the pre assessments and before the post assessments. The field notes were updated as technology was used in the classroom.

Methods

The following section will describe the methods used for data collection with a general timeline of the research project.

Data Collection

An IRB application to the University of Central Florida Department of Research was submitted and approved in June of 2004 (see appendix O). A typed letter was sent to Winding Hills K-8 School explaining my action research and have received the approval of the principal (see appendix P). A letter to the parents and guardians of my students was sent home explaining the action research and how their children could be involved (see appendix A). I have written a child assent script (see appendix B). The child assent script was read to the students asking them to participate in the research while reminding them that their participation was completely voluntary.

Week 1

After reading aloud the student assent script, students answered the questions on the Computer Questionnaire and the Science Questionnaire surveys. The technology survey asked students about the amount of technology the students used at home, at school or any other place during the last semester of the last school year. It also asked them their opinions of the usage of technology in the classroom. The science attitude survey asked questions about how the students felt towards science. At the end of the study, students answered the questions on the survey again in order to determine if there were any differences in their responses over the previous semester.

Students took the pre vocabulary assessment covering the definitions of 160 science-specific vocabulary words. Students were asked to match the vocabulary words with the correct definition. Students completed the same assessment again at the end of the study in order to determine if there were any differences in their responses over the previous semester.

Weeks 2-17

The population of students was placed into two groups, Group A and Group B. It was not necessary for each group to be equal in academic achievement, as the students were compared against themselves. The two groups were only formed in order to determine whose turn it was to use the computers for the related assignments. Each week, students were given a list of 10 vocabulary words. As a normal classroom activity, they needed to find two different definitions for the words as well as find examples of the concept or use the word correctly in a detailed sentence as explained in the Vocabulary Homework Requirements and Vocabulary Grade Sheet (see appendix Q). One group could only use traditional paper sources for the assignment such as dictionaries and textbooks. The other group was able to use various forms of technology such as multimedia encyclopedias, the Internet, and Microsoft Word. The following week, students switched, allowing those who did not use technology to be able to use it for the current week and vice versa. This continued on a rotational basis so that every student had the same amount of time with the technology. All students were unable to use technology at the same time due to the limited number of computers in the classroom.

Sixteen vocabulary quizzes were given covering all of the 160 vocabulary words. The data from weekly vocabulary quizzes helped determine what affect the technology use had on academic performance in terms of demonstrating a mastery of scientific vocabulary.

The students used a variety of technology in this classroom that they do not use extensively in other classrooms. For example, before starting the project of designing and building a mousetrap powered car, they worked through a WebQuest that was posted in a section of the school's web page. The WebQuest guided them to predetermined sites where they could

find photos, descriptions, and instructions on building a mousetrap powered car. Further research through the WebQuest enabled students to find sites that showed winning car designs as well as find tips and tricks they could use to improve their design. Some experiments were introduced via a PowerPoint projected using a digital projector. This form of presentation allowed students to see examples which went along with the directions. The PowerPoint could also have been reviewed anytime later by the students when they accessed the classroom server computer through any of the regular classroom computers. In addition, student groups wrote weekly reflections using Microsoft Word. The reflections included what they did during the past week, what they learned by doing the various activities as well as how what we have studied related to science outside of the classroom. When working in the reflections, students accessed digital photos of themselves during the week's activities and imported the photos into their Word documents. After their reflection was completed, they saved it in the corresponding folder on the classroom server computer and printed it from a laser printer through the classroom network. Students also used the computers for routine tasks like researching definitions to weekly vocabulary words or typing their weekly vocabulary homework.

Week 18

Student completed the vocabulary post assessment. Students also completed the Computer Questionnaire and Science Questionnaire surveys again.

Vocabulary Assessments

Each student completed the entire 160 word vocabulary assessment. The assessments were divided into 2 parts: the words they could have used technology in the classroom to complete related assignments and the words they could not use technology in the classroom to complete the assignments. The names of the students and their scores were placed into a spreadsheet using Microsoft Excel. The mean score for each part was determined for each student for both the pre and post assessment. Likewise, the post mean score for using technology was compared to the pre mean score. The post mean score for not using technology was compared to the pre mean score. The standard deviation for all calculations was also determined.

Weekly Vocabulary Quizzes

Over the duration of the research, students completed 16 vocabulary quizzes. Each week, half of the students were allowed to use technology in the classroom to complete the related assignments and the other half were not permitted to use technology. An Excel spread sheet was made listing the grades for each student. For each student, a mean was determined for technology related scores, and a mean was determined for a non-technology related scores.

Computer and Science Attitude Surveys

The computer attitude and science attitude surveys have a response based on the Likert scale. The participants and their answers for each question were arranged on a spreadsheet using Microsoft Excel. A mean score and standard deviation for each question on the pre and post Computer Questionnaire survey was determined as well as for the Science Questionnaire survey.

The mean score from the pre assessment for each survey was compared to the score of the post assessment of that survey to determine any difference in attitude toward science.

Summary

Chapter 3 presented the design of this study. A time line for the study as well as the school and classroom setting were also given. Within the time line, details on data collection included how students were assessed at the beginning of the study, a description of the activities they were involved with, how data was collected as well as how final assessments were completed. A description of the assessments, quizzes and surveys was also given. The data that relates to the effects of technology being integrated into the curriculum has also been documented. In Chapter Four, Data Analysis, the data is interpreted and any relationships discussed.

CHAPTER FOUR: ANALYSIS

Introduction

This research study reports what effect the integration of technology had on student performance, student attitudes towards science as well as student attitudes towards technology. All of the data in the form of vocabulary assessments, weekly vocabulary quizzes, computer attitude surveys, science attitude surveys, student written reflections, field notes and e-mails that pertain to the study were collected over an 18 week period.

There are 86 students in the 8th grade at Winding Hills K-8 School. Almost all of the students, 84, agreed to take part in the research and received parental consent. Though academic data was obtained from all 84 participating students, the number of voluntary science and technology attitude surveys completed fluctuated each time the surveys were given out. This was due in part to absences or students not wanting to answer the questions during a particular survey administration as their participation was optional.

This chapter discusses the emerging themes from the data for each of the research questions established in chapter 1. Each theme is discussed in detail according to the research study's questions of how the integration of technology affected student performance, attitudes towards science and attitudes towards technology.

How Technology Integration Affected Student Performance

Research Question #1 -How did the integration of technology into the 8th grade science curriculum affect student academic performance?

Themes

Data for research question number one were collected through pre and post vocabulary assessments, weekly vocabulary quizzes and field notes. Upon analyzing the data, a few themes had emerged.

- Theme 1A-Students appreciated having the computers available as another resource to use when researching vocabulary word definitions and examples for classroom assignments.
- Theme 1B-Students felt that using classroom technology made the studying of scientific vocabulary more enjoyable and less stressful.
- Theme 1C-Students perceived using technology as causing personal increases in student performance as it related to understanding the vocabulary terms.

Vocabulary Assessments

All 84 of the study's participants completed a pre vocabulary assessment consisting of 160 science vocabulary terms and 83 of the study's participants completed the post vocabulary assessment. All the pre vocabulary assessments scores and post vocabulary assessment scores were input into a spreadsheet by using Microsoft Excel. The researcher used Microsoft Excel to

compute both the mean assessment score and the differences between the pre and post assessments. Part A contained 80 of the assessment's 160 words while Part B contained the remaining 80 words. The two parts were combined in order to provide an overall pre and post vocabulary assessment score.

Table 1
Comparison of Pre and Post Vocabulary Assessments

Vocabulary Assessments						
	Pre-A	Pre-B	Pre- Comb.	Post-A	Post-B	Post- Comb.
Mean	73.92	73.29	73.60	80.54	80.38	80.46
Standard Deviation	10.78	11.33	11.05	11.76	12.05	11.90

As Table 1 illustrated, participants average a score of 73.60% on the vocabulary terms before the study and 80.46% after the study was completed. The scores for Vocabulary List A increased by 6.62 points and the scores for Vocabulary List B increased 7.09 points. Overall, the vocabulary assessments showed an increase of 7 points or 9.32%. Though vocabulary assessment scores increased during the period of technology integration, the effect of technology integration on those scores could not be determined because of the absence of a control group.

Weekly Vocabulary Quizzes

The vocabulary terms were originally sorted into two sections: section A and section B. The purpose of the two sections was for half of the students to use classroom technology such as computers, the Internet and multimedia encyclopedias to research both the meaning and examples of the vocabulary words while the other half of students used print materials in the classroom such as textbooks and dictionaries. It was quickly discovered, though, that since students with home computers were using technology at home to complete the assignments when it was not their turn to use the classroom technology. Since the researcher could not limit the use of technology at home, the two groups were no longer distinguishably different. The only variable left was to sort the data based on who had typed their vocabulary homework in order to see effect on typing versus hand-writing on student performance. If it was the week in which a student was allowed to use the classroom computers in order to work on vocabulary and they typed their homework either in the classroom or at home, then they were able to receive extra credit on that homework assignment. If it was a week in which a student was not allowed to use the classroom computers but they typed their vocabulary homework at home, then they did not receive extra credit. Figure 2 illustrates the percentage of students who typed their vocabulary homework each week. Though typing of the vocabulary homework was not required, there was a relatively high percentage of homework being typed. This suggests that the using of computers to type homework assignments was preferred over hand-writing assignments.

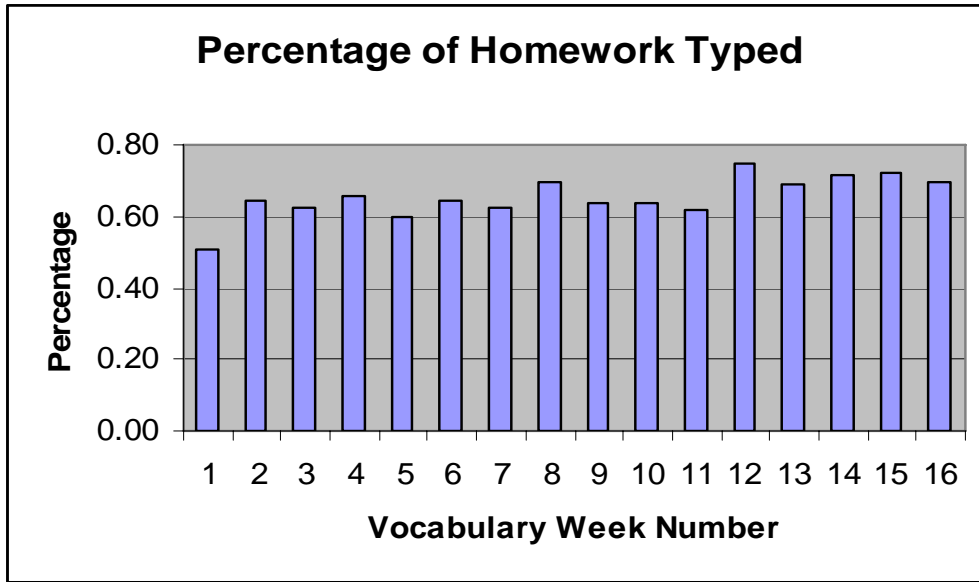


Figure 1: Percentage of Homework Typed

All 84 of the participants took weekly vocabulary quizzes. Three samples are included in Appendix H, Appendix I and Appendix J. There were sixteen vocabulary quizzes. Approximately 1,360 scores were compiled on a spreadsheet using Microsoft Excel. Figure 3 illustrates the average weekly vocabulary quiz scores.

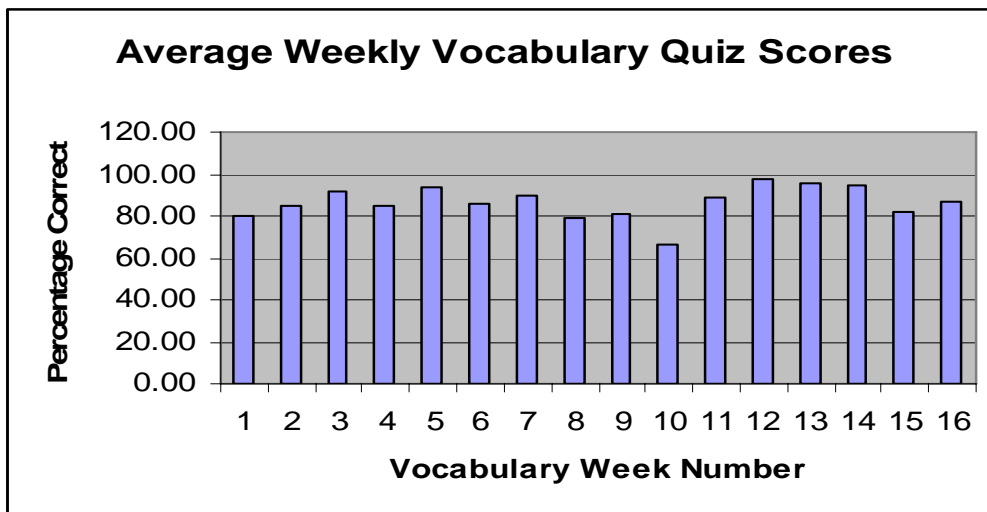


Figure 2: Average Weekly Vocabulary Quiz Scores

Using Microsoft Excel, the researcher ran a correlation between whether the vocabulary homework given to prepare for the weekly vocabulary quiz was typed or not and the weekly vocabulary scores in order to determine if typing had an effect on student performance. To do this, the researcher entered all of the vocabulary scores into a spreadsheet and noted next to each of the 1,360 quiz scores whether the participant typed the homework by entering the value of “1” or whether the assignment was hand-written entering in the value of “0.” When a student did not complete a homework assignment at all or used a school issued homework voucher, the category was left blank.

According to Gay & Airasian (2003), a correlation coefficient of .1829 is needed for a level of significance of .10 and a correlation coefficient of .2172 is needed for a level of significance of .05 with a sample size ranging between 80-89 participants. The mean correlational coefficient for all 16 vocabulary quizzes was 0.04 with a standard deviation of 21.4. The highest correlation coefficient ever reached was a 0.14, and that was reached during weeks 5, 7 and 14. The lowest correlation was during week one, with a correlation coefficient of -0.19. Figure 4 illustrates the weekly correlation coefficients. The data suggest that there is no correlation between learning vocabulary terms and typing out the vocabulary homework as opposed to hand writing the vocabulary homework because the minimum correlation coefficients have not been met.

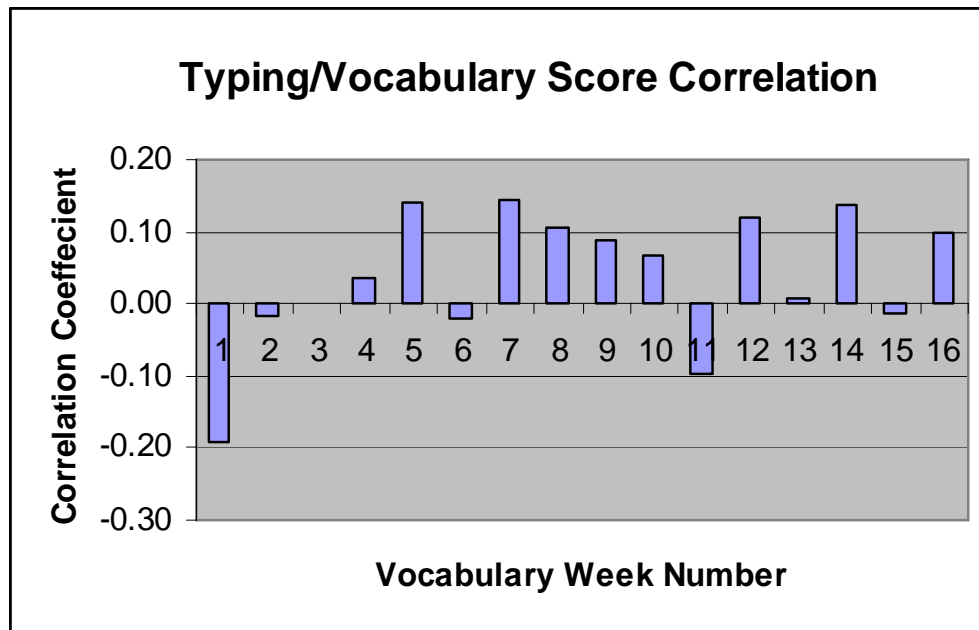


Figure 3: Typing/Vocabulary Score Correlation

Though it is discussed later how student’s perception of the use of computers and technology helped them learn vocabulary, there was no strong correlation between using the computer and student performance in terms of actual vocabulary understanding.

Field Notes

During the course of the research, students were asked about their feelings towards the three research questions of this study to include how they felt having access to and using so much technology in the classroom affected them academically. Some of their responses which support the themes in the data are discussed in this section.

Students appreciated having another resource to use when researching vocabulary word definitions and examples for classroom assignments. They commented on how technology made the information more readily available and that using the technology was easier versus traditional

print media. In addition to textbooks, science reference books, encyclopedias and dictionaries, students were provided with computers which they were able to use to access the Internet or various multimedia, encyclopedia software. Students made the following comments, which were typical, about having another resource when discussing their beliefs about the effects technology had on student performance:

When I couldn't find a word in the sciencesaurus [reference book] or a dictionary I use[d] the Internet it was helpful.

The computers did open another source for vocabulary so yes they did affected [affect] in a sense, our learning.

I liked having the computers/technology available because it offered us a broader learning source.

I liked it because it gave me another resource to choose from [in where I wanted to find my information]. If I could not find it in a textbook I could look on the computers.

It helped me by having all the resources at the tip[s] of my fingers.

The internet was a big part in helping me get deffinitions [definitions].

We have eaiser [easier] access to each word. We all take advantage of it.

I was exposed to a new resource. Which led to many more resources, and I then could find more examples and more definitions.

It helped with organization and refrences [references] for finding definitions.

I kind of like it because some experiments or vocab [vocabulary] words are pretty tough to comprehend so it helps.

I personally thought it was a much more convinient [convenient] way to learn the words than looking them up in a dictionary.

I enjoyed being able to use computers/technology for vocab [vocabulary] assignments because it is easier to type rather than hand write all the information.

Students felt that using classroom technology made the studying of scientific vocabulary more enjoyable and more helpful. Students enjoyed researching on the computers and typing their assignments. Students made the following comments, which were typical, about the ease of using computers and technology when working on vocabulary assignments:

I thought it was good since it's easier to look up words online.

Makes doing the work less stressful.

It got it done quicker.

I was glad to have computers to use for the vocabulary, it made it extremely simple compared to hand-writing it.

I like having them available because it's easier and quicker.

I feel great about it because it's more organized when you type the vocab [vocabulary] and on the internet you can find the definition for a word.

It made the vocabulary assignments easier and more fun.

I felt more relaxed knowing I could type up my vocab [vocabulary] words, because it's much easier.

Yes, because instead of taking a long time trying to find a word you can just go on a computer and find a words [word's] definition real quick.

I kind of think it is easier because you can check your answers on different websites.

Students perceived that using technology increased their performance as it related the understanding the vocabulary terms. Students commented on how they enjoyed using the computers, but they also expressed that they believed it was helping them have a better understanding of the meaning of the vocabulary terms. Students made the following comments when discussing how they felt technology affected their learning:

Yes, because it helps by being hands-on.

It can give you a better understanding.

Yes because it made it quicker and I could memorize them better.

It helped us to learn the different types of definition[s] for each word.

Having to recopy the vocabulary off of the computer [a website] helps me remember
the definitions of the words

It helped me to memorize them therefore helping me raise my grade.

Typing the words helped me learn the definitions and examples more easily.

It affected our learning because when you have a computer you have a choice of using
software or the internet [Internet], so then you have more than one definition
which will give you a better understanding of the words.

I fell that it is very beneficial to us, since it gives us a better understanding of the words.

Summary of Question #1

The integration of technology into the 8th grade science curriculum affected student academic performance in several ways. The addition of computers and technology into the assignments was a welcomed change. Students felt that using the computers and technology made working on the assignments easier and more helpful. The data did not show a correlation

to using technology and student performance. Overall, students perceived that they were learning more when using computers.

How Technology Integration Affected Student Attitude Towards Science

Research Question #2-How did the integration of technology affect student attitude towards science?

Themes

Data for research question number two were collected through pre and post science attitude surveys, e-mails and field notes. Upon analyzing the data, a few themes emerged.

- Theme 2A-Students appreciated having the computers/technology as another resource for learning science.
- Theme 2B-Students enjoyed using computers and technology as a part of the science curriculum.
- Theme 2C-Students felt it was beneficial to integrate computers and technology into the science curriculum.

Science Attitude Surveys

Participants were given a pre and post science attitude assessment. The TOSRA Instrument (Fraser, 1981) was shortened from seven to four categories to meet the specific needs of this research. The four remaining categories were attitudes towards science, enjoyment of

science lessons, leisure interest in science, and career interest in science. The survey was composed of 40 questions, in which there were 10 questions in each of the four categories.

The responses to each question on the pre and post survey were compiled into a spreadsheet using Microsoft Excel. Eighty-two participants completed the pre-survey and seventy-six participants, six less than the pre-survey, completed the post-survey. A total of approximately 6,320 responses from the pre and post-survey were entered into the spreadsheet.

Each response was based on a Likert scale. The data for each question was tabulated based on the number of responses for the categories of strongly agree, agree, not sure, disagree, and strongly disagree. Some of the questions were negatively worded so the numbers on the Likert scale were reversed before data analysis as indicated by the TOSRA instructions. The responses were then summarized for each question for sorting as strongly agree and agree responses in one category and disagree and strongly disagree in another category. The researcher then converted the responses to percentages as compared to the total number of participants who answered each particular question. Next, the mean and standard deviation for the responses to each question was calculated. Finally, data from the specific questions were assembled back into their original categories of attitude towards science, enjoyment of science lessons, leisure interest in science and career interest in science. All four of the categories showed a decrease in positive attitudes towards science. Though the overall attitude towards science decreased, it is important to note some of the changes in attitude as reflected by specific questions.

The following pages analyze responses to the Science Questionnaire by sections. This begins with the questions that relate to an attitude towards science in general. This is followed by questions which relate to the enjoyment of science lessons. Next, questions which relate to a

participant's leisure interest in science are covered, ending with the questions which inquire about a participant's career interest in science.

Attitude Towards Science

In the category of Attitude Towards Science, students were asked questions about how much they enjoyed science. Though student responses indicated a positive attitude towards science, the percentage of students with a positive attitude towards science decreased during the study based on the science attitude survey. As illustrated on Figure 5, when the survey was given before the research, 83.8% of the participants responded with a strongly agree or agree response to the questions inquiring about a positive attitude towards science. After the research that percentage dropped to 79.3%. There was a decrease of 4.5 percentage points in the strongly agree and agree responses expressing a positive attitude towards science, while there was a 1.0 percentage point increase in the disagree and strongly disagree responses expressing a negative attitude towards science. This represents a decrease of 5.7% in responses expressing a positive attitude towards science and an increase of 23.3% expressing a negative attitude towards science.

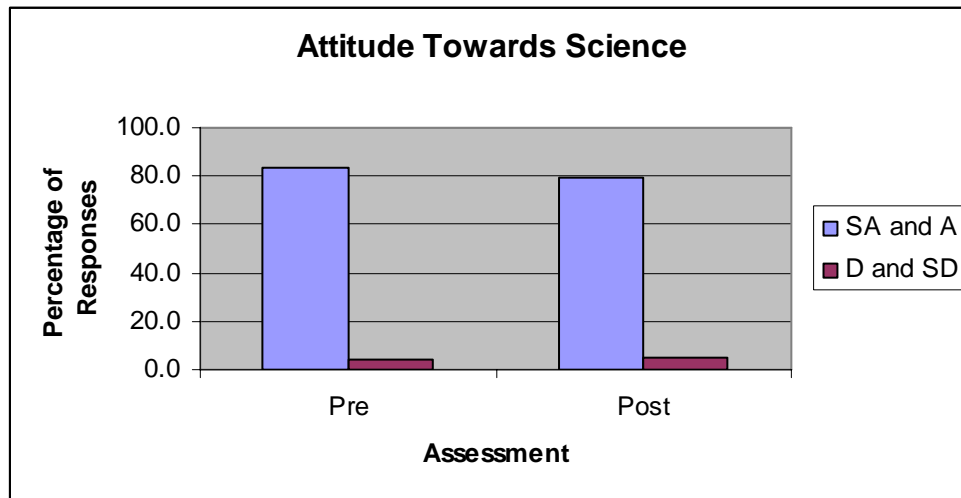


Figure 4: Pre and Post Attitudes Toward Science

The results of three questions that had the most impact on the change in this category are analyzed in more detail in the following paragraphs in order to show their importance in this study.

Question #1-I would prefer to find out why something happens by doing an experiment than by being told.

When the questionnaire was given before the research project, 98% of the participants answered with strongly agree or agree and 0% with disagree or strongly disagree with a standard deviation of 0.5. When the questionnaire was given after the research project, only 91% of the participants answered with strongly agree or agree, and the percentage of students who chose disagree or strongly disagree increased to 3.9% with a standard deviation of 0.8.

Questions #5-Doing experiments is not as good as finding out information from teachers.

The first time the survey was given, 96% (standard deviation of 0.7) of the participants disagreed with the statement, but that percentage decreased to 87% (standard deviation of 1.0) the second time the questionnaire was given. Originally, 3.7% of the participants agreed with the question, but later 6.6% agreed. This suggests the participants felt it was more valuable for them to learn science through experiments as opposed to having a teacher provide them with the information.

Question #29-It is better to ask the teacher the answer than to find it out by doing experiments.

Question #29 further emphasizes the opinion that participants feel it is better to learn on their own as opposed to having the teacher provide answers. Originally, 90% (standard deviation of 0.7) of the participants disagreed with the statement the first time the survey was given out, but that percentage dropped to 79% (standard deviation of 0.8) the final time the survey was given. There was minimum change in the percentage of participants agreeing with the statement as 1.2% agreed during the first survey and 1.3% during the final survey.

Enjoyment of Science Lessons

In the category of Enjoyment of Science Lessons, students were asked questions about how they would prefer to learn science. Though student responses indicated a positive attitude towards the enjoyment of science lessons, the percentage of students with a positive attitude towards science lessons decreased during the study based on the science attitude survey. Figure 6 illustrates when the survey was given before the research, 73.5% of the participants responded with a strongly agree or agree response to the questions inquiring about their enjoyment of science lessons. After the research that percentage dropped to 69.9%. There was a decrease of 3.7 percentage points in the strongly agree and agree responses expressing a positive attitude towards science lessons, while there was an increase of 1.9 percentage points in disagree and strongly disagree responses expressing a negative interest towards enjoyment of science lessons. This represents a decrease of 5.2% in responses expressing a positive attitude towards science lessons and an increase of 28.1% in expressing a negative attitude towards science lessons.

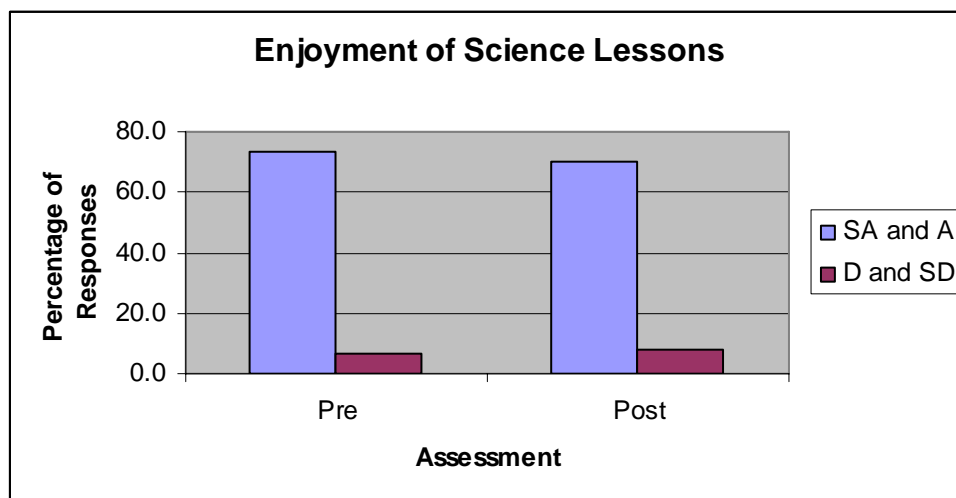


Figure 5: Pre and Post Enjoyment of Science Lessons

The following paragraphs address three of the questions that had the most impact on the change in this category and are analyzed in more detail.

Question #35-I would enjoy visiting a science museum at the weekend.

When the questionnaire was given before the research project, 43% of the participants answered with strongly agree or agree and 19% with disagree or strongly disagree (standard deviation of 1.0). When the questionnaire was given after the research project, only 35% of the participants answered with strongly agree or agree and the percentage of students who chose disagree or strongly disagree increased to 26% (standard deviation of 1.1).

Question #22-Science lessons are a waste of time.

Only 90% (standard deviation of 0.7) of the participants disagreed with the statement the first time the survey was given but that percentage decreased to 80% (standard deviation of 0.9) the second time the questionnaire was given. Originally, 1.3% of the participants agreed with the question but later percentage increased to 7.9%. The data suggest that students felt that science lessons were a good use of their time overall but the positive attitude towards science decreased during the research period.

Question #30-The material covered in science lessons is uninteresting.

The first time the questionnaire was given 78% (standard deviation of 0.6) of the participants disagreed with the statement, but that percentage decreased to 69% (standard deviation of 0.9) the second time the questionnaire was given. Originally, 1.3% of the participants agreed with the question but later that percentage significantly increased to 11%. The data from this question also illustrates a large percentage of students feeling that science is interesting though that percentage decreased during the research period.

Leisure Interest in Science

In the category of Leisure Interest in Science, students were asked questions about how much they enjoyed science outside of the educational setting. Though student responses indicated a relatively neutral attitude towards a leisure interest in science lessons, the percentage of students with a negative attitude towards a leisure interest in science increased during the study based on the science attitude survey. As Figure 7 illustrates, when the survey was given before the research, 28.9% of the participants responded with a strongly agree or agree response to the questions inquiring about having a leisure interest in science. After the research, that percentage dropped very slightly to 28.3%. Also, the percentage of participants that expressed that they did not have a leisure interest in science increased from 36.7% to 39% by the end of the study. There was a decrease of 0.6 percentage points in the strongly agree and agree responses expressing a positive leisure interests towards science, while there was a 2.3 percentage point increase in the disagree and strongly disagree responses expressing a negative attitude towards a

leisure interest in science. This represents a decrease of 2.1% in responses expressing a positive attitude towards leisure interest in science and an increase of 6.3% expressing a negative attitude towards a leisure interest in science.

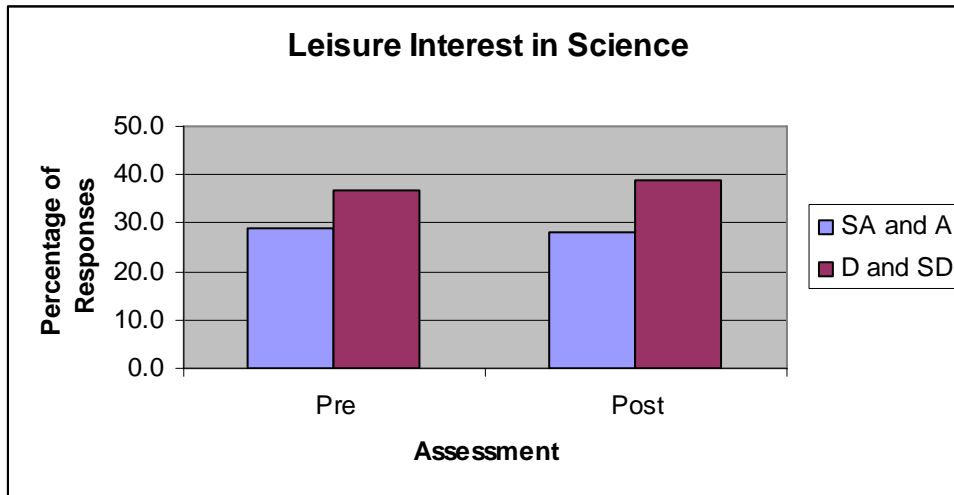


Figure 6: Pre and Post Leisure Interest in Science

Below, two of the questions that had the most impact on the change in this category are analyzed in more detail.

Question #11-I would like to be given a science book or a piece of scientific equipment as a present.

When the questionnaire was given before the research project, 21% of the participants answered with strongly agree or agree and 43% with disagree or strongly disagree (standard deviation of 1.1). When the questionnaire was given after the research project, only 16% of the

participants answered with strongly agree or agree, and the percentage of students who chose disagree or strongly disagree increased to 53% (standard deviation 1.2).

Question #31-Listening to talk about science on the radio would be boring.

Only 13% (standard deviation of 1.0) of the participants disagreed with the statement the first time the survey was given, but that percentage increased to 21% (standard deviation of 1.1) the second time the questionnaire was given. Originally, 57% of the participants agreed with the question, but later percentage significantly increased to 47%.

Both questions #11 and #31 provide data that suggests a decrease in positive attitude towards science. Students were less likely to want a science book as a present and less likely to want to listen to talk about science on the radio.

Career Interest in Science

In the category of Career Interest in Science, students were asked questions about how they feel towards working in different areas of science. Though student responses indicated a slightly more positive attitude towards a career interest in science, the percentage of students with a positive attitude towards a career interest in science decreased during the study based on the science attitude survey. As Figure 8 illustrates, when the survey was given before the research, 38.5% of the participants responded with a strongly agree or agree response to the questions inquiring about their interest in having a career in science. After the research, that percentage dropped to 33.6%. There was a decrease of 4.9 percentage points in the strongly

agree and agree responses expressing a positive attitude towards a career in science, while there was no change in the disagree and strongly disagree responses expressing a negative attitude towards a career in science. This represents a decrease of 14.6% in responses expressing a positive attitude towards a career in science and no change in the percentage who would not like a career in science.

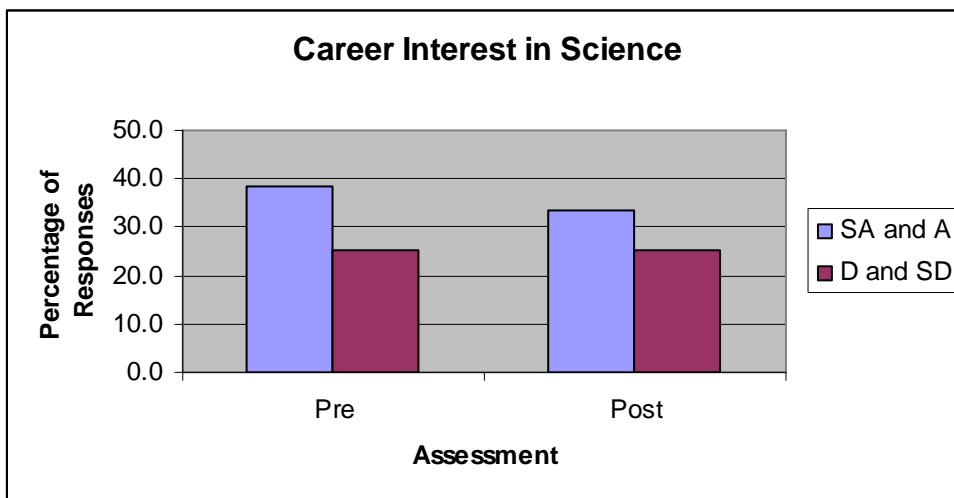


Figure 7: Pre and Post Career Interest in Science

Four of the questions that had the most impact on the change in this category are analyzed in more detail in the below paragraphs.

Question #16-Working in a science laboratory would be an interesting way to earn a living.

When the questionnaire was given before the research project, 56% of the participants answered with strongly agree or agree and 16% with disagree or strongly disagree (standard

deviation of 1.0). When the questionnaire was given after the research project, only 51% of the participants answered with strongly agree or agree and the percentage of students who chose disagree or strongly disagree increased to 21% (standard deviation of 1.1).

Question #12-I would dislike a job in a science laboratory after I leave school.

The first time the survey was given 30% (standard deviation of 0.9) of the participants disagreed with the statement, but that percentage decreased to 25% (standard deviation of 1.0) the second time the questionnaire was given. Originally, 27% of the participants agreed with the question, but later 35% agreed.

Question #24-I would like to teach science when I leave school.

When the questionnaire was given before the research project, 3.7% of the participants answered with strongly agree or agree and 60% with disagree or strongly disagree (standard deviation of 0.8). When the questionnaire was given after the research project, the percentage increased to 6.6% of the participants who answered with strongly agree or agree, and the percentage of students who chose disagree or strongly disagree decreased to 46% (standard deviation of 0.9).

Question #40-I would like to be a scientist when I leave school.

When the questionnaire was given before the research project, 11% of the participants answered with strongly agree or agree and 36% with disagree or strongly disagree (standard deviation of 0.9). When the questionnaire was given after the research project, only 12% of the participants answered with strongly agree or agree, and the percentage of students who chose disagree or strongly disagree decreased significantly to 27% (standard deviation of 0.9).

All three questions, question #16, question #12, question #24 and question #40 all indicate a decrease in desire to have a career position in science. There was a decrease in the percentage of students wanting a job in a science laboratory, wanting to teach science and wanting to be a scientist when leaving school.

E-Mails

All participants in the study, as well as their parents, were given the e-mail address of their science teacher. The teacher sends out weekly e-mails to all 8th grade students and their parents in the form of a newsletter almost every Friday. All e-mail communication to the science teacher was collected and printed in hopes of providing additional data for the study. All e-mails were unsolicited. Each e-mail was read and categorized as relating to research question #1, research question #2, research question #3, or not relating to the research at all.

Only three e-mails were received by parents that related to question #2. All three e-mails expressed a student's positive interest towards science and all were from different parents.

- E-mail #1, from Wednesday, September 15, states that the student is so excited about this year [in science class] and is really enjoying sharing with her sister [who took the class last year] what she is studying.
- Email #2, from Tuesday, October 26, states that the student wants to volunteer in the community and would prefer work related to science.
- Email #3, from Friday, November 19, states that her daughter really enjoys science class.

Though many e-mails were received from parents expressing their positive attitude towards the researcher's science class, only the three specifically mentioned their child's attitude toward the overall area of science.

Field Notes

During the course of the study, students were questioned about their feelings towards the research questions of this study which included how they felt about science. Some of their responses which support the themes in the data are discussed in this section.

Students appreciated having access to computers and technology as another resource for learning science. They felt technology could provide them with additional resources for acquiring knowledge. Students made the following comments, which were typical, about using computers and technology as part of science class:

I liked it, it was different than the norm.

I think it is a great source for tons of science stuff.

Without technology, we would not be at the level we are today in scientific discoveries therefore having technology helps us make our own discoveries in science.

I feel it provides a more depth explanation on what we are learning.

I like using technology because it allows us to do many experiments. Without technology we would be limited in science to only-non-using technology things.

I felt a bit of need for it, because I felt I should've been exposed to more resources that I could use.

Because if your [you're] not sure of something for example the Mousetrap cars, we used the computers and went to different sites to find different ways of creating a car.

I think it's good because it gives different points of views because with a teacher your [you] focus of [on] the teacher but with a computer you can do many different thing[s].

Yes, I do think it helped me because it helps me understand topics about questions or experiments we have.

Students also felt that using computers and technology in science class helped them to enjoy studying science more. For example, many students commented on how computers and technology made science class fun and interesting. Students made the following comments about using technology during science class:

I enjoyed using computers to learn science except when they froze.

It made science more exciting with using the computer to type and make power points instead of just writing it on paper.

I am not the biggest fan of computers and technology however I like using them in science because it gives you knowledge about technology and I feel more comfortable using computers too.

It was fun and a[n] enjoyable [enjoyable] experience.

Having computers in the classroom made science more fun and interesting to learn.

Yes, it did because it was a lot more fun and interesting.

It made me want to learn and made science fun.

It made it more fun, better.

Students felt it was beneficial to integrate computers and technology into the curriculum. For example, students commonly commented on how computers and technology helped them to learn and save time as they were learning science concepts. Students made the following comments about the benefits of integrating technology into the science classroom.

I feel that it is useful.

I think it is a good way to learn.

Its [it is] easier to comprehend.

Having computers made it easier to find answers then looking through an entire book.

Computers make everything much more convient [convenient].

I thought it was so much more convinient [convenient] and a huge time saver.

Summary of Question #2

The integration of technology into the 8th grade science curriculum affected student attitudes towards science by changing their attitudes towards science. Though some percentages

in the attitude towards science data decreased during the research period, overall, students appreciated having computers and technology as another resource when learning science. They also enjoyed using the computers as part of the science curriculum, and they felt it made learning science more enjoyable. Finally, students felt it was beneficial to integrate computers and technology into the science curriculum.

How Technology Integration Affected Student Attitude Towards Technology

Research Question #3-How does the integration of technology affect student attitude towards technology?

Themes

Data for research question number three were collected through pre and post computer attitude surveys, weekly vocabulary data and field notes. Upon analyzing the data, a few themes had emerged.

- Theme 3A-Students appreciated having the computers and technology in the classroom and as part of the curriculum.
- Theme 3B-Students viewed the integration of computers and technology into the curriculum as a positive and beneficial addition.
- Theme 3C-Students felt that using technology made it easier for them to complete assignments as well as made their assignments neater.
- Theme 3D-Students gained confidence in using computers and technology.

Computer Attitude Surveys

The participants were given a pre and post computer attitude survey. The survey consisted of 20 primary questions. The survey asked about their computer experience, how much they use computers at home and school, their opinions about using computers and their opinions about the advantages of using computers in an educational environment.

Seventy-five of the participants completed the pre attitude survey and 80 participants completed the post survey. The responses from each participant were assembled onto a spreadsheet using Microsoft Excel, documenting approximately 5,890 responses to questions from the participants. For the questions that inquired about how much time the participant uses the computer for a particular task, the mean response for each question was calculated as well as the standard deviation. When the question asked for an opinion using a Likert scale, the total number of participants responding to the question was tabulated before generalization percentages were calculated.

Overall, most participants have been using computers for a long time, use computers at home or at school often and feel comfortable using computers. At the beginning of the research, the mean number of years the participants had been using computers was 7.2 years with a standard deviation of 2.2. At the end of the research, the participants reported having used computers for a mean of 7.5 years with a standard deviation of 2.2 again. All seventy five of participants reported having a home computer at the beginning of the survey, and all eighty of the participants completing the survey at the end of the research reported having a home computer.

Before the research, participants reported using the computer at home for a mean of 14 hours per week with a standard deviation of 12. They spent the most time using the Internet (5.1

hours), using e-mail (3.6 hours), playing games (2.4 hours) and word processing (1.9 hours) each week. After the research, participants reported using the computer at home during the research period for a mean of 14.7 hours per week, with a standard deviation of 15.77. They spent the most time using e-mail (4.9 hours), using the Internet (4.7 hours), playing games (2.2 hours) and word processing (2 hours) per week.

Before the research, participants reported using the computers at school for a mean of 4.5 hours per week, with a standard deviation of 4.8. They spent the most time using the Internet (1.7 hours), word processing (.9 hours), using presentation software like Microsoft PowerPoint (0.5hours) and playing games (0.4 hours) each week. After the research, participants reported using the computers at school during the research period for a decreased mean of only 3.3 hours per week, with a standard deviation of 2.8. They spent the most time word processing (1 hour), using the Internet (0.9hours), using presentation software like Microsoft PowerPoint (0.4 hours). In addition, students also use computers to take Accelerated Reader computerized reading tests (AR tests) which test comprehension after reading a book independently (0.4 hours) per week.

Participants spent relatively little time using computers at other locations such as the public library or a parent's work site. The participants reported a mean of 0.7 hours per week before the study and 0.4 hours per week during the study.

Overall, the participants in the study have a high amount of interaction with computers and technology outside of the school setting as well as when they are at school. The amount of time the average participant spent on the computer at home is an indication that they enjoy using computers and are confident in using them.

Computer Questionnaire and Research Question #3

The computer questionnaire is analyzed in four sections. The first section analyzes questions that inquire about the participants comfort level with using computers. The second section is the analysis of questions that inquire about how computers should be used in an educational setting. The third section shares the analysis of questions that inquire about the participants opinions about the value of computers in the educational setting. Finally, the questions that inquire about the advantages of using computers and their relationship with teaching will be analyzed.

Questions about comfort with computers

Survey Question #6	%Disagree Pre/Post	%Agree Pre/Post
I am comfortable using computers.	2.6/1.3	97/99

Survey Question #7	%Disagree Pre/Post	%Agree Pre/Post
I am fearful of computers.	97/99	2.6/1.3

The responses to survey question #6 and #7 suggest that the vast majority of the participants feel comfortable with using computers and have little fear of using computers.

Originally, 97% (standard deviation of 0.9) felt comfortable with computers, and that percentage increased to 99% (standard deviation of 0.7) by the end of the study. The percentage of students who felt fearful went from 2.6% (standard deviation of 0.7) to 1.3% (standard deviation of 0.6). Both of these questions show that the participants felt comfortable with using computers or their level of fear in using computers and technology decreased during the study.

Questions about how computers should be used

Survey questions numbers 8, 10 and 14 ask the participants about their opinions on how computers should be used in the classroom. As a general trend, most participants responded with opinions that the most appropriate use of computers in the classroom should be for higher level tasks as opposed to drill and practice or remedial activities.

Survey Question # 8	%Disagree Pre/Post	%Agree Pre/Post
The most appropriate use of computers in classrooms is for drill-and-practice exercises.	47/50	53/50

There was a decrease in the percentage of students who felt computers should be used for drill-and-practice type exercises. The percentage of students who felt that computers should be used for drill and practice dropped from 53% (standard deviation of 1.2) to 50% (standard deviation of 1.2), a total of three percentage points over the course of the research. The

percentage of participants who agreed with the statement was approximately equal to the percentage of students who disagreed with the statement by the end of the research period.

Survey Question # 10	%Disagree Pre/Post	% Agree Pre/Post
Computers are an “extra,” outside of instruction, in the classroom.	40/47	60/53

The percentage of students who felt that computers were an “extra” decreased by seven percentage points or 13.2% during the course of the research. This would suggest that the participants felt computers were a beneficial part of the curriculum as they were exposed to different usages over the term of the study.

Survey Question #14	%Disagree Pre/Post	% Agree Pre/Post
The most appropriate use of computers in classrooms is for remediation exercises.	51/53	49/47

The participants were approximately split in their opinions about how computers should be used for remediation with a slight increase in those feeling that remediation was not the most appropriate use. Those who felt that the most appropriate use of computers in the classroom is

for remediation exercises fell from 49% (standard deviation of 1.0) to 47% (standard deviation of 1.3) and those who disagreed with the statement went from 51% (standard deviation of 1.0) to 53% (standard deviation of 1.3).

Questions about the value of computers

Survey Question #9	%Disagree Pre/Post	%Agree Pre/Post
Computers are an integral part of instruction.	8.5/6.3	92/94

The vast majority of participants agreed that computers are an integral part of instruction. Originally, 92 % (standard deviation of 0.8) agreed that computers were an integral part of instruction, and that percentage increased to 94% (standard deviation of 0.9) by the end of the research. In addition, the percentage of students that disagreed that computers were an integral part of instruction decreased 35% from 8.5% (standard deviation of 0.8) to 6.3% (standard deviation of 0.9).

Survey Question #12	%Disagree Pre/Post	% Agree Pre/Post
Computers in education are helpful to teachers.	2.6/1.3	97/99

Survey Question #13	%Disagree Pre/Post	% Agree Pre/Post
Computers will improve instruction.	7.9/3.8	92/96

Questions number 12 and 13 illustrated that the vast majority of participants felt that computers are beneficial when used in the classroom. The number of students who felt computers were helpful to teachers went from 97% (standard deviation of 0.8) to 99% (standard deviation of 0.7). The number of students who felt computers would improve instruction increased from 92% (standard deviation of 0.9) to 96% (standard deviation of 0.8).

Survey Question #15	%Disagree Pre/Post	% Agree Pre/Post
Excluding my technology courses, technology is integrated into my classes.	24/24	76/76

Approximately three-fourths of the participants felt that technology was integrated into their classes before the study began. That percentage did not change from the beginning of the research to the end. This suggests that they feel that computers and technology were integrated in other classes before the research as well as in the researcher's class and their other current classes.

Questions About Advantages of Using Computers and Teaching

The participants expressed an increase in their positive attitudes when asked about the advantages of using computers and teaching. Students felt that they created higher quality, better looking products with when using computers and technology. They also felt they were more likely to work harder and complete second drafts when using computers.

Table 2

Advantages of Using Computers When Teaching

Question	Not or Mild Advantage		Modest or Strong Advantage		% Increase
	Pre	Post	Pre	Post	
Students create better-looking products than they do with just writing and traditional media.	18	15	67	76	13.4
Student's writing <u>quality</u> is better when they use word processing.	36	32	58	65	12.1
Students work harder at their assignments when they use computers.	61	42	25	42	68.0
Students help one another more while doing computer work.	47	44	39	40	2.6
Students are more willing to do second drafts.	41	37	43	54	25.6

There was a 68% increase in the number of participants who felt that students worked harder when they used computers. Originally, 25% of the participants agreed with the statement (standard deviation of 1.3) , but that percentage increased to 42% (standard deviation of 1.3) at the end of the study. There was also a 25.6% increase in the participants who said they were more willing to do second drafts if they used computers. There was only a 2.6% increase in the opinion that students are more willing to help one another while using computers. This may be the result of the small, comfortable setting in which most of the 84 participants have been working together throughout their middle school experience. The small setting of our school perhaps promotes cooperation more as opposed to a large middle school setting.

Weekly Vocabulary Assignment Data

During the study, students were given ten vocabulary words in which they were asked to find two different definitions for as well as examples of the vocabulary word or concept (see appendix Q). Students could use the computers in the classroom or a computer outside of school to type the weekly vocabulary homework. Each week half of the students were allowed to receive extra credit if they typed their vocabulary homework and the other half would have a turn the following week. This was done in hopes of producing two groups, those that typed their assignment and those who did not, which could provide data on the effects of typing on academic performance. The students were very enthusiastic about using the computers in order to complete the research part of their assignment and for typing their assignment. As Figure 8 illustrates, even though only one half of the 84 participants were allowed to receive extra credit in a given week, the percentage of students typing their homework always exceeded 50%.

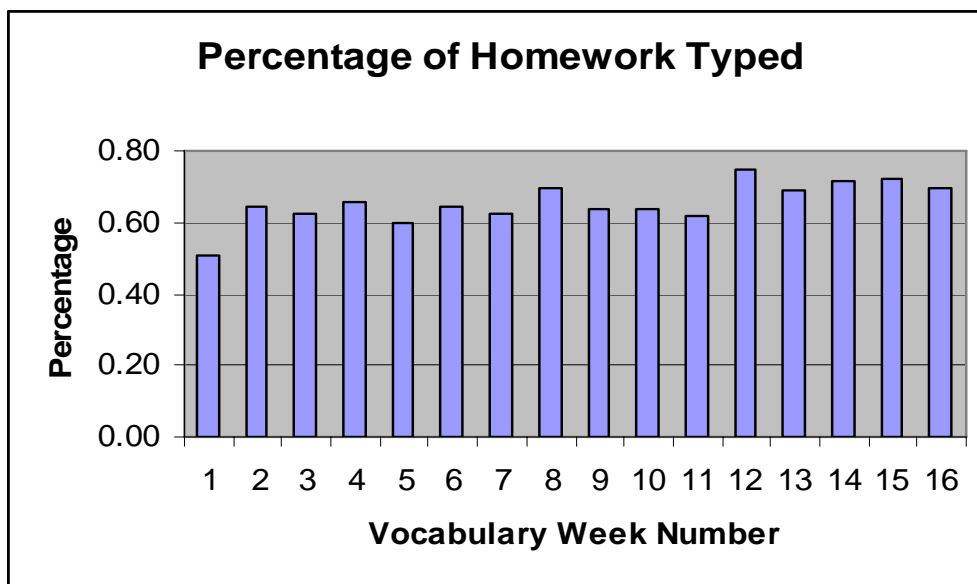


Figure 8: Percentage of Vocabulary Homework Typed

This occurrence also contributed to the emerging themes in the data. Data suggest that students appreciate having the computers and technology in the classroom, see them as a benefit, and feel it is easier to use computers and technology in order to complete assignments as opposed to handwriting.

Field Notes

During the course of the study, students were asked about their feelings towards technology when they were exposed to and required to use so much of it as part of the science curriculum. Students stated that they enjoyed using the computers and technology and felt it was an important resource to have in the classroom. Students also thought it was beneficial for learning science to have computers and technology integrated into the curriculum. And finally, students felt there were advantages to using computers and technology in the classroom as they

made work easier, neater and helped students gain experience and confidence in using them. Some of their responses which support the themes in the data are discussed by theme.

Students stated that they enjoyed using the computers and technology in the classroom. When asked how they felt about having computers and technology available for the vocabulary assignments, they commonly mentioned that they felt it was an important resource to have in the classroom. Students made the following comments, which were typical, about how they felt toward having technology in the classroom:

I think it is great and a different way of learning.

I think they are great for research and fun.

Sometimes it makes work easier and it's less boring because it's faster (in comparison to books).

If you have more technology [it] helps us understand computers better.

They have made me think of technology of [as] a very important resource.

Because computers can show you sometimes how things work in technology.

I like using computers/technology because you can find out different things.

It changed my opinions about using technology in the classroom because before I thought it was useless to use technology in the classroom when you can do that at home and use resources at school, but now I think that using technology in the classroom is good because it teaches us a lot and will help us in the future.

Students also commented on some of the benefits of using computers and technology in the classroom. When asked about what they felt about using computers and technology to learn

science, students expressed positive attitudes. Some of these comments, which were typical, were:

Good I feel better using a computer at home.

I enjoy using computers/technology.

I love computers and technology. They are very enjoyable.

I like using computers and using them in the classroom.

I thought using technology in the classroom would be a lot harder and confusing but it wasn't.

I thought it made science more fun and I learned a little more about technology in general.

It was helpful.

I love it its [it is] funer [more fun] to learn that way.

Everytime [Ever time] I use them, I learn more about technology and how to use computers, which is always good (and enjoyable).

I like technology, so having it in the classroom is a plus.

I like using computers/technology. It's fun to use, and a great resource for homework.

I never really used the computer much before and now it's really interesting.

It was a fun experience, having a lot of computers and such to help us with our work.

Students also commented on what they felt were advantages for them to use computers and technology. When asked how they felt about using computers and technology in general, they often commented that it made work easier and quicker. Some of these comments, which were typical, were as follows:

I love using computers because easier to use and is fun to use.

Using a computer allows work to get done much quicker.

It helps students learn easy.

I felt it made class easier.

I think it helps a lot.

We get things done faster and its [it is] more reliable.

I think it's easier for students to learn more about what to do.

I always thought having technology in the class would make things easier.

And finally, sometimes students made comments that expressed that they were confident with using computers. When asked how they felt about using computers and technology in the classroom they commonly mentioned they felt they were able to do more with them. Some of there comments, which were typical, were as follows:

I feel very comfortable.

I used to not really pay attention to computers in classes, but now that I use them more often, I believe it's important to learn about technology.

I feel much better about them after using them in science.

I feel confident when using a computer, because I have grown up around computers so I know how to use them.

Summary of Question #3

The integration of technology into the 8th grade science curriculum affected attitudes towards technology in several ways. Students appreciated having the computers and technology

in the classroom as part of the curriculum. They viewed the integration as beneficial as they enjoyed using the technology and felt by using it they were learning more about technology which would help them outside of the science classroom setting. And finally, they felt using computers and technology made it easier for them to complete neater assignments.

Summary

In chapter 4 data were presented and analyzed according to each of the three research questions. Several themes for each research question had emerged when the triangulated data was analyzed. Those themes, and the data from each source which supports it, was discussed in detail. In chapter 5, the conclusions will be discussed, recommendations will be made and relevance to future studies will be addressed.

CHAPTER FIVE: CONCLUSION

Purpose of Research

The purpose of this study was to determine the effects of integrating technology into an 8th grade science curriculum on student performance, attitude towards science and attitude towards the use of technology. I wanted to understand what affects integrating the use of 22 classroom computers and various other forms of technology into the curriculum would have on the students. The eighteen week long study provided students with the opportunity to word process, research on the Internet through traditional search methods and through a guided web quest, view experiment directions through PowerPoint presentations, write weekly reflections with integrated digital photos and experience other forms of technology integration. Based on the data I collected in the forms of attitude surveys, pre and post vocabulary assessments, vocabulary quizzes, vocabulary tests, documented communications and field notes, my conclusions were that the integration of technology did not have an effect on academic student performance as measured by this study but students appreciated having the technology resources in the classroom, enjoyed using the various forms of technology, felt using technology made the assignments easier and neater, and in some cases, gained confidence in using computers and technology. The focus of this study's conclusions was the literature review connections, the conclusions for each research question, and the limitations of the research.

Literature Review

With the ever-increasing trend for society to welcome technology, students will need to become technologically literate if they are to become successful in their adult life. Computer use is very common outside of the classroom and is increasing at schools.

In order for the integration of technology into the curriculum to be successful, barriers must be overcome. Some of these barriers include having the technology available whether in the classroom or a lab setting, planning technology usage, and training the teachers so they reach the level of confidence necessary to include it in their teaching methods.

Question #1-Integration and Student Academic Performance

There have been attempts to not only teach students technological skills for the sake of learning technological skills but with hopes of also increasing student achievement in other content areas. Though there have been relatively few research studies on the affects of technology on academic performance, some of the research suggested that there could be gains. The integration of computers with traditional instruction produces higher academic achievement than traditional instruction alone (ACT, 2004). “When we approach the adoption of new tools and practices with discernment, gains in student performance are likely to accrue” (McKenzie, 2002a p. 40). I have concluded that in my situation technology integration did not increase academic performance. “Introducing a computer, telecommunications tools or other technological resources into students’ learning experiences doesn’t automatically result in approved learning” (McGrath, 1998).

My research studied the effects of using computers and the Internet to research vocabulary terms. I was able to study the relationship between typing vocabulary homework assignments and vocabulary quiz scores. I concluded that a correlation did not exist between the two. Students expressed feelings that using computers and technology helped them learn the vocabulary better but data were unable to support that relationship.

Question #2-Integration and Attitude Toward Science

How students feel about technology can affect how they feel about science class when technology is integrated into the curriculum. It has been found that students generally like learning with computers and their attitude towards school is positively affected.

My research studied the effects of technology integration on attitudes towards science. I also found that students liked learning with computers. They were excited to have so many computers. They were also excited to do so much work with the computers. I also found that student positive attitudes toward science decreased during the research period.

Research also suggests that students can use computers to assist in publishing. Computers or word processing can aid in students' writing skills and their ability to organize and sort data better than paper and pencil methods. I found this to be true in my situation as well. Students were more willing to make changes to their work and felt they had neater final drafts when using technology.

Question #3-Integration and Attitude Toward Technology

It is important to examine student attitudes as they may contribute to the successful integration of technology into the classroom. How students feel about technology can affect how

they feel about using technology when completing assignments. Though many students enjoy using technology, there are some students who do not have positive attitudes towards technology due to their inexperience, lack of confidence, personal preferences or other reasons.

I found that the majority of my students had positive attitudes towards technology. I also found a few students who had changed to a more positive attitude towards computers after the research. One student did comment that she did not like computers before the study and continued to dislike computers after the study.

Whatever the attitude towards technology, it is important to choose uses for the technology that promote additional student growth. Less emphasis should be placed on using simple drill software and more emphasis should be placed on computer use that requires students to use higher level thinking skills.

Assignments were designed to challenge students thinking while integrating into the science curriculum. Students were involved in writing weekly reflections about what they were learning in class, doing guided research through WebQuests in order to learn how to improve their mouse trap powered cars, and learning how to conduct an experiment or project through the aid of digitally projected PowerPoint presentations.

Summary

Teachers who hold the constructivist teaching theory of having a classroom environment that is student centered are more likely to integrate technology into the curriculum. The structure of my class and my assignments are based on the constructivist theory. Students are often working in groups and take an active role in constructing their knowledge of science.

Question #1

I asked question number one because I wanted to see if the combination of involving different forms of technology I used in my classroom would effect student performance in a way that could be measured through testing and assessments. The different forms of technology that would have directly impacted their vocabulary tests and assessments would have been the use of computers to word process the assignment, and the use of the Internet or multimedia encyclopedias to research the meaning of the vocabulary terms.

I was surprised to discover that though the majority of the students would have their homework typed, the students did not appear to have as much interest in using the computers in the classroom for typing as compared to last year's students. Approximately one-half of the class was allowed to use the computers during class each week to complete their vocabulary homework assignments at any one time, and generally, only one-half of those students actually used computers. When I asked them why, they usually responded by saying it was easier to do it at home because if they started the assignment in the classroom they had to finish and print it in the classroom by the end of the week. I required the work be completed in class because I would not allow students to bring in computer disks which could be infected with a virus and contaminate our classroom network, or most importantly, our classroom server which was used by all students and myself.

I was unable to determine if using the Internet had an effect on student performance because of the previously mentioned point that students would use it at home on weeks I did not want them to; therefore, eliminating a weekly control group to compare those who used the Internet to those who did not. I did observe, however, that the Internet, in this particular

circumstance was not a benefit, though the students perceived that it was. Sometimes students would copy a definition down and not have the correct meaning of the word. For example, when looking up the meaning and examples for “deposition” students would sometimes give examples of the legal term of taking a statement instead of the scientific meaning related to erosion. I found the examples in the science textbook to provide much more detailed and accurate examples of the vocabulary concepts as they related to our science units.

In conclusion, I found students had an overall positive attitude towards using computers and technology in the classroom. Comments were often made about how they glad they were that we had so many computers in the classroom. They also felt computers and technology were a beneficial resource to have. Student perceptions of their performance sometimes changed when they used the computers as they felt they were learning the vocabulary terms better, even though the data did not support that belief.

Question #2

Question number two was asked because after years of working with integrating technology into my curriculum, I wanted to see what effects it would have on how my students perceived the science class overall. Students generally had a positive attitude towards the classroom environment and the subject of science. Most students have had the same three science teachers I presently teach with for their entire middle school science education. My science colleagues at Windy Hills K-8 School have the same philosophy of inquiry based science with an emphasis on hands-on activities and with less emphasis on printed materials like textbooks. The science atmosphere in these classrooms has created a positive attitude towards

science class and science. All of the data from e-mails, conversations with parents and students along with my field notes have correlated the idea of science class and science being fun.

Science Attitude Surveys

When I administered the science attitudinal surveys, students generally expressed positive attitudes in the area of science during the pre and post assessment. However, it was discovered that in all four categories of science in which the survey was measuring the percentage of positive attitudes slightly decreased which seemed to have conflicted with the other data. This might be due in part to a couple of conditions. One important consideration is the amount of testing and assessments the students were required to complete this year and how it affected their attitude towards assessments and surveys in general. During the 18 week research period, students were required by either the county or school administration to complete pre and mid assessments for language arts, writing, math, and science classes as well as complete several practice "Florida Writes" five paragraph essays, practice FCAT math assessments, and practice FCAT reading assessments. I frequently referred to this year as "The Year of the Assessments." I was able to administer my pre assessments and surveys before most of the required assessments were given, but unfortunately, I had to give out the post assessments and surveys after the multitude of other required assessments. Students were being assessed so much that it might have accounted for less positive attitudes the science survey reported. The second consideration is due to the multitude of assessments they were required to take might have contributed to the decrease in the number of students who volunteered to complete the

surveys at the end of the research period. Students were not motivated to complete yet another survey or anything that could be construed as an assessment.

Question #3

Finally, question number three was designed to help provide insight to any negative effects technology may have on students. Though our school provided typing lessons to all students as they progressed through the elementary grades, some students that have transferred to our school may not have had extensive training in typing or computer usage. I was interested in knowing if some students might have felt intimidated or overwhelmed with the extensive use of computers in the classroom.

Students held a positive attitude towards the integration of technology into the curriculum. They also felt it was beneficial to have the technology and that it helped make their work easier and neater. Some students who had negative feelings towards technology had changed to a more positive attitude and had gained more confidence with using technology.

Limitations

This study had several limitations in the form of researcher bias, sample population and data collection methods. Each limitation will be discussed separately with any future considerations.

Researcher Bias

As the science teacher involved in this study, my feelings towards technology were evident by how I set up the classroom with 22 computers and my history of extensively integrating technology into the curriculum. My attitudes towards science and technology could have had an influence on the students' opinions or their willingness to express contradicting opinions. Students were assured repeatedly that their true feelings were desired on the surveys and not what they thought I wanted to hear.

Participants

Another limitation was the population of participants in the study. In order to include the widest variety of students in regards to experience, interest, race or ethnic background, home language or special needs, I chose to use the entire 8th grade population of 86 students at our school. However, since our school is a magnet school, which means they must apply and be accepted before attending classes here, the conclusions from my research may not be applicable when compared to a different teaching environment.

Data collection

I realized early on that I was not going to be able to have a control group. In order to make a comparison between those who did not use technology and those who did use technology for a vocabulary assignment, I separated the class into 2 groups and rotated who could use the classroom computers each week. I discovered when it was not a student's turn to use the computers for a particular week they would use it at home as all students had access to a computer at home. I was unable, then, to have two distinguishably different groups to compare.

Data collection could have been improved by specifically asking students to respond to topics related to the research questions. For example, students wrote weekly reflections about what they did in science class and what they learned but very rarely made comments which related directly to the research questions. Having used weekly reflections in their current format proved to provide very little related data. The same concern existed with the e-mails. Though parents wrote with comments during the research period, the communications rarely were related to the research questions. The data collection could have been improved with more routine qualitative instruments that directly inquire about the research topics.

It was surprising to see the results of the post science attitude survey. Students' positive attitudes towards science had decreased in all four categories. The amount of school or county required assessments being administered during the research period could have affected students' responses. This could also explain the decrease in number of students who volunteered to complete the surveys at the end of the research period. Our county cancelled twelve days of school due to four hurricanes that occurred during the research period. The cancellation of rescheduling of school days may have also affected student opinions or perceptions. It would have been beneficial to interview students in order to determine the reason for the decrease in attitudes towards science.

Conclusion

In this study, I wanted to determine the effects of technology integration on student academic performance, attitude toward science and attitude toward technology. The analysis of the data showed there was no correlation between typing and researching an assignment versus

traditional paper, pencil and textbook methods. The data also showed that students liked to use technology in the classroom and felt it was beneficial. Results also indicated that students had a positive attitude toward technology integration, and improved negative attitudes some students held towards technology after using it during the research period.

Appendix A: Parental Consent

Appendix B: Child Assent Script

Child Assent Script

As you know, my name is Mr. Brunton, and I am a student at the University of Central Florida. I would like to ask you to participate in a research project to answer three questions. 1-How does the integration of technology into the 8th grade curriculum affect student academic performance? 2-How does the integration of technology affect student attitude towards science? 3-How does the integration of technology affect student attitude towards technology. If you choose to take part, you may stop your participation at any time and you will not have to answer any questions you do not want to answer. Only my instructor at the University and I will see your responses. Taking part in this research will not affect your grades. Would you like to participate?

Appendix C: Vocabulary Assessment Part A-1

Vocabulary Assessment List A-1

Directions:

- Read all directions before starting the test.
- **DO NOT WRITE ANYTHING ON THIS TEST BOOK!**
- Clear all items off of your desk except for the following items:
 - #2 pencil
 - laminated cover sheet
 - answer sheet
 - this test book
- On the answer sheet, fill in all of the following:

Name: **(your first and last name)**
Subject: **(Vocabulary A)**
Period: **(block number)** Date: **(today's date)**

- Read each question carefully and choose the best answer
- When you have checked your work, turn in your laminated cover sheet, answer sheet, and test book

1. variable

- A. factor being measured or observed in an experiment (Also known as the **RESPONDING VARIABLE**)
- B. an event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment
- C. the factor that is changed in an experiment in order to study changes in the dependent variable (Also known as the **MANIPULATING VARIABLE**)

2. independent variable

- A. factor being measured or observed in an experiment (Also known as the **RESPONDING VARIABLE**)
- B. an event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment
- C. the factor that is changed in an experiment in order to study changes in the dependent variable (Also known as the **MANIPULATING VARIABLE**)

3. dependent variable

- A. factor being measured or observed in an experiment (Also known as the **RESPONDING VARIABLE**)
- B. an event, condition, or factor that can be changed or controlled in order to study or test a hypothesis in a scientific experiment
- C. the factor that is changed in an experiment in order to study changes in the dependent variable (Also known as the **MANIPULATING VARIABLE**)

4. investigation

- A. a procedure that is carried out in order to observe a response caused by a stimulus
- B. a plan of inquiry that uses science process skills as tools to gather, organize, analyze, and communicate information
- C. procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis

5. experiment

- A. a procedure that is carried out in order to observe a response caused by a stimulus
- B. a plan of inquiry that uses science process skills as tools to gather, organize, analyze, and communicate information
- C. procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis

6. scientific method

- A. a procedure that is carried out in order to observe a response caused by a stimulus
- B. a plan of inquiry that uses science process skills as tools to gather, organize, analyze, and communicate information
- C. procedure that is carried out and repeated under controlled conditions in order to discover, demonstrate, or test a hypothesis

7. microscope

- A. an instrument that makes small objects appear smaller
- B. an instrument that makes small objects appear larger
- C. an instrument that makes large objects appear smaller

8. organ

- A. any living plant, animal, or fungus that maintains various vital processes necessary for life
- B. similar cells acting to perform a specific function; four basic types of tissue are muscle, connective, nerve, and epidermal
- C. a structure containing different tissues that are organized to carry out a specific function

9. tissue

- A. any living plant, animal, or fungus that maintains various vital processes necessary for life
- B. similar cells acting to perform a specific function; four basic types of tissue are muscle, connective, nerve, and epidermal
- C. a structure containing different tissues that are organized to carry out a specific function

10. organism

- A. any living plant, animal, or fungus that maintains various vital processes necessary for life
- B. similar cells acting to perform a specific function; four basic types of tissue are muscle, connective, nerve, and epidermal
- C. a structure containing different tissues that are organized to carry out a specific function

11. heterozygous

- A. cell or organism that does not have any alleles for a particular trait
- B. cell or organism that has two different alleles for a particular trait
- C. cell or organism that has identical rather than different alleles for a particular trait

12. homozygous

- A. cell or organism that does not have any alleles for a particular trait
- B. cell or organism that has two different alleles for a particular trait
- C. cell or organism that has identical rather than different alleles for a particular trait

13. protist

- A. unicellular organism
- B. a cellular organism
- C. a non-cellular, disease-causing particle that uses the genetic material from its host to reproduce

14. virus

- A. unicellular organism
- B. a cellular organism
- C. a non-cellular, disease-causing particle that uses the genetic material from its host to reproduce

15. photosynthesis

- A. a process of warm weather causing increased humidity in the atmosphere
- B. a chemical process by which plants trap light energy to convert carbon dioxide and water into carbohydrates (sugars)
- C. the motion of an organism or part of an organism toward or away from an external stimulus

16. tropism

- A. a process of warm weather causing increased humidity in the atmosphere
- B. a chemical process by which plants trap light energy to convert carbon dioxide and water into carbohydrates (sugars)
- C. the motion of an organism or part of an organism toward or away from an external stimulus

17. system

- A. a set of objects, organisms, or different parts acting to form a whole
- B. a group of organisms working independently of each other
- C. an organization of various animals from different ecosystems

18. energy pyramid

- A. (food cycle) the interconnected feeding relationships in a food chain found in a particular place and time
- B. a pyramidal diagram that compares the amount of energy available at each position, or level, in the feeding order
- C. transfer of energy through various stages as a result of feeding patterns of a series of organisms

19. food chain

- A. (food cycle) the interconnected feeding relationships in a food chain found in a particular place and time
- B. a pyramidal diagram that compares the amount of energy available at each position, or level, in the feeding order
- C. transfer of energy through various stages as a result of feeding patterns of a series of organisms

20. food web

- A. (food cycle) the interconnected feeding relationships in a food chain found in a particular place and time
- B. a pyramidal diagram that compares the amount of energy available at each position, or level, in the feeding order
- C. transfer of energy through various stages as a result of feeding patterns of a series of organisms

21. carnivore

- A. an animal that feeds on plants and animals
- B. an animal that feeds on plants
- C. an animal or plant that consumes or obtains nutrients from animals

22. herbivore

- A. an animal that feeds on plants and animals
- B. an animal that feeds on plants
- C. an animal or plant that consumes or obtains nutrients from animals

23. consumer

- A. an organism that makes its own food from the environment; usually a green plant
- B. any organism that feeds or obtains nutrients by breaking down organic matter from dead organisms
- C. an organism that feeds on other organisms for food

24. producer

- A. an organism that makes its own food from the environment; usually a green plant
- B. any organism that feeds or obtains nutrients by breaking down organic matter from dead organisms
- C. an organism that feeds on other organisms for food

25. decomposer

- A. an organism that makes its own food from the environment; usually a green plant
- B. any organism that feeds or obtains nutrients by breaking down organic matter from dead organisms
- C. an organism that feeds on other organisms for food

26. predator

- A. an organism that is used for making food
- B. an organism caught or hunted for food by another organism
- C. an organism that consumes other organisms

27. prey

- A. an organism that is used for making food
- B. an organism caught or hunted for food by another organism
- C. an organism that consumes other organisms

28. adaptation

- A. a characteristic of an organism that decreases its chance of survival in its environment
- B. a characteristic of an organism that decreases its chance to reproduce
- C. a characteristic of an organism that increases its chance of survival in its environment

29. conservation

- A. a condition in which there are no more living members of a species
- B. controlled use and/or maintenance of natural resources; various efforts to preserve or protect natural resources
- C. a condition where there are very few living members of a species in existence

30. extinction

- A. a condition in which there are no more living members of a species
- B. controlled use and/or maintenance of natural resources; various efforts to preserve or protect natural resources
- C. a condition where there are very few living members of a species in existence

31. acceleration

- A. amount of distance traveled divided by time taken; the time-rate at which any physical process takes place
- B. rate of change in velocity, usually expressed in meters per second; involves an increase or decrease in speed and/or a change in direction
- C. the prime-rate at which a body changes its position; defined as displacement divided by the time of travel

32. speed

- A. amount of distance traveled divided by time taken; the time-rate at which any physical process takes place
- B. rate of change in velocity, usually expressed in meters per second; involves an increase or decrease in speed and/or a change in direction
- C. the prime-rate at which a body changes its position; defined as displacement divided by the time of travel

33. velocity

- A. amount of distance traveled divided by time taken; the time-rate at which any physical process takes place
- B. rate of change in velocity, usually expressed in meters per second; involves an increase or decrease in speed and/or a change in direction
- C. the prime-rate at which a body changes its position; defined as displacement divided by the time of travel

34. air resistance

- A. force of air on moving objects
- B. a quality that tends to produce movement or acceleration of a body in the direction of its application; a push or pull
- C. a force that opposes the relative motion of two material surfaces in contact with one another

35. force

- A. force of air on moving objects
- B. a quality that tends to produce movement or acceleration of a body in the direction of its application; a push or pull
- C. a force that opposes the relative motion of two material surfaces in contact with one another

36. friction

- A. force of air on moving objects
- B. a quality that tends to produce movement or acceleration of a body in the direction of its application; a push or pull
- C. a force that opposes the relative motion of two material surfaces in contact with one another

37. pressure

- A. the force exerted in an opposite direction
- B. the force exerted in a certain amount of time
- C. the force exerted per unit area

38. Newton's 1st Law

- A. For every action, there is an equal but opposite reaction
- B. an object will keep doing what it is doing unless the forces acting on it become unbalanced
- C. Force = Mass X Acceleration

39. Newton's 2nd Law

- A. For every action, there is an equal but opposite reaction
- B. an object will keep doing what it is doing unless the forces acting on it become unbalanced
- C. Force = Mass X Acceleration

40. Newton's 3rd Law

- A. For every action, there is an equal but opposite reaction
- B. an object will keep doing what it is doing unless the forces acting on it become unbalanced
- C. Force = Mass X Acceleration

Appendix D: Vocabulary Assessment Part A-2

Vocabulary Assessment List A-2

Directions:

- Read all directions before starting the test.
- **DO NOT WRITE ANYTHING ON THIS TEST BOOK!**
- Clear all items off of your desk except for the following items:
 - #2 pencil
 - laminated cover sheet
 - answer sheet
 - this test book
- On the answer sheet, fill in all of the following:

Name: **(your first and last name)**
Subject: **(Vocabulary A)**
Period: **(block number)** Date: **(today's date)**

- Read each question carefully and choose the best answer
- When you have checked your work, turn in your laminated cover sheet, answer sheet, and test book

41. reflection

- A. a change in the direction of a wave that occurs as it passes from one medium to another of different density
- B. the bouncing off or turning back of light, sound, or heat from a surface
- C. the change in direction of a wave caused by passing by an obstacle or traveling through an opening

42. refraction

- A. a change in the direction of a wave that occurs as it passes from one medium to another of different density
- B. the bouncing off or turning back of light, sound, or heat from a surface
- C. the change in direction of a wave caused by passing by an obstacle or traveling through an opening

43. diffraction

- A. a change in the direction of a wave that occurs as it passes from one medium to another of different density
- B. the bouncing off or turning back of light, sound, or heat from a surface
- C. the change in direction of a wave caused by passing by an obstacle or traveling through an opening

44. electromagnetic radiation

- A. radiation that can be harnessed to make electricity
- B. the emission and propagation of the entire range of electromagnetic spectrum including: gamma rays, x-rays, ultraviolet radiation, visible light, microwaves, and radio waves
- C. radiation that lies within the visible range

45. light

- A. radiation that can be harnessed to make electricity
- B. the emission and propagation of the entire range of electromagnetic spectrum including: gamma rays, x-rays, ultraviolet radiation, visible light, microwaves, and radio waves
- C. radiation that lies within the visible range

46. magnetic field

- A. having the property of attracting iron and certain other materials by virtue of a surrounding field of force
- B. having the ability to attract magnetic materials
- C. the region where magnetic force exists around magnets or electric currents

47. magnetic

- A. having the property of attracting iron and certain other materials by virtue of a surrounding field of force
- B. having the ability to attract magnetic materials
- C. the region where magnetic force exists around magnets or electric currents

48. prism

- A. an instrument that uses a prism to separate and catalog light wavelengths
- B. a piece of glass with polished plane surfaces that disperses a beam of white light into its component colors
- C. an instrument that can determine the elements in a substance

49. spectroscope

- A. an instrument that uses a prism to separate and catalog light wavelengths
- B. a piece of glass with polished plane surfaces that disperses a beam of white light into its component colors
- C. an instrument that can determine the elements in a substance

50. electromagnetic spectrum

- A. the range of waves that are visible to the human eye
- B. the range of waves that can produce a magnetic field
- C. the full range of electromagnetic waves

51. erosion

- A. the natural processes that break down and change rock into soil, sand, and other materials; no transportation of those materials takes place
- B. layering matter in a natural process
- C. the wearing away of Earth's surface by the breakdown and transportation of rock and soil

52. water cycle

- A. the path water takes as it is being cycled through the environment, including condensation, evaporation, and precipitation
- B. the process of mechanically cleaning the water through filtration and the removal of solid waste
- C. the system of pipes, faucets and valves that are used to deliver water to a site

53. weathering

- A. the natural processes that break down and change rock into soil, sand, and other materials; no transportation of those materials takes place
- B. layering matter in a natural process
- C. the wearing away of Earth's surface by the breakdown and transportation of rock and soil

54. deposition

- A. the natural processes that break down and change rock into soil, sand, and other materials; no transportation of those materials takes place
- B. layering matter in a natural process
- C. the wearing away of Earth's surface by the breakdown and transportation of rock and soil

55. chemical weathering

- A. the breakdown of plastics and lab equipment due to frequent use of acidic chemicals
- B. the breakdown and alteration of rocks at or near the Earth's surface as a result of chemical processes
- C. the process of making acid rain due to pollution

56. plate tectonics

- A. the study of earth changing events like volcanoes, tornadoes and hurricanes
- B. the movement of large plates in the earth that cause earthquakes
- C. theory in which the Earth's crust is divided into a smaller number of large, rigid plates whose movements cause seismic activity along their borders

57. resource

- A. a resource that is replaced or restored, as it is used, by natural processes in a reasonable amount of time
- B. any material that can be used to satisfy a need
- C. a resource that can only be replenished over millions of years

58. renewable resource

- A. a resource that is replaced or restored, as it is used, by natural processes in a reasonable amount of time
- B. any material that can be used to satisfy a need
- C. a resource that can only be replenished over millions of years

59. nonrenewable resource

- A. a resource that is replaced or restored, as it is used, by natural processes in a reasonable amount of time
- B. any material that can be used to satisfy a need
- C. a resource that can only be replenished over millions of years

60. ocean basin

- A. a deep part of the ocean which helps to clean the ocean's water
- B. a depression on the surface of Earth occupied by water
- C. a dry area on the earth's surface which used to be an ocean's floor

61. moon

- A. a large, gaseous, self-luminous body held together by gravity and powered by thermonuclear reactions
- B. the closest star to Earth and the center of our solar system
- C. a natural satellite that revolves around a planet

62. moon phase

- A. a phrase that indicates the distance between the moon and the earth
- B. a phrase that indicates the fraction of the Moon's disc that is illuminated (as seen from Earth)
- C. a phrase that indicates the condition of the moon's surface conditions

63. star

- A. a large, gaseous, self-luminous body held together by gravity and powered by thermonuclear reactions
- B. the closest star to Earth and the center of our solar system
- C. a natural satellite that revolves around a planet

64. sun

- A. a large, gaseous, self-luminous body held together by gravity and powered by thermonuclear reactions
- B. the closest star to Earth and the center of our solar system
- C. a natural satellite that revolves around a planet

65. solar system

- A. a star and all the planets and other bodies that orbit it; the region in space where these bodies move
- B. another name for the entire universe
- C. a large collection of stars, gases, and dust that are part of the universe bound together by gravitational forces

66. planet

- A. the closest star to Earth and the center of our solar system
- B. a large body in space that orbits a star and does not produce light of its own
- C. a large, gaseous, self-luminous body held together by gravity and powered by thermonuclear reactions

67. galaxy

- A. a star and all the planets and other bodies that orbit it; the region in space where these bodies move
- B. another name for the entire universe
- C. a large collection of stars, gases, and dust that are part of the universe bound together by gravitational forces

68. spring tide

- A. a tide that happens twice a year when the moon is closest to the earth
- B. the tide of increased range that occurs twice monthly at the new and full phases of the Moon
- C. a twice-monthly tide of minimal range that occurs when the Sun, Moon, and Earth are at right angles to each other, thus decreasing the total tidal force exerted on Earth

69. neap tide

- A. a tide that happens twice a year when the moon is closest to the earth
- B. the tide of increased range that occurs twice monthly at the new and full phases of the Moon
- C. a twice-monthly tide of minimal range that occurs when the Sun, Moon, and Earth are at right angles to each other, thus decreasing the total tidal force exerted on Earth

70. constellation

- A. a star pattern identified and named as a definite group
- B. a large, gaseous, self-luminous body held together by gravity and powered by thermonuclear reactions
- C. a group of planets, moons and asteroids revolving around a star

71. solid

- A. one of the fundamental states of matter with a definite volume but no definite shape
- B. one of the fundamental states of matter in which the molecules do not have a fixed volume or shape
- C. having a definite shape and a definite volume; one of the fundamental states of matter

72. liquid

- A. one of the fundamental states of matter with a definite volume but no definite shape
- B. one of the fundamental states of matter in which the molecules do not have a fixed volume or shape
- C. having a definite shape and a definite volume; one of the fundamental states of matter

73. gas

- A. one of the fundamental states of matter with a definite volume but no definite shape
- B. one of the fundamental states of matter in which the molecules do not have a fixed volume or shape
- C. having a definite shape and a definite volume; one of the fundamental states of matter

74. mass

- A. a solid, liquid, or gas that possesses inertia and is capable of occupying space
- B. the amount of “stuff” an object contains
- C. measurement of how much “stuff” is packed in a certain volume of a substance

75. matter

- A. a solid, liquid, or gas that possesses inertia and is capable of occupying space
- B. the amount of “stuff” an object contains
- C. measurement of how much “stuff” is packed in a certain volume of a substance

76. mixture

- A. a combination of two or more substances uniformly dispersed throughout a single phase
- B. the product of a thorough blending of two or more substances, chemically combined
- C. the product of a thorough blending of two or more substances, not chemically combined

77. solution

- A. a combination of two or more substances uniformly dispersed throughout a single phase
- B. the product of a thorough blending of two or more substances, chemically combined
- C. the product of a thorough blending of two or more substances, not chemically combined

78. neutral

- A. a particle, object, or system that has an excess number of electrons
- B. a particle, object, or system that lacks a net charge
- C. a particle, object, or system that has a shortage of electrons

79. element

- A. a substance made up of a combination of two or more elements held together by chemical bonds that cannot be separated by physical means; has properties unlike those of the elements that make up the substance
- B. a substance that cannot be reduced to a simpler substance by chemical means
- C. a combination of two or more substances that have not combined chemically and that can be separated by physical means

80. compound

- A. a substance made up of a combination of two or more elements held together by chemical bonds that cannot be separated by physical means; has properties unlike those of the elements that make up the substance
- B. a substance that cannot be reduced to a simpler substance by chemical means
- C. a combination of two or more substances that have not combined chemically and that can be separated by physical means

Appendix E: Vocabulary Assessment Part B-1

Vocabulary Assessment List B-1

Directions:

- Read all directions before starting the test.
- **DO NOT WRITE ANYTHING ON THIS TEST BOOK!**
- Clear all items off of your desk except for the following items:
 - #2 pencil
 - laminated cover sheet
 - answer sheet
 - this test book
- On the answer sheet, fill in all of the following:

Name: **(your first and last name)**
Subject: **(Vocabulary B)**
Period: **(block number)** Date: **(today's date)**

- Read each question carefully and choose the best answer
- When you have checked your work, turn in your laminated cover sheet, answer sheet, and test book

1. allele
 - A. any of two or more alternate forms of a gene that an organism may have for a particular trait
 - B. any living plant, animal, or fungus that maintains various vital processes necessary for life
 - C. a specific part of a chromosome or sequence of DNA that determines a particular feature or characteristic in an organism
2. gene
 - A. any of two or more alternate forms of a gene that an organism may have for a particular trait
 - B. any living plant, animal, or fungus that maintains various vital processes necessary for life
 - C. a specific part of a chromosome or sequence of DNA that determines a particular feature or characteristic in an organism
3. recessive
 - A. an allele for a trait that will be masked unless the organism is homozygous for this trait
 - B. tendency of certain alleles to mask the expression of their corresponding alleles
 - C. a tendency for certain alleles to remain hidden when no other allele is present
4. dominance
 - A. an allele for a trait that will be masked unless the organism is homozygous for this trait
 - B. tendency of certain alleles to mask the expression of their corresponding alleles
 - C. a tendency for certain alleles to remain hidden when no other allele is present
5. sexual reproduction
 - A. a form of reproduction in which new individuals are formed without the involvement of gametes
 - B. reproduction involving the union of gametes producing an offspring with traits from both parents
 - C. a process of nuclear division in eukaryotic cells during which the nucleus of a cell divides into two nuclei, each with the same number of chromosomes
6. asexual reproduction
 - A. a form of reproduction in which new individuals are formed without the involvement of gametes
 - B. reproduction involving the union of gametes producing an offspring with traits from both parents
 - C. a process of nuclear division in eukaryotic cells during which the nucleus of a cell divides into two nuclei, each with the same number of chromosomes

7. mitosis

- A. a form of reproduction in which new individuals are formed without the involvement of gametes
- B. the process of nuclear division in cells during which the number of chromosomes is reduced by half
- C. a process of nuclear division in eukaryotic cells during which the nucleus of a cell divides into two nuclei, each with the same number of chromosomes

8. meiosis

- A. a form of reproduction in which new individuals are formed without the involvement of gametes
- B. the process of nuclear division in cells during which the number of chromosomes is reduced by half
- C. a process of nuclear division in eukaryotic cells during which the nucleus of a cell divides into two nuclei, each with the same number of chromosomes

9. punnett square

- A. an organization system for tracking biotic and abiotic factors
- B. a way of organizing the elements by their properties
- C. a graphic check board used to determine results from a particular genetic cross

10. life cycle

- A. the entire sequence of events in an organism's growth and development
- B. the stages that abiotic factors go through
- C. the entire sequence of events in a habitat

11. biotic

- A. factors in an environment relating to, caused by, or produced by living organisms
- B. an environmental factor not associated with the activities of living organisms
- C. environmental factors that are neither living or non-living

12. abiotic

- A. factors in an environment relating to, caused by, or produced by living organisms
- B. an environmental factor not associated with the activities of living organisms
- C. environmental factors that are neither living or non-living

13. community

- A. an integrated unit of a biological community, its physical environment, and interactions
- B. all the populations of organisms belonging to different species and sharing the same geographical area
- C. the sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air

14. ecosystem

- A. an integrated unit of a biological community, its physical environment, and interactions
- B. all the populations of organisms belonging to different species and sharing the same geographical area
- C. the sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air

15. environment

- A. an integrated unit of a biological community, its physical environment, and interactions
- B. all the populations of organisms belonging to different species and sharing the same geographical area
- C. the sum of conditions affecting an organism, including all living and nonliving things in an area, such as plants, animals, water, soil, weather, landforms, and air

16. habitat

- A. a group of organisms of different species living in a specific geographical area
- B. a group of organisms of the same species living in a specific geographical area
- C. a place in an ecosystem where an organism normally lives

17. population

- A. a group of organisms of different species living in a specific geographical area
- B. a group of organisms of the same species living in a specific geographical area
- C. a place in an ecosystem where an organism normally lives

18. entropy

- A. a measure of randomness or disorder of a closed system
- B. any alteration of the natural environment producing a condition harmful to living organisms; may occur naturally or as a result of human activities
- C. the existence of a wide range of different species in a given area or specific period of time

19. biodiversity

- A. a measure of randomness or disorder of a closed system
- B. any alteration of the natural environment producing a condition harmful to living organisms; may occur naturally or as a result of human activities
- C. the existence of a wide range of different species in a given area or specific period of time

20. pollution

- A. a measure of randomness or disorder of a closed system
- B. any alteration of the natural environment producing a condition harmful to living organisms; may occur naturally or as a result of human activities
- C. the existence of a wide range of different species in a given area or specific period of time

21. screw

- A. a type of simple machine that consists of a rod driven through the center of a cylinder that is allowed to rotate freely, yielding a mechanical advantage equal to the cylinder's diameter
- B. a type of simple machine that consists of an inclined plane used to separate two objects
- C. a type of simple machine that consists of an inclined plane wrapped around a cylinder

22. wedge

- A. a type of simple machine that consists of a rod driven through the center of a cylinder that is allowed to rotate freely, yielding a mechanical advantage equal to the cylinder's diameter
- B. a type of simple machine that consists of an inclined plane used to separate two objects
- C. a type of simple machine that consists of an inclined plane wrapped around a cylinder

23. wheel and axle

- A. a type of simple machine that consists of a rod driven through the center of a cylinder that is allowed to rotate freely, yielding a mechanical advantage equal to the cylinder's diameter
- B. a type of simple machine that consists of an inclined plane used to separate two objects
- C. a type of simple machine that consists of an inclined plane wrapped around a cylinder

24. lever

- A. a type of simple machine; consists of a rigid bar that pivots about a fulcrum, used to transmit and enhance power or motion
- B. the pivot point of a lever
- C. a type of simple machine; a slanted surface that makes it easier to move a mass from a lower point to a higher point

25. fulcrum

- A. a type of simple machine; consists of a rigid bar that pivots about a fulcrum, used to transmit and enhance power or motion
- B. the pivot point of a lever
- C. a type of simple machine; a slanted surface that makes it easier to move a mass from a lower point to a higher point

26. inclined plane

- A. a type of simple machine; consists of a rigid bar that pivots about a fulcrum, used to transmit and enhance power or motion
- B. the pivot point of a lever
- C. a type of simple machine; a slanted surface that makes it easier to move a mass from a lower point to a higher point

27. pulley

- A. a type of simple machine; consists of a rigid bar that pivots about a fulcrum, used to transmit and enhance power or motion
- B. a type of simple machine; a circular lever, usually a wheel with a groove where a rope can be placed and used to change the direction of a force
- C. a type of simple machine; a slanted surface that makes it easier to move a mass from a lower point to a higher point

28. kinetic energy

- A. the property of a body, due to its mass, that causes it to resist any change in its motion unless overcome by a force
- B. the energy possessed by a body because of its motion
- C. the energy an object has because of its position or structure; stored energy

29. potential energy

- A. the property of a body, due to its mass, that causes it to resist any change in its motion unless overcome by a force
- B. the energy possessed by a body because of its motion
- C. the energy an object has because of its position or structure; stored energy

30. inertia

- A. the property of a body, due to its mass, that causes it to resist any change in its motion unless overcome by a force
- B. the energy possessed by a body because of its motion
- C. the energy an object has because of its position or structure; stored energy

31. energy

- A. a change of energy from one form to another (e.g., mechanical to electrical, solar to electrical)
- B. a quantity that describes the capacity to do work; a source of usable power
- C. a fundamental principle stating energy cannot be created nor destroyed but only changed from one form to another

32. energy transfer

- A. a change of energy from one form to another (e.g., mechanical to electrical, solar to electrical)
- B. a quantity that describes the capacity to do work; a source of usable power
- C. a fundamental principle stating energy cannot be created nor destroyed but only changed from one form to another

33. conservation of energy

- A. a change of energy from one form to another (e.g., mechanical to electrical, solar to electrical)
- B. a quantity that describes the capacity to do work; a source of usable power
- C. a fundamental principle stating energy cannot be created nor destroyed but only changed from one form to another

34. wavelength

- A. the peak or highest point on a wave
- B. the lowest point on a wave
- C. the distance between crests of a wave

35. crest

- A. the peak or highest point on a wave
- B. the lowest point on a wave
- C. the middle point on a wave

36. trough

- A. the peak or highest point on a wave
- B. the lowest point on a wave
- C. the middle point on a wave

37. vibration

- A. in any periodic function (e.g., a wave) the maximum absolute variation of the function
- B. a repetitive movement around an equilibrium point
- C. the number of cycles or waves per unit time

38. frequency

- A. in any periodic function (e.g., a wave) the maximum absolute variation of the function
- B. a repetitive movement around an equilibrium point
- C. the number of cycles or waves per unit time

39. amplitude

- A. in any periodic function (e.g., a wave) the maximum absolute variation of the function
- B. a repetitive movement around an equilibrium point
- C. the number of cycles or waves per unit time

40. circuit

- A. an interconnection of electrical elements forming a complete path for the flow of current
- B. a wire or other material that is able to conduct electricity
- C. an organizational chart for showing the path of electricity in a system

Appendix F: Vocabulary Assessment Part B-2

Vocabulary Assessment List B-2

Directions:

- Read all directions before starting the test.
- **DO NOT WRITE ANYTHING ON THIS TEST BOOK!**
- Clear all items off of your desk except for the following items:
 - #2 pencil
 - laminated cover sheet
 - answer sheet
 - this test book
- On the answer sheet, fill in all of the following:

Name: **(your first and last name)**
Subject: **(Vocabulary B)**
Period: **(block number)** Date: **(today's date)**

- Read each question carefully and choose the best answer
- When you have checked your work, turn in your laminated cover sheet, answer sheet, and test book

41. conduction

- A. emission of energy in the form of rays or waves
- B. the transmission of heat through a medium and without the motion of the medium
- C. heat transfer in a gas or liquid by the circulation of currents from one region to another

42. convection

- A. emission of energy in the form of rays or waves
- B. the transmission of heat through a medium and without the motion of the medium
- C. heat transfer in a gas or liquid by the circulation of currents from one region to another

43. radiation

- A. emission of energy in the form of rays or waves
- B. the transmission of heat through a medium and without the motion of the medium
- C. heat transfer in a gas or liquid by the circulation of currents from one region to another

44. efficiency

- A. the relative effectiveness of a system or device determined by comparing input and output
- B. internal energy found by adding the kinetic energy of particles making up a substance
- C. a form of energy resulting from the temperature difference between a system and its surroundings

45. heat

- A. the relative effectiveness of a system or device determined by comparing input and output
- B. internal energy found by adding the kinetic energy of particles making up a substance
- C. a form of energy resulting from the temperature difference between a system and its surroundings

46. thermal energy

- A. the relative effectiveness of a system or device determined by comparing input and output
- B. internal energy found by adding the kinetic energy of particles making up a substance
- C. a form of energy resulting from the temperature difference between a system and its surroundings

47. calorie

- A. unit of energy; the amount of heat needed to raise one liter of water one degree Celsius at standard atmospheric pressure
- B. unit of energy; the amount of heat needed to raise one gram of water one degree Celsius at standard atmospheric pressure
- C. unit of energy; the amount of heat needed to raise one gram of water one degree Fahrenheit at standard atmospheric pressure

48. longitudinal wave

- A. a wave whose oscillation is at a right angle to the direction in which the wave travels
- B. a wave whose oscillation is perpendicular to the direction in which the wave travels
- C. a wave whose oscillation is parallel to the direction in which the wave travels

49. transverse wave

- A. a wave whose oscillation is at a right angle to the direction in which the wave travels
- B. a wave whose oscillation is perpendicular to the direction in which the wave travels
- C. a wave whose oscillation is parallel to the direction in which the wave travels

50. conductor

- A. outermost layer of Earth covering the mantle
- B. a substance that allows heat or electricity to pass through it
- C. a vent or fissure in Earth' s surface through which magma and its associated materials are expelled; generally a mountain-like structure

51. crust

- A. outermost layer of Earth covering the mantle
- B. a substance that allows heat or electricity to pass through it
- C. a vent or fissure in Earth' s surface through which magma and its associated materials are expelled; generally a mountain-like structure

52. volcano

- A. outermost layer of Earth covering the mantle
- B. a substance that allows heat or electricity to pass through it
- C. a vent or fissure in Earth' s surface through which magma and its associated materials are expelled; generally a mountain-like structure

53. topography

- A. the study of the earth's origins
- B. the study of how the earth was formed and has changed over time
- C. the surface, shape, and composition of a land area

54. earthquake

- A. the expelling of magma from an opening in the earth's surface
- B. the shaking of the ground caused by a sudden release of energy in Earth's crust
- C. the combination of strong winds and rain caused by convection currents

55. equator

- A. an imaginary circle around Earth's surface located between the poles and a plane perpendicular to its axis of rotation that divides it into the Northern and Southern Hemispheres
- B. a point on the earth farthest from the core
- C. the imaginary line on which an object rotates (e.g., Earth's axis runs through Earth between the North Pole and the South Pole); an imaginary straight line that runs through a body; a reference to the line in a coordinate system or graph

56. igneous rock

- A. a type of rock that forms from molten or partly molten material that cools and hardens
- B. rock formed from layers of sediment that overlay and squeeze together or are chemically combined
- C. a type of rock that forms from existing rock because of extreme changes caused by heat, pressure, or chemical environments

57. sedimentary rock

- A. a type of rock that forms from molten or partly molten material that cools and hardens
- B. rock formed from layers of sediment that overlay and squeeze together or are chemically combined
- C. a type of rock that forms from existing rock because of extreme changes caused by heat, pressure, or chemical environments

58. metamorphic rock

- A. a type of rock that forms from molten or partly molten material that cools and hardens
- B. rock formed from layers of sediment that overlay and squeeze together or are chemically combined
- C. a type of rock that forms from existing rock because of extreme changes caused by heat, pressure, or chemical environments

59. fossil

- A. any substance that comes from the earth and is renewable
- B. the remains of animal or plant life from past geologic ages that are now in a form suitable for use as a fuel (e.g., oil, coal, or natural gas)
- C. a whole or part of a plant or animal that has been preserved in sedimentary rock

60. fossil fuels

- A. any substance that comes from the earth and is renewable
- B. the remains of animal or plant life from past geologic ages that are now in a form suitable for use as a fuel (e.g., oil, coal, or natural gas)
- C. a whole or part of a plant or animal that has been preserved in sedimentary rock

61. gravitation

- A. a force of attraction between two masses
- B. a repelling effect between opposite charges
- C. the observed effect of the force of gravitation

62. gravity

- A. a force of attraction between two masses
- B. a repelling effect between opposite charges
- C. the observed effect of the force of gravitation

63. atmosphere

- A. the void in space in which there is no air
- B. the layers of gas that surround Earth, other planets, or stars
- C. the conditions on the surface which describe the habitat

64. axis

- A. an imaginary circle around Earth's surface located between the poles and a plane perpendicular to its axis of rotation that divides it into the Northern and Southern Hemispheres
- B. a point on the earth farthest from the core
- C. the imaginary line on which an object rotates (e.g., Earth's axis runs through Earth between the North Pole and the South Pole); an imaginary straight line that runs through a body; a reference to the line in a coordinate system or graph

65. universe

- A. a large collection of stars, gases, and dust that are part of the universe bound together by gravitational forces
- B. the total sum of all matter and energy that exists
- C. a star and all the planets and other bodies that orbit it; the region in space where these bodies move

66. atom

- A. a subatomic particle having a positive charge and which is found in the nucleus
- B. the center region of an atom where protons and neutrons are located; also a cell structure that contains the cell's genetic material
- C. the smallest unit of a chemical element that can still retain the properties of that element

67. electron

- A. a stable elementary particle that is negatively charged and orbits the nucleus of an atom
- B. a subatomic particle having zero charge, found in the nucleus of an atom
- C. a subatomic particle having a positive charge and which is found in the nucleus of an atom

68. neutron

- A. a stable elementary particle that is negatively charged and orbits the nucleus of an atom
- B. a subatomic particle having zero charge, found in the nucleus of an atom
- C. a subatomic particle having a positive charge and which is found in the nucleus of an atom

69. nucleus

- A. a subatomic particle having zero charge, found in the nucleus of an atom
- B. the smallest unit of a chemical element that can still retain the properties of that element
- C. the center region of an atom where protons and neutrons are located; also a cell structure that contains the cell's genetic material

70. proton

- A. a stable elementary particle that is negatively charged and orbits the nucleus of an atom
- B. a subatomic particle having zero charge, found in the nucleus of an atom
- C. a subatomic particle having a positive charge and which is found in the nucleus of an atom

71. change of state

- A. a physical change that occurs when matter changes to another state (i.e., liquid, gas, or solid)
- B. a reaction or a change in a substance produced by chemical means that results in producing a different chemical
- C. a reaction; a change in matter from one form to another, without forming new substances

72. chemical change

- A. a physical change that occurs when matter changes to another state (i.e., liquid, gas, or solid)
- B. a reaction or a change in a substance produced by chemical means that results in producing a different chemical
- C. a reaction; a change in matter from one form to another, without forming new substances

73. physical change

- A. a physical change that occurs when matter changes to another state (i.e., liquid, gas, or solid)
- B. a reaction or a change in a substance produced by chemical means that results in producing a different chemical
- C. a reaction; a change in matter from one form to another, without forming new substances

74. volume

- A. concentration of matter of an object; number of individuals in the same species that live in a given area; the mass per unit volume of a substance in a given area
- B. the amount of matter in something
- C. a measure of the amount of space an object takes up

75. density

- A. concentration of matter of an object; number of individuals in the same species that live in a given area; the mass per unit volume of a substance in a given area
- B. the amount of matter in something
- C. a measure of the amount of space an object takes up

76. evaporation

- A. the process by which a liquid is converted to its vapor phase by heating the liquid
- B. the process of changing from a gas (i.e., water vapor) to a liquid (i.e., dew); the act of making more dense or compact
- C. transfer of thermal energy in a fluid (liquid or gas), in which warmer fluid rises and cooler fluid sinks

77. condensation

- A. the process by which a liquid is converted to its vapor phase by heating the liquid
- B. the process of changing from a gas (i.e., water vapor) to a liquid (i.e., dew); the act of making more dense or compact
- C. transfer of thermal energy in a fluid (liquid or gas), in which warmer fluid rises and cooler fluid sinks

78. The Periodic Table of Elements

- A. a model of the atom where electrons orbit the nucleus in orbits and electrons can exist in certain orbits and energy levels
- B. table used to predict what traits offspring will have, based on what traits the parents have
- C. a chart where the elements are organized by their properties

79. Bohr model

- A. a model of the atom where electrons orbit the nucleus in orbits and electrons can exist in certain orbits and energy levels
- B. table used to predict what traits offspring will have, based on what traits the parents have
- C. a chart where the elements are organized by their properties

80. chromatography

- A. a technique for separating a mixture of gases, liquids, or dissolved substances.
- B. the study of light
- C. the study of how traits are passed from parent to offspring

Appendix G: 160 Science Vocabulary Terms

160 Science Vocabulary Terms

1. variable
2. independent variable
3. dependent variable
4. investigation
5. experiment
6. scientific method
7. microscopic
8. organ
9. tissue
10. organism
11. allele
12. gene
13. recessive
14. dominance
15. sexual reproduction
16. asexual reproduction
17. mitosis
18. meiosis
19. punnett square
20. life cycle
21. allele
22. gene
23. recessive
24. dominance
25. sexual reproduction
26. asexual reproduction
27. mitosis
28. meiosis
29. punnett square
30. life cycle
31. biotic
32. abiotic
33. community
34. ecosystem
35. environment
36. habitat

37. population
38. entropy
39. biodiversity
40. pollution
41. carnivore
42. herbivore
43. consumer
44. producer
45. decomposer
46. predator
47. prey
48. adaptation
49. conservation
50. extinction
51. screw
52. wedge
53. wheel and axle
54. lever
55. fulcrum
56. inclined plane
57. pulley
58. kinetic energy
59. potential energy
60. inertia
61. acceleration
62. speed
63. velocity
64. air resistance
65. force
66. friction
67. pressure
68. Newton's 1st Law
69. Newton's 2nd Law
70. Newton's 3rd Law
71. energy
72. energy transfer
73. conservation of energy
74. wavelength
75. crest
76. trough
77. vibration
78. frequency
79. amplitude
80. circuit
81. reflection

82. refraction
83. diffraction
84. electromagnetic radiation
85. light
86. magnetic field
87. magnetic
88. prism
89. spectroscope
90. electromagnetic spectrum
91. conduction
92. convection
93. radiation
94. efficiency
95. heat
96. thermal energy
97. calorie
98. longitudinal wave
99. transverse wave
100. conductor (in terms of heat)
101. erosion
102. water cycle
103. weathering
104. deposition
105. chemical weathering
106. plate tectonics
107. resource
108. renewable resource
109. nonrenewable resource
110. ocean basin
111. crust
112. volcano
113. topography
114. earthquake
115. equator
116. igneous rock
117. sedimentary rock
118. metamorphic rock
119. fossil
120. fossil fuels
121. moon
122. moon phase
123. star
124. sun
125. solar system
126. planet

- 127. galaxy
- 128. spring tide
- 129. neap tide
- 130. constellation
- 131. gravitation
- 132. gravity
- 133. atmosphere
- 134. axis
- 135. universe
- 136. atom
- 137. electron
- 138. neutron
- 139. nucleus
- 140. proton
- 141. solid
- 142. liquid
- 143. gas
- 144. mass
- 145. matter
- 146. mixture
- 147. solution
- 148. neutral
- 149. element
- 150. compound
- 151. change of state
- 152. chemical change
- 153. physical change
- 154. volume
- 155. density
- 156. evaporation
- 157. condensation
- 158. The Periodic Table of Elements
- 159. Bohr model
- 160. chromatography

Appendix H: Weekly Vocabulary Quiz Sample #1

Name: _____ Date: _____ Period _____

Vocabulary Quiz #3

Choose the best word the example is describing. Each word will only be used once.

-heterozygous	-homozygous	-protist	-virus	-photosynthesis
-tropism	-system	-food chain	-food web	-energy pyramid

1. _____ protozoan, slime molds, amoebas and certain algae
2. _____ interrelated or overlapping food chains
3. _____ different allele
4. _____ 100 acres of vegetation to feed 5 giraffes which in turn feed 1 lion
5. _____ food from the sun, carbon dioxide, chlorophyll and glucose
6. _____ little fish eaten by medium fish, medium fish eaten by big fish
7. _____ coral reef, fish, marine mammals and aquatic plants
8. _____ plant roots growing toward gravity even when a seed is planted "upside down"
9. _____ influenza, disease causing agent
10. _____ identical allele

Choose the best word to complete each sentence. Each word will only be used once.

-heterozygous	-homozygous	-protist	-virus	-photosynthesis
-tropism	-system	-food chain	-food web	-energy pyramid

11. _____ I could see from the _____ that one panther needs a lot of smaller animals for its energy who in turn need an even large supply of smaller animals and plants for their energy.

12. _____ These two fruit flies are _____ for red eye color because they have the identical alleles.

13. _____ After our class simulated a large _____ we could see that many species were interdependent.

14. _____ Due to _____ the plant was growing in the shade but was leaning over to reach an area that was full of sunlight.

15. _____ Alana was doing an experiment on _____ and wanted to see what affects different colors of light might have.

16. _____ The dog's bones, brain, blood, and organs all form a _____.

17. _____ By looking at the _____ Alexcia could see that the mice eat vegetation, snakes eat the mice and large birds eat the snakes.

18. _____ I thought the doctor was going to give me a prescription but she said she couldn't since I had a _____.

19. _____ The _____ had a very simple cellular structure when we examined it with the microscope.

20. _____ The two mice are _____ for fur color because they have different alleles.

Appendix I: Weekly Vocabulary Quiz Sample #2

Name: _____ Date: _____ Period _____

Vocabulary Quiz #6

Choose the best word the example is describing. Each word will only be used once.

screw	wedge	wheel and axle	lever	fulcrum
pulley	inclined plane	kinetic energy	potential energy	inertia

1. _____ ramp
2. _____ knife, axe, scissor blade
3. _____ fishing pole, pliers, baseball bat, wheel barrow handles
4. _____ a flower pot sitting on a fifth floor ledge
5. _____ clamp, inclined plane wrapped around a cylinder
6. _____ the center pin on a pair of scissors
7. _____ smashing into the windshield when not wearing a seatbelt
8. _____ faucet handle, door knob, screwdriver
9. _____ spinning bicycle wheel, runners running, rolling ball
10. _____ block and tackle

Choose the best word to complete each sentence. Each word will only be used once.

screw	wedge	wheel and axle	lever	fulcrum
pulley	inclined plane	kinetic energy	potential energy	inertia

11. _____ Alexcia and Alana rode on a see saw which is a type of _____.
12. _____ A roller coaster has the most amount of _____ when it is at the highest position on the track.
13. _____ As Alana was using a screwdriver to put in a screw she couldn't help but think that it was unusual to think of the screwdriver as a _____.
14. _____ Though some students could use the stairs, those students using wheel chairs used a form of _____ to get on the school's stage.
15. _____ The roller coaster had so much _____ the ride had to use brakes to stop the coaster safely so the riders could get off or it would have kept on going.
16. _____ A simple elevator with ropes or cables also would have at least one _____.
17. _____ The tip of a nail is a _____ as it pushes apart an opening in the wood.
18. _____ A roller coaster has the most amount of _____ when it is at the bottom of a tall hill.
19. _____ When Mihoko twisted the handle on the clamp, which is a form of a _____, the threaded axle slowly pushed the two pieces of wood closer together.
20. _____ As I lifted the weights up and down with my arm I noticed that my elbow was acting as a _____.

Appendix J: Weekly Vocabulary Quiz Sample #3

Name: _____ Date: _____ Period _____

Vocabulary Quiz #15

Choose the best word the example is describing. Each word will only be used once.

solid	liquid	gas	mass	matter
mixture	solution	neutral	element	compound

1. _____ calcium, aluminum, oxygen, helium, sodium
2. _____ neither positive or negative
3. _____ fruit salad, vegetable salad, turkey stuffing, chicken soup
4. _____ has a shape and volume that can change
5. _____ Koolaid, Coke, tea
6. _____ solids, liquids and gases
7. _____ sugar, salt, baking soda
8. _____ has a fixed shape and volume that do not change
9. _____ how much “stuff” makes up an object
10. _____ has a fixed volume but can change shape

Choose the best word to complete each sentence. Each word will only be used once.

solid	liquid	gas	mass	matter
mixture	solution	neutral	element	compound

11. _____ The substance had turned _____ when it had neither a positive of negative charge.
12. _____ All _____ takes up space and contains a certain amount of material.
13. _____ The elements in a _____ are chemically bonded and has properties different from the elements that make it up.
14. _____ If placed into a glass a _____ would leak out and expand.
15. _____ Mihoko likes to drink coffee which is an example of a _____.
16. _____ Alana said an example of a _____ would be a bowl of pretzels, granola and nuts.
17. _____ The _____ of an object can be measured in grams.
18. _____ If placed into a glass a _____ would take the shape of the glass and stay in the glass.
19. _____ An _____ is made up of one kind of atom.
20. _____ If placed in a glass a _____ would not change to the shape of the glass.

Appendix K: Computer Questionnaire

Computer Questionnaire

Student Version

Name: _____
Date: _____
Period: _____
Gender: _____

_____ 1. How many years have you been using computers?

_____ 2. Do you have a home computer?

_____ a. If yes, how many years have you had a home computer?

3. If you use a computer at **HOME**, about how many **HOURS** per **WEEK** do you use each of these applications?

_____ a. Word Processing (e.g. Word, Works)

_____ b. Spreadsheet (e.g. Excel)

_____ c. Presentation (e.g. PowerPoint)

_____ d. Email (e.g., correspondence, chats, conferences, IM)

_____ e. Internet (e.g., Explorer, Netscape, browsers)

_____ f. Games/Tutorials/Drills (e.g. Myst, Doom, Solitaire)

_____ g. Reference (e.g. Encarta, books on CD, encyclopedias on CD)

_____ h. Other (name the application(s)) _____

4. Think about **LAST SEMESTER**. In a typical **WEEK** at **SCHOOL**, how many **HOURS** did you use each of these applications?

_____ a. Word Processing (e.g. Word, Works)

_____ b. Spreadsheet (e.g. Excel)

_____ c. Presentation (e.g. PowerPoint)

_____ d. Email (e.g., correspondence, chats, conferences, IM)

_____ e. Internet (e.g., Explorer, Netscape, browsers)

_____ f. Games/Tutorials/Drills (e.g. Myst, Doom, Solitaire)

_____ g. Reference (e.g. Encarta, books on CD, encyclopedias on CD)

_____ h. Other (name the application(s)) _____

_____ 5. How many **HOURS** per **WEEK** do you use the computers at a place **other than home or school**?

a. If yes, name the place or places _____

Circle the number that best indicates your agreement or disagreement with each of the following statements concerning your knowledge about technology.

Statement	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
6. I am comfortable using computers.	1	2	3	4	5	6
7. I am fearful of computers.	1	2	3	4	5	6
8. The most appropriate use of computers in classrooms is for drill-and-practice exercises.	1	2	3	4	5	6
9. Computers are an integral part of instruction.	1	2	3	4	5	6
10. Computers are an “extra,” outside of instruction, in the classroom.	1	2	3	4	5	6
11. The best use of computers in classrooms is as a reward for students who finish required work early.	1	2	3	4	5	6
12. Computers in education are helpful to teachers.	1	2	3	4	5	6
13. Computers will improve instruction.	1	2	3	4	5	6
14. The most appropriate use of computers in classrooms is for remediation exercises.	1	2	3	4	5	6
15. Excluding my technology courses, technology applications were integrated into my classes.	1	2	3	4	5	6

Which of these are advantages of using computers in teaching? Check one box for each question. If you haven’t had enough experience with computers to have an opinion, check the “don’t know” box.

	Not true, not an advantage	Somewhat true, a mild advantage	True, a modest advantage	True, a strong advantage	Don’t know
16. Students create better-looking products than they do with just writing and traditional media.					
17. Student’s writing <u>quality</u> is better when they use word processing.					
18. Students work harder at their assignments when they use computers.					
19. Students help one another more while doing computer work.					
20. Students are more willing to do second drafts.					

Appendix L: PT3 Survey Permission

Brunton, Gregory

From: Mia Williams [MIA.WILLIAMS@asu.edu]
Sent: Wednesday, May 05, 2004 4:01 PM
To: Brunton, Gregory
Subject: RE: Permission to use survey instruments

Sorry for the delay- your message was lost among other things.

You may use the documents as they are on-line for that purpose.
Please include citations as appropriate for what you use.
Let me know if you have questions or need further assistance.
Best wishes on your project.

Mia Kim Williams

Educational Technology

Arizona State University West
College of Education
V-602-543-6413
F-602-543-6350
<http://www.west.asu.edu/mwilliam>

-----Original Message-----

From: Brunton, Gregory [mailto:bruntog@ocps.k12.fl.us]
Sent: Tuesday, April 20, 2004 12:38 PM
To: Mia Williams
Subject: Permission to use survey instruments

PT3 Project Representative,

I am a student at the University of Central Florida working on my thesis. I am exploring how technology affects student's retention.

I would like permission to use and adapt your survey/questionnaire instrument title PT3 Teacher Pre-Questionnaire.

Thank you for your consideration,

Greg Brunton

Appendix M: Pre/Post Science Attitude Survey

Science Questionnaire

DIRECTIONS

1. This test contains a number of statements about science. You will be asked what you yourself think about these statements. There are no 'right' or 'wrong' answers. Your opinion is what is wanted.
2. All answers should be given on the separate Answer Sheet. Please do not write on this booklet.
3. For each statement, draw a circle around

SA if you **STRONGLY AGREE** with the statement;
A if you **AGREE** with the statement;
N if you are **NOT SURE**;
D if you **DISAGREE** with the statement;
SD if you **STRONGLY DISAGREE** with the statement.

Practice Item

It would be interesting to learn about boats.

Suppose that you **AGREE** with this statement, then you would circle A on your Answer Sheet, like this:

SA (A) N D SD

4. If you change your mind about an answer, cross it out and circle another one.
5. Although some statements in this test are fairly similar to other statements, you are asked to indicate your opinion about all statements.

1. I would prefer to find out why something happens by doing an experiment than by being told.
2. Science lessons are fun.
3. I would like to belong to a science club.
4. I would dislike being a scientist after I leave school.
5. Doing experiments is not as good as finding out information from teachers.
6. I dislike science lessons.
7. I get bored when watching science programs on TV at home.
8. When I leave school, I would like to work with people who make discoveries in science.
9. I would prefer to do experiments than to read about them.
10. School should have more science lessons each week.
11. I would like to be given a science book or a piece of scientific equipment as a present.
12. I would dislike a job in a science laboratory after I leave school.
13. I would rather agree with other people than do an experiment to find out for myself.
14. Science lessons bore me.
15. I dislike reading books about science during my holidays.
16. Working in a science laboratory would be an interesting way to earn a living.
17. I would prefer to do my own experiments than to find out information from a teacher.
18. Science is one of the most interesting school subjects.

19. I would like to do science experiments at home.
20. A career in science would be dull and boring.
21. I would rather find out about things by asking an expert than by doing an experiment.
22. Science lessons are a waste of time.
23. Talking to friends about science after school would be boring.
24. I would like to teach science when I leave school.
25. I would rather solve a problem by doing an experiment than be told the answer.
26. I really enjoy going to science lessons.
27. I would enjoy having a job in a science laboratory during my school holidays.
28. A job as a scientist would be boring.
29. It is better to ask the teacher the answer than to find it out by doing experiments.
30. The material covered in science lessons is uninteresting.
31. Listening to talk about science on the radio would be boring.
32. A job as a scientist would be interesting.
33. I would prefer to do an experiment on a topic than to read about it in science magazines.
34. I look forward to science lessons.
35. I would enjoy visiting a science museum at the weekend.
36. I would dislike becoming a scientist because it needs too much education.
37. It is better to be told scientific facts than to find them out from experiments.
38. I would enjoy school more if there were no science lessons.
39. I dislike reading newspaper articles about science.
40. I would like to be a scientist when I leave school.

Science Questionnaire Answer Sheet

Name: _____ Block: _____ Date: _____

Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
----------------	-------	----------	----------	-------------------

1. SA A N D SD
2. SA A N D SD
3. SA A N D SD
4. SA A N D SD
5. SA A N D SD
6. SA A N D SD
7. SA A N D SD
8. SA A N D SD
9. SA A N D SD
10. SA A N D SD
11. SA A N D SD
12. SA A N D SD
13. SA A N D SD
14. SA A N D SD
15. SA A N D SD
16. SA A N D SD
17. SA A N D SD

(over)

Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
----------------	-------	----------	----------	-------------------

18.	SA	A	N	D	SD
19.	SA	A	N	D	SD
20.	SA	A	N	D	SD
21.	SA	A	N	D	SD
22.	SA	A	N	D	SD
23.	SA	A	N	D	SD
24.	SA	A	N	D	SD
25.	SA	A	N	D	SD
26.	SA	A	N	D	SD
27.	SA	A	N	D	SD
28.	SA	A	N	D	SD
29.	SA	A	N	D	SD
30.	SA	A	N	D	SD
31.	SA	A	N	D	SD
32.	SA	A	N	D	SD
33.	SA	A	N	D	SD
34.	SA	A	N	D	SD
35.	SA	A	N	D	SD
36.	SA	A	N	D	SD
37.	SA	A	N	D	SD
38.	SA	A	N	D	SD
39.	SA	A	N	D	SD
40.	SA	A	N	D	SD

Appendix N: TOSRA Permission

Subj: **RE: TOSRA-Request Permission to Use**
Date: 6/8/2004 11:43:26 PM Eastern Daylight Time
From: B.Fraser@curtin.edu.au
To: GBrunton@aol.com

Greg

You have my permission to use and modify TOSRA.

I could mail you a copy, but you didn't provide your mailing address.

Good luck with your research.

Barry Fraser

-----Original Message-----

From: GBrunton@aol.com [<mailto:GBrunton@aol.com>]
Sent: Tuesday, 8 June 2004 10:47 AM
To: B.Fraser@smec.curtin.edu.au
Subject: TOSRA-Request Permission to Use

Dr. Fraser,

I am a graduate student at the University of Central Florida. I am writing a thesis title " The Effects of Integrating Technology into the 8th Grade Science Curriculum."

I would like to ask:

1. May I have permission to use the TOSRA?
2. Do you know where I could obtain a clean (unmodified) copy of the instrument?
3. Would I have permission to modify the TOSRA for my needs?

Thank you very much for your consideration.

Sincerely,
Greg Brunton

Wednesday, June 09, 2004 America Online: GBruntton

Appendix O: IRB Approval Page



THE UNIVERSITY OF CENTRAL FLORIDA
INSTITUTIONAL REVIEW BOARD (IRB)

IRB Committee Approval Form

PRINCIPAL INVESTIGATOR(S): Greg Brunton

PROJECT TITLE: The Effects of Integrating Technology into an 8th Grade Science Curriculum.

Committee Members:

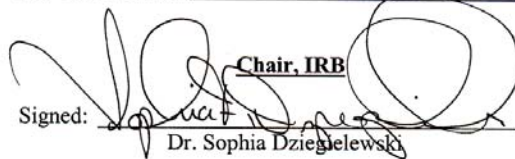
- Dr. Theodore Angelopoulos: _____
- Ms. Sandra Browdy: _____
- Dr. Jacqui Byers: _____
- Dr. Ratna Chakrabarti: _____
- Dr. Karen Dennis: _____
- Dr. Barbara Fritzsche: _____
- Dr. Robert Kennedy: _____
- Dr. Gene Lee: _____
- Ms. Gail McKinney: _____
- Dr. Debra Reinhart: _____
- Dr. Valerie Sims: _____

Contingent Approval
Dated: _____

Final Approval
Dated: _____

Expedited
Dated: 18 June 2004

Exempt
Dated: _____

Chair, IRB
Signed: 
Dr. Sophia Dziegielewska

NOTES FROM IRB CHAIR (IF APPLICABLE): _____

P: Letter to Principal



Windy Ridge School
3900 Beech Tree Drive • Orlando, Florida 32835
Office: (407) 296-5100 • Fax: (407) 296-5107
Home of the Silver Hawks



Maria Vazquez
Principal
Catherine P. Wilson
Assistant Principal

Dear Mrs. Vazquez,

I am requesting your permission to begin an action research project as part of my graduate program at the University of Central Florida.

The research will take place from August 4, 2004 and is anticipated to continue through August 4, 2005. I will complete the project under the supervision of Dr. Jeanpierre, assistant professor at UCF. The purpose of my study is to determine the effects of integrating computer usage on student performance, attitude towards science and attitude towards technology. I will be collecting data from my classroom only. No experimental testing will be used.

My action research study consists of seven data collection methods: pre and post assessment, weekly quizzes, student reflective journals, student survey, parent survey, student and parent correspondence as it relates to the study such as parent notes and e-mails, and classroom observation notes. My action research study will focus on three major questions: 1-How does the integration of technology into the 8th grade curriculum affect student's academic performance? 2-How does the integration of technology affect student attitude towards science? 3-How does the integration of technology affect student attitude towards technology?

Students and parents will first answer the questions on the technology survey and the science attitude survey. The technology survey will ask parents and students about the amount of technology the students use and their opinions of the usage of technology in the classroom. The science attitude survey will ask questions about how the students feel towards taking the science class. Near the end of the study, students and parents will answer the questions of the survey again in order to determine if there are any differences in their responses.

Students will take a pre assessment covering the definitions of approximately 150 scientific vocabulary words. Students will be asked to match the vocabulary word with the correct definition. Students will take the same assessment again near the end of the study.

The population of students will be placed in two groups, group A and group B. Each week, students will be given a list of 10 vocabulary words. As a normal classroom activity, they will need to find at least three different definitions for the words. One group will only use traditional paper sources for the assignment like dictionaries and textbooks and the other group will be able to use various forms of technology like multimedia encyclopedias, the Internet, and Microsoft Word. The following week, students will switch allowing those who didn't use technology to be able to use it for the current week. This will continue on a rotational basis so that every student has the same amount of time with the technology. All students will be unable to use technology at the same time due to the limited number of computers in the classroom. The data from weekly vocabulary quizzes will help determine what affect the technology use had on academic performance in terms of scientific vocabulary.

The School Board of Orange County, Florida does not discriminate in admission or access to or treatment or employment in its programs and activities on the basis of race, color, religion, age, sex, national origin, marital status, disability or any other reason prohibited by law. The Equal Opportunity supervisor responsible for compliance is Emma Newton, Deputy Superintendent, Human Resources & Labor Relations, and she may be contacted at the Educational Leadership Center, 445 W. Amelia Street, Orlando, FL 32801, 407-317-3239.



Windy Ridge School
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Maria Vazquez
Principal
Catherine P. Wilson
Assistant Principal

I will teach the students how to use various forms of software to include: Microsoft Word, Microsoft PowerPoint, Microsoft Excel, Microsoft Paint, webquest, multimedia encyclopedia, and the Internet. Students will use the software to complete routine classroom tasks like writing weekly reflections, researching, and documenting data from science experiments.

Although not a focus of the action research study, I will sort the data to determine if there was any affect the integration of technology had based on the gender of a student.

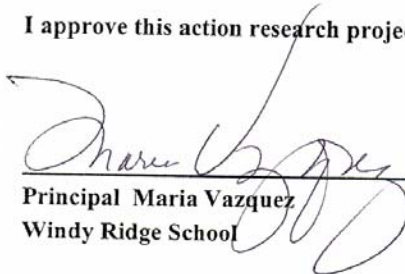
The benefits of this study will be for me to learn how to effectively use technology when teaching and hopefully improve student performance in science, student attitude toward science and student attitude toward computer usage. There are no anticipated risks. This research will involve customary classroom activities.

I would like to use the students from all four of my science classes. There will be no compensation given to my students. Participation or nonparticipation in this study will in no way affect the student's grades or placement in any programs. No grades or points will be given for participation. Students will not be penalized for nonparticipation.

Thank you for your consideration,

Greg Brunton

I approve this action research project.

 1 6-7-2004
Principal Maria Vazquez Date
Windy Ridge School

The School Board of Orange County, Florida does not discriminate in admission or access to or treatment or employment in its programs and activities on the basis of race, color, religion, age, sex, national origin, marital status, disability or any other reason prohibited by law. The Equal Opportunity supervisor responsible for compliance is Emma Newton, Deputy Superintendent, Human Resources & Labor Relations, and she may be contacted at the Educational Leadership Center, 445 W. Amelia Street, Orlando, FL 32801, 407-317-3239.

Appendix Q: Vocabulary Homework Directions/Grade Sheet

Vocabulary Homework Requirements

- You have been given the “8th Grade FCAT Science Vocabulary List” to place in your journal. You may use the definitions from this source to complete the assignment. You will need to use another source from the classroom, library, or home for the second definition and to find out more about the words.
- Depending on your thesis group letter, every other week you will be allowed to use the classroom computers for researching the words using the Internet or multimedia encyclopedias and for typing out the assignment.
- On the other weeks, you may handwrite the assignment and use the classroom print resources like dictionaries and textbooks.
- 5 extra credit points will be awarded to the vocabulary assignment if it is typed on the weeks your thesis group is allowed to use the classroom computers. It can either be typed and printed in the classroom or at home. You will not be able to earn extra credit on the other weeks for typing.
- Vocabulary assignments will be graded according to the Vocabulary Grade Sheet.
- The assignment will need to be in this outline form:

Number, Word

- Definition #1
- Definition #2
- Detailed example of the concept

For example:

1. Ecosystem

- an integrated unit of a biological community, its physical environment, and interactions. (FCAT Vocab List)
 - a working unit made up of organisms interacting with each other and with non-living factors. (red classroom textbook)
 - When visiting a pine flatwoods ecosystem, I learned that fire is beneficial as it burns out the faster growing hardwood trees while it doesn't hurt the slower growing pine trees.
- Vocabulary assignments are due on the day of the quiz.
 - Vocabulary quizzes will be every week on the first school day of the week. All of the vocabulary lists and quiz dates are posted in the classroom for the entire 9 weeks.
 - You may earn extra credit by completing circle maps of some of the week's vocabulary words you didn't complete circle maps for on the regular vocabulary assignment. You will receive 2 points for each circle map with a maximum of 10 points. Circle maps are to be turned in stapled to the vocabulary quiz.

Vocabulary Grade Sheet

- _____ (1) vocabulary list number written as title. Ex. "Vocabulary List #4"
- _____ (1) first name, last name, date, block in heading
- _____ (1) thesis group number in heading
- _____ (1) handwriting is very neat or if typed, only the font "Times New Roman " size "12" is used.
- _____ (1) each vocabulary word is numbered
- _____ (5 max-1/2 point each) the correct outline form is used
- _____ (10 max-1 point each) each word has two different definitions
- _____ (10 max-1/2 point each) each definition lists the source afterwards
- _____ (10 max-1 point each) each word includes a detailed example of the concept. NOT A DEFINITION!
- _____ (10 max-5 points each) in addition, 2 circle maps are to be completed
 - word in center
 - in the quadrants: definition #1, definition #2, a detailed example of the concept, and a sentence using the word which demonstrates your understanding of the concept
 - sources inside the outside box

Name _____ Date _____ Block _____

Vocabulary List # _____ Total Score _____ Thesis Group _____

Name and signature of student who graded the assignment:

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