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Technology as a Tool for Improving Academic Performance and Morale in the Elementary Classroom

Aimee L. Sheldon
St. John Fisher College

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Aimee L. Sheldon
St. John Fisher College
Dedication

I dedicate this research paper to three very important people who have influenced my life in more ways than they know: my husband-to-be, Matthew, my mother, and my father. To Matthew, my rock, thank you for giving me unconditional love and support. To my mother, thank you for instilling a drive in me to do something meaningful with my life. Finally, to my father, thank you for showing me what dedication truly stands for – I hope that throughout my life, I have made you a proud "dad."
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Literature Review

Throughout the past decade, technology use in the classroom has grown significantly. In turn, much research has been conducted to determine the benefits that the use of various technological tools (computer, Internet, digital cameras, camcorders, calculators, etc.) can have in the educational setting. All of the sources agreed that technology does impact the learner (to some extent) and that the impact generally depends on the type of technology used and to what degree. The literature that exists on the topic recognizes the heterogeneous nature of today's classroom, and that each class requires accommodations to bring the class as a whole to its full potential. However, they have drawn quite different conclusions in addressing the following questions:

1. Can technology be fun and entertaining in the classroom?
2. Is technology a performance enhancer or reducer?
3. Do attitudes effect technology use in the classroom?
4. Is technology a facilitator for constructivist learning?
5. Does technology benefit students with disabilities?
6. Does gender play a factor in technology enjoyment and use?

This review of the literature on technology's impact on student performance and morale focuses on these six questions.

Can Technology Be Fun and Entertaining in the Classroom?

Technology use in the classroom has become much more prevalent in today's society than it ever has before. One could theorize that the inclusion of technology in a lesson or activity brings a more entertaining or fun component to the lesson being taught.
Various technological tools are available to teachers and they can potentially be used to facilitate a more fun environment in which to learn. In Anthony Daniels' (2004) research entitled *Composition Instruction: Using Technology to Motivate Students to Write*, he wrote that the "recent influx of computer technologies into the educational system has produced a quandary for educators on how to integrate these new technologies into the curriculum" (p. 157). The literature found on this topic included the use of digital cameras, digital video, computers (programs and games), and their potential motivational or harmful attributes to the user.

The literature that reflected upon technology as a positive component to classroom activities (Carter, Sumrall, & Curry, 2006; Daniels, 2004; Fiorentino & Castelli, 2005) had a very similar undertone. The research done by these authors has brought them to the conclusion that technology can bring strong entertainment and motivational value to every-day classroom activities. In an article intended to sway the reader to include digital cameras in their teaching, Carter, Sumrall, and Curry (2006) conducted an experiment for their research with fourth-grade students, which involved the inclusion of digital cameras to build collages of leaves and bark for the students to identify the trees throughout the school property. Their incorporation of digital cameras in the lesson revealed that by including technology in the lessons, the students not only enjoyed the experience but improved their "comfort level with technology in the process" (Carter et al., p. 19). By including a useful technology component to a fairly common elementary school lesson, the authors introduced a new appreciation for technology to the students. They found that interest in a potentially less enthralling lesson could be
heightened by the inclusion of technology. Carter et al. (2006) concluded that “the digital photography project truly spurred students’ interest” (p. 23).

Additional pieces of literature that reflected positively on technology’s effect in the classroom included those by Fiorentino and Castelli (2005) and previously mentioned work by Daniels (2004). Fiorentino and Castelli’s (2005) article reflected on technology in the physical education classroom; one that may not be considered as often as other traditional classroom settings (mathematics, writing, etc.). Their research focused on pinpointing how technology can be beneficial in such an environment. In addition, the research revealed that technology can create opportunities for all students. Fiorentino and Castelli (2005) wrote, “The integration of technology in the gymnasium can address some of these challenges by improving teacher efficiency and increasing student motivation” (p. 16). Their focus was on one way physical educators are incorporating technology, using virtual gymnasiums or VGs. The VG allows “teachers the opportunity to assess student performance in ‘virtual’ situations that can be designed by the students or the teachers” (Fiorentino & Castelli, 2005, p. 16). By using “game-like practice situations” the students’ were motivated to participate in perhaps a less exciting lesson (Fiorentino & Castelli, 2005, p. 16).

Daniels (2004), on the other hand, researched technology’s positive effect within the writing curriculum. Daniels’ study was focused on the motivational effects computer technology has on students’ writing abilities. By including computers in writing composition a positive correlation was established. Daniels (2004) observed the positive relationship during several observations as a Language Arts instructor and found that:
The most obvious was the increased level of excitement expressed by students whenever they were allowed to use the computer. I noticed that even the most disinterested student would often ‘perk up’ when they were allowed to use the computer. Originally, I attributed this increased enthusiasm to the idea that the kids liked the game programs. As I watched further, I noticed that although they did enjoy the games, the students also seemed to like the computers in general. Additionally, it appeared that the students were working on their writing for longer periods of time and complaining less. (pp. 162-163)

In addition to these observations, another component to Daniels’ (2004) research was allowing students the choice to use a computer or not for their writing pieces. All students “chose to use the computer” (p. 168). The result was that “students produced works that were longer in length and they expressed more enthusiasm and excitement toward their work” (Daniels, 2004, p. 168).

Although overall, Daniels’ (2004) findings supported technology as a positive force to learning, he did take into consideration any potential negative effects that computers may have on writing composition. Daniels (2004) concluded that “The overwhelming amount of evidence suggests that the negative effects of computer-aided composition are minimal, and ultimately worth the risks” (p. 173).

The literature that focused more on technology’s harmful affects was titled *Edutainment: Is learning at risk?* (Okan, 2003) The coined term edutainment was referred to as “applications that possess the allure of electronic games while achieving educational goals” (Okan, 2003, p. 255). Such games may include those that are found on the World Wide Web or even those that are purchased by the school district: games that
at times may be used by the teacher as a be-all, end-all form of educating a student. An assertion exists that “such software motivates students to explore topics in greater depth” (Okan, 2003, p. 259) and in turn some may believe that rich, learning experiences are created by such software. Okan’s (2003) argument in the research article was that in order to see the “educational potential of ‘edutainment’ software” (p. 255) one must look at both the advantages and disadvantages that edutainment brings to the learner. Okan (2003) expanded his argument by writing the following:

One unforeseen danger of adapting computer technology into education so enthusiastically is that learning is seen as fun and entertainment. Learners who are exposed heavily to the Internet, video games, and ready-made images presented by multimedia develop a new attitude towards learning. (p. 257)

The research by Okan attempted to look not only at all the potential benefits, but also at the potential shortcomings to the inclusion of technology, or in some cases, the computer as the primary educator. As a conclusion, Okan put forth the argument that “advertising of ‘edutainment’ materials is proceeding at full force without any significant, evaluative studies into the effects that the very use of these materials has on young people” (Okan, 2003, p. 262). Perhaps many loopholes exist in the available research regarding technology’s motivational/entertainment value within education. The literature on this topic suggested that there are still many questions to be answered before any solid theories materialize. Daniels proposed that “Once educators and researchers can reach the point of clearly identifying the motivational benefits of computer aided composition, we can then move on to the question of quality” (Daniels, 2004, p. 169).
Is Technology a Performance Enhancer or Reducer?

With the ever increasing availability of educational technologies, there comes the question regarding its benefit to the learner. Does the inclusion of technology within educational activities enhance or hurt the learner's performance? As with many theories, evidence is necessary in order to determine technology's effects on student learning and performance. The literature collected seems to overwhelmingly support the argument that technology enhances student learning in the classroom.

In an effort to further the understanding regarding technology's impact on learning, Krentler and Willis-Flurry (2005) conducted research at the college level on discussion board technology and its potential to enhance student learning. The instructor "posted questions and issues, and the students could respond with postings and reply to the postings of other students" (Krentler & Willis-Flurry, 2005, p. 317). Within their research, they found that regardless of any prior Internet experience, "students learned more by using technology as a learning tool" (Krentler & Willis-Flurry, 2005, p. 320). In addition, their research led them to suggest that "students would do well to avail themselves of learning opportunities that involve the use of technology" (Krentler & Willis-Flurry, 2005, p. 320). Affirming the theory that technology can benefit student performance, the authors wrote that the results of their study supported "the generally held tenet that the use of technology can and does enhance student learning" (Krentler & Willis-Flurry, 2005, p. 321).

Articles by Purcell, Ponomarenko, and Brown (2006) and Leonard, Davis, and Sidler (2005) investigated the inclusion of technology in traditional classroom instruction and how its use may enhance student performance. Purcell, Ponomarenko, and Brown
Technology as a Tool (2006), researched Geographic Information Systems (GIS), which are “computer software that captures, manipulates, analyzes, and displays data on specialized layered maps” (Purcell et al., 2006, p. 24). Within a lesson intended for fifth grade students, sites were designed that included GIS maps that allowed students to “gather information about specific earthquakes and volcanoes in the United States” (Purcell et al., 2006, p. 25). To insure that the research was valid, they included both a non-GIS group and a GIS group. Prior to the lesson they administered a pretest and following the lesson they administered a posttest to each group of students, respectively. When the research was complete, they analyzed the pretest and posttest data which revealed the following:

Students in the GIS and non-GIS groups performed similarly overall on both tests. Thus it appears that GIS is at least as good as a traditional science curriculum in teaching fifth-grade students about plate tectonics, earthquakes, and volcanoes, regardless of whether there is a map-based component to the concepts taught.

(Purcell et al., 2006, p. 26)

In addition, their analysis also revealed:

The GIS group performed significantly better on their posttests than the non-GIS group on the map-based questions, indicating that GIS is absolutely more beneficial as a teaching tool than a traditional curriculum when there is a map-based component to the concept being taught. (Purcell et al., 2006, p. 26)

Therefore, the research by Purcell et al. (2006) affirmed that including technology within traditional classroom instruction can be as good, if not better than excluding technology to enhance student learning.
Literature by Leonard, Davis, and Sidler (2005) focused on Computer-Assisted Instruction (CAI) and the significance it has for educating African-American students. The study's purpose "was to examine the interactions and performance of African-American students as they read culturally relevant stories and solved mathematics and science problems on the computer" (Leonard et al., 2005, p. 263). The researchers intended to determine if a computer simulation titled Riding the Freedom Train affected student learning in mathematics and science. Following the study, Leonard et al. (2005) found that "the computer was very motivating" to the students (p. 279) and that "None of the students gave up but instead worked until they finished the program or until their time was up" (p. 279).

In addition to the more traditional curriculum based results, Leonard et al. (2005) found that "the computer program created the need for procedural knowledge. Students quickly learned how to navigate the program and use the scaffolds, if needed, to advance it" (p. 280). Therefore, not only did the computer simulation appear to enhance learning and motivate the students, it provided students the opportunity to gain important knowledge on program navigation and procedures.

Literature by Eskicioglu and Kopec (2003) and Zumbach, Kumpf, and Koch (2004) approached the topic by researching multimedia applications in the classroom and how they may or may not enhance student performance. "Multimedia can be defined to be multiple forms of media (text, graphics, images, animation, audio and video) that work together" (Eskicioglu & Kopec, 2003, p. 199). Eskicioglu and Kopec (2003) stated in the literature that multimedia "can promote independent and cooperative learning, and improve performance of low achievers and special student populations, while heightening
interest in learning, writing, and research” (Eskicioglu & Kopec, 2003, p. 199). Their research documented various alliances, workshops, and case studies that set forth arguments for multimedia in the classroom setting. The literature states that multimedia “offers great promise to enhance education in all stages from kindergarten to college” (Eskicioglu & Kopec, 2003, p. 218).

Eskicioglu and Kopec (2003) did not fail to write about any implications to the use of multimedia in the classroom. They noted that “IT technologies may disrupt the learning process seriously unless the infrastructure is reliable and appropriate” (Eskicioglu & Kopec, 2003, p. 217). In addition, their research revealed that “Although computer and communication technologies have unique capabilities for enhancing learning, the infrastructure of a multimedia-enabled classroom is complex and implies many radical changes in all areas including curriculum development, pedagogical approach, faculty training, and organizational matters” (Eskicioglu & Kopec, 2003, p. 218). These implications may help to prepare educators when considering the kinds of multimedia that they introduce in their classroom.

Zumbach, Kumpf, and Koch (2004) also wrote of multimedia applications, but their focus was specifically on multimedia within PBL (Problem-Based Learning) as a tool for enhancing student performance in the classroom. The authors examined “the introduction of multimedia to enhance computer-based PBL in elementary school” (Zumbach et al., 2004, p. 25). PBL is described as a process that “starts with a problem presented to the learners. Problems are ill-designed cases that are open-ended. The typical function of the problem is to trigger or initiate a problem-solving process within a group” (Zumbach et al., 2004, p. 25). The researchers developed a PBL unit with MS
PowerPoint to allow for an interactive learning environment for the students. The focus of the PBL was on encountering a badger in the forest (Zumbach et al., 2004). To insure that the research was valid, they included both a PBL class and a non-PBL class (lecture based) which was referred to as the LBL class.

The study revealed that the inclusion of PBL “led to a significant better result in the follow-up test” (Zumbach et al., 2004, p. 33) and also “led to a better long-term retention as opposed to LBL” (Zumbach et al., 2004, p. 34). On the other hand, there were some results that did not favor the PBL class; “analysis of children’s problem-solving performance yielded no significant results, neither between both groups nor among all assessment times” (Zumbach et al., 2004, p. 33). The authors stated that the “Results indicate a slight advantage of the LBL-condition” (Zumbach et al., 2004, p. 33).

Zumbach, Kumpf, and Koch (2004) may have been surprised at the results of the study, but it did reveal that “by combining technology with an adequate instructional method it is possible to replace parts of traditional lectures with meaningful self-directed learning” (p. 35).

The various pieces of literature on the topic revealed that although technology has the potential to benefit student performance, there are many implications and ideas to consider when including it in classroom activities. By doing so, the educator has the opportunity to improve student learning, while potentially easing their own work load.

Do Attitudes Effect Technology Use in the Classroom?

Various literatures exposed the potential that student success in learning computer technology equates to positive attitudes, while students who are less successful have a
more negative attitude. Liu, Maddux, and Johnson (2004) wrote that "studies have suggested that students' computer attitudes are related to their success in learning computer technology" (p. 593). Many theories exist regarding attitudes toward technology and how both students and teachers develop the attitudes they have. The literature on this topic attempted to support some of the many theories on the topic with research conducted in various educational settings.

Literature by Liu, et al. (2004), and Messineo and DeOllos researched student attitudes and perceptions toward technology. Their focus for the research was college students; specifically teacher education students. The study by Liu et al. (2004) looked at time as a variable to a student's success in learning computer technology. At completion of the study, data analysis revealed the following:

Time spent on learning and using computer technologies can be predicted by a linear combination of the four computer attitude variables—Enjoyment, Motivation, Importance, and Freedom from Anxiety. Students who have more positive attitudes tend to spend more time on learning and using technologies. (Liu et al., 2004, p. 602)

Perhaps the results of the research revealed that educators must find a way to improve student attitudes toward technology in order to increase student learning and use of technology. As a conclusion to the research, the authors wrote that "When we plan computer education for students, we should take into consideration not only factors related to establishing positive attitudes, but also those related to increasing quality computer-learning time" (Liu et al., 2004, p. 604).
Messineo and DeOllos' (2005) study explored the perceptions students have regarding their computer competence. They took a similar approach to Liu et al. (2004) by focusing their research on college students. The research was conducted to determine the best way to implement the use of technology within college classrooms. Messineo and DeOllos (2005) found that “students view their computer competence differently depending on whether they are using the technology for personal or course-related tasks” (p. 50). The authors found it interesting that students were less confident in their ability to use e-mail and the Internet in the classroom as opposed to using them in a classroom setting (Messineo & DeOllos, 2005).

The literature also stated that “while the expressed levels of experience and comfort are high for some forms of technology, exposure and confidence with more advanced applications are lacking” (Messineo & DeOllos, 2005, p. 50). Students’ comfort level dropped dramatically from Internet, e-mail, and word processing to college course technology including online testing, online homework, and online courses. (Messineo & DeOllos, 2005) Messineo and DeOllos (2005) wrote that “the lack of comfort and confidence could translate into students’ being less willing to take risks with technology and perhaps succumbing to a self-fulfilling prophecy of inability” (p. 53).

Messineo and DeOllos’ (2005) article sought to determine the best way for educators to approach student learning by taking student attitudes toward technology into consideration. “Helping students identify their attitudes about technology as well as their personal skills and deficiencies could help focus exercises and activities” (Messineo & DeOllos, 2005, p. 50).
The literature by Czubaj (2004) discussed teacher attitudes that exist about incorporating technology in the curriculum. The author's research on educator concerns in regard to cyberspace curricula revealed that the attitudes teachers have regarding technology can directly affect students' attitudes and achievement for learning with technology. "When educators are hesitant to implement technology within their classrooms, their students are provided limited exposure, at best, to the full range of uses of the technology in the educational setting" (Czubaj, 2004, p. 676). On the other hand, if educators frequently incorporate technology in classroom activities, their students will be exposed to its many uses and in turn be more apt to have a positive attitude toward technology as a whole.

Czubaj's (2004) research revealed various reasons for teachers' attitudes that transfer to hesitation for including technology in their classroom. Czubaj (2004) found the following:

Educators were reluctant to replace paper-based assessments, the rapport that is built between the instructor and the students during instruction was hindered when using computers, students may feel less motivated toward their education, and the computer fails to involve a student holistically because all of the five senses are not employed with computer instruction. (p. 680)

Czubaj (2004) stressed that the negative attitudes that many teachers have toward technology can potentially be transferred to positive attitudes through additional teacher training and also allowing for more teacher input for technology development and planning within the schools.
Many attitudes exist on the topic of technology use in the classroom; some positive, some negative. The literature revealed that there are many methods and means to correct the foundations that create the negative attitudes toward a tool that when used correctly, can benefit student learning significantly.

Is Technology a Facilitator for Constructivist Learning?

Constructivist learning has grown in popularity within the realm of education. Constructivist learning could be termed as an environment in which the students are more actively involved in their learning; in a constructivist learning environment, students are much more engaged in the subject matter than if they were in a traditional lecture based setting. Due to its nature, one may theorize that technology can be a facilitator for constructivist learning environments. Grabe and Grabe (2004) wrote of technology as “both supporting traditional methods of instruction and also encouraging experiences consistent with the constructivist perspective” (p. 73).

The literature by Grabe and Grabe (2004) and Hand (1997) viewed technology’s role in constructivist learning as very important, if not necessary. Hand (1997) wrote that “information in itself is not knowledge; it is the selection, evaluation, and synthesizing of the information that is important, and this must be taught in a systematic manner along with the technical skills of using various computer applications” (p. 111). In essence, this statement placed responsibility on the teacher in regard to appropriate selection of curricula material. A parallel must exist between the teaching of the material and the teaching of the computer skills necessary to achieve success using the computer applications for learning.
In addition, the literature by Hand (1997) revealed that "constructivist learning is well supported by learning technologies. It does not mean a breakdown of order, but a recognition that students will learn better in situations in which they are required to become responsible for their own learning" (p. 115). So, essentially, students who are given more responsibility for their own learning by means of technology, will potentially be more successful with learning the material that those who are not. In addition, Hand’s developments on the topic revealed the following:

We know that some students, who often were regarded as reluctant learners, are becoming much more task oriented and excited about their learning when working with the computers. We see how students can be amazingly inventive and creative in their use of computer applications. Computers do seem to encourage both independent and collaborative learning, as well as problem solving behaviors. They undoubtedly offer an intellectual challenge, which the students are keen to meet. (Hand, 1997, p. 118)

The author had a very strong opinion for the inclusion of technology in the classroom. Hand (1997) stressed that tools of technology are very powerful and that when used correctly, they can improve classroom learning, especially those focused on constructivist principles.

Grabe and Grabe (2004) took a very similar approach to Hand (1997) in that their research led them to very strong convictions regarding technology’s benefit to constructivist learning environments. The authors wrote that with the inclusion of technology applications, “instructional activities can be extended to create a more active learning experience” (Grabe & Grabe, 2004, p. 177).
the experience that the students will have. Grabe and Grabe (2004) stated that "in many situations, assigning two students to a computer is a matter of practicality, but it also represents a way to change the nature of the learning experience in a constructivist direction" (p. 177). The inclusion of technology does not, in itself, create a constructivist learning environment. What it can do is create a new, and often more diverse way in approaching and presenting a lesson or activity to students. In concluding, Grabe and Grabe (2004) wrote that complex computer software "fits more easily into a constructivist approach than an approach focused on the presentation of information" (p. 178).

Additional pieces of literature to reflect on technology's role within constructivist learning included those by Abramovich and Cho (2006) and Chang (2006). In their research, Abramovich and Cho (2006) discovered reasons to support teachers' inclusion of technology in problem posing, which can be considered a constructivist approach, within mathematics education at the elementary level. They focused "on using open-ended problems with young children, something that requires special skills by the teachers. These skills may include the ability to use computers as cognitive amplifiers in exploring the open-ended nature of appropriate mathematical situations" (Abramovich & Cho, 2006, p. 310). Abramovich and Cho (2006) felt that teachers teach their students in a format in which they themselves can learn better and in relation to that they wrote that, "many efforts of mathematics education reform are aimed at the development of new intellectual activities in support of classroom pedagogy enhanced by constructivist applications of educational technology" (p. 320). Therefore, constructivist learning
enhanced by educational technology is gaining respect within the realm of education for the positive impact that it has on student learning.

The literature by Chang (2006) had a very similar undertone to the previous piece. Chang’s (2006) study examined tenth grade earth science students and how they were influenced by their preferences of learning environment. The students were randomly broken up into eight groups and placed in either a teacher-centered model for delivering computer assisted instruction or a student-centered model for delivering computer assisted instruction (Chang, 2006). The study revealed the following:

The less constructivist-oriented students receiving the teacher-centered strategies appeared to increase in more positive attitudes compared with those students taught by student-centered instruction, while the more constructivist-oriented individuals seemed to benefit more from the student-centered approach in comparison with students learning from the teacher-centered condition. (p. 802)

The results of the study seemed to make perfect sense; those favoring constructivist learning environments would in fact benefit more from student-centered conditions for a major component of constructivist learning is making students responsible for their own learning with less teacher interaction. If that is the type of learning they favor, more often than not, they will learn more from such an environment.

The literature on the topic varied widely on the approaches and settings used to implement the research. Although that was the case, the literature did reveal various commonalities for including technology in constructivist learning environments. When used properly, technology can facilitate constructivist learning in the classroom.
Does Technology Benefit Students with Disabilities?

Teaching in any shape or form requires a lot of hard work, compassion, and a desire to improve the lives of the students they are intended to educate. Today’s society is seeing a rise in inclusive classrooms, or classrooms that include students of all backgrounds – students classified with or without a disability, within the educational realm. Whether this is due to the cyclical nature of education or not, the educational community has sought different ways to benefit the teacher and students in such classrooms, including those environments composed entirely of students with disabilities. Including technology in the students' daily activities is one such method. Some of the available literature on this method included articles written by Jerry D. Neal and Dennis Ehlert (2006) and Rebecca Elder-Hinshaw, Genevieve Manset-Williamson, Jason M. Nelson, and Michael W. Dunn (2006). The former authors wrote of various technologies available to benefit students with disabilities to include in a school’s library or media center, while the latter researched and wrote of the benefits of including reading assistive technology to multimedia inquiry projects within inclusive classrooms.

Neal and Ehlert’s (2006) article described multiple technologies that every library or media center should have available to students with disabilities. Some of the technologies in the piece of literature included Microsoft Windows XP, JAWS for Windows, Kurzwell 3000 Version 9, Inspiration CD-Rom, Boarddecisionmaker, and SMART Board, to name a few (Neal & Ehlert, 2006). When writing on this topic, the authors stated that the assistive technologies available “enrich the lives of students with disabilities” (Neal & Ehlert, 2006, p. 119). In fact, it is important for schools to invest in such products for “federal laws now mandate that assistive technologies be considered
when special education programs are being tailored for students with challenging learning and behavior needs” (Neal & Ehlert, 2006, p. 119).

Neal and Ehlert’s research on the various assistive technologies revealed to them multiple potential benefits to students with disabilities. For instance, when researching JAWS for Windows, a program that dictates to the student the text on the screen by means of the computer’s sound card, they found that “Students who are visually impaired or have severe reading problems can now become more productive” (Neal & Ehlert, 2006, p. 120) by use of the product. They also found that the CD-ROM Inspiron, another such product that they researched, “is a visual learning tool that inspires all types of learners to develop ideas and organize their thoughts graphically” (Neal & Ehlert, 2006, p. 121) while at the same time supporting “students’ multiple learning styles by allowing students to hear their own work read aloud or by adding their own spoken words to their projects” (Neal & Ehlert, 2006, p. 121). In addition, Neal and Ehlert (2006) researched another assistive technology, SMART Board, which is “an interactive device that combines the power of a computer with a write-on white board” (p. 123). Their research revealed that the device “allows for a number of applications for students who cannot directly manipulate a keyboard and is quite motivating for students” (Neal & Ehlert, 2006, p. 123). While Neal and Ehlert took a more informational approach when writing their article regarding the available technologies to students with disabilities, other literature found on the topic focused on classroom research as a basis for the argument for assistive technology and the benefits they afford such students.

Elder-Hinshaw, Manset-Williamson, Nelson, and Dunn (2006) investigated reading assistive technologies, which are intended to support students with reading
analyzed and wrote of data that they collected over several years in the Texas public school system, to determine any correlation between gender and computer enjoyment, and whether grade level plays a factor for the genders. They examined technology’s influence on both genders within various grade levels over four years. The authors’ research indicated the following:

Fifth grade girls are more positive than boys on computer enjoyment across the four years studied: 2000, 2001, 2002, and 2005. Data gathered in 2005 also reconfirmed that by Grade 8, boys are more positive on the subscale of computer enjoyment than girls. (Christensen et al., 2005, p. 35)

Christensen, Knezek, and Overall’s (2005) research revealed that a gender discrepancy does in fact exist, and that grade level, which corresponds with age, could be used as a basis for discovering more about gender discrepancies for technology use. In addition, the authors analyzed gender discrepancies among particular components of technology including e-mail and Web skills which indicated that “some technology-related areas exist in which girls are measurably higher than boys, even after the transition to lower computer enjoyment” (Christensen et al., 2005, p. 35). This article affirmed that a gender gap does in fact exist in technology enjoyment.

An additional piece of literature that focused on the topic of gender as a factor in technology enjoyment and use is one that was written by Scheckelhoff (2006). The author’s research led her to recognize that girls are potentially at a disadvantage when technology is included in their learning. Girls “lose valuable opportunities for developing needed technology skills,” (Scheckelhoff, 2006, p. 52) which in turn may limit them in the future careers they will choose. The literature suggested that the technology focus in
educational settings needs to be redirected to benefit the female students through such mediums as “all-girls computing events,” (Scheckelhoff, 2006, p. 55) which may help to bridge this particular divide between the genders.

Both pieces of literature on this subject drew a similar conclusion; those involved in a child’s learning can directly influence their feelings toward technology. Christensen et al. (2005) wrote that “Parents, administrators, community partners, and software manufacturers all have important parts to play in ensuring that girls emerge from their educational experiences ready and willing to use technology to the fullest” (p. 35). Scheckelhoff (2006) reinforced this view when writing that “Teachers and teaching methods influence girls’ technology skills, abilities and attitudes” (p. 54). These findings derived from the literature, place a lot of the responsibility on a child’s community to help to rectify the gender gap with technology.

Much of the literature available on the topic attempted to determine any correlations within gender discrepancies related to technology and learning. The literature revealed that discrepancies do exist. Through the use of community involvement in learning, changes within the grade level, and technology settings that focus on girls, the gender gap in technology use and enjoyment could potentially become obsolete.

Summary

The literature found with a focus on technology in the classroom left many stones unturned; stones that will need to be turned in order to arrive at a more thorough conclusion as to the effects and characteristics of technology in the classroom. Many educators have held the belief that technology can enhance learning, but before arriving
at such an opinion it is necessary to have sufficient evidence in support of such an argument. While much research has been conducted in an effort to study the effects of technology in a classroom and to individual students, and much of the research conducted tends to support technology use in the classroom, the available literature seems inconclusive and lacking of key ingredients to support the argument fully.
Methodology

This research focused on technology and its impact on elementary students in the classroom. Within that focus, this research intended to uncover the ways in which technology can increase student performance and morale during the normal course of study at the elementary level.

Participants

The research study took place at State Road Elementary School in Webster, NY, as part of the usual classroom activities. The school consisted of students from kindergarten to fifth grade. The primary classrooms for the study were (2) third grade classrooms within the school. Each third grade classroom consisted of a tenured teacher, while the researcher was a non-tenured, certified, substitute teacher within the district. Each classroom had approximately 20-25 students of various backgrounds including ESOL (students with primary languages other than English) and students with a disability. In addition, other grade levels (K-5) and teachers were used for observation and input for the research study.

Process

The research that was conducted explored the use of technology in the elementary classroom and how it may or may not have supported student understanding and/or motivation toward the curriculum. The tools used to gather data for the research included lesson study, classroom observations, and a teacher questionnaire.
Lesson studies were used to reveal any correlations that exist between technology use and student performance/morale. Lesson study is the reflection of lessons among groups of teachers to improve classroom learning. *Lesson Study: A Japanese Approach to Improving Mathematics Teaching and Learning* by Fernandez and Yoshida (2004) helped to guide the research for this portion of study in the classroom. A total of three lesson studies were implemented in the third grade classrooms. A technology component was used in each lesson to make the lesson valid for the research study, although some students were not provided with the technology component in order to determine technology’s role in student learning and morale. The regular classroom teachers were in the classroom for each lesson to observe the lessons being taught. Following each lesson, the researcher who acted as teacher/lesson leader and regular classroom teachers met to study the content, instruction and student actions/reactions from the lesson. The lesson was then revised and implemented at least one additional time.

Classroom observations were used to gather additional data that was not retrieved from the lesson study. The observations took place during normal classroom activities at various elementary grade levels. The observations helped to reveal student reactions to technology (favorable or unfavorable), in what ways technology was being used/applied, what kinds of technology tools were being used, and any other gaps that may not have been fulfilled by the other research methods that were used to gather data for the study.

A questionnaire was given to the teachers throughout the school as an additional component to the research. The teachers were given the option to complete the questionnaire. It was used to gather teacher perceptions and opinions of technology and its use in the elementary classroom. In addition, the questionnaire helped to identify
teachers' knowledge and comfort with technology in their individual classroom. The content of the completed questionnaires will be analyzed for varied or consistent perceptions of technology use in the teachers' classrooms.

**Measuring Success**

The success of the research was determined by gathering all of the information and data and revealing any similarities and differences in the research and past research as well as any gaps that still needed to be filled in order to further validate the study. The success of the research would reveal whether or not technology use was in fact a beneficial component to the elementary classroom.
Results

This research which focused on technology as a tool for improving a student’s performance or morale in the elementary classroom was conducted in such a way so that the results would effectively support, present additional viewpoints or sides to the debate, or introduce oppositions to previous research related to the topic. For this particular research, three lesson studies, a teacher questionnaire, and classroom observations were used to gather information. The teacher questionnaire and classroom observations took place within a K-5 elementary school. The lesson studies took place within two third grade classes (within the same elementary school) which will be hereon out referred to as Class A and Class B.

Lesson Study 1

The first lesson study was entitled Tree Vocabulary and was a lesson focused on the Explore and Evaluate portions of the 5E Lesson Plan design. A lesson on tree vocabulary was always used as a portion of the third grade unit on Trees, however during this particular lesson, a technology component was added. This lesson was designed to allow students the opportunity to become comfortable and knowledgeable with multiple educational tools, in this case a dictionary, online dictionary (www.dictionary.com), and glossary from a science textbook, when searching for definitions of various tree vocabulary words.

For the original lesson with Class A, there were fifteen students present; six of the students were male, and nine of the students were female. The students’ tasks were to pair with their teacher-selected partner, and work with them at each station (dictionaries,
online dictionaries, and glossaries) to locate words from the worksheets provided. The students were given ten minutes at each station to complete each worksheet; when the ten minutes was up, they were notified and they moved onto the next station. The words on the three different worksheets (Using an Online Dictionary, Using a Glossary, and Using a Dictionary) were chosen at random except for the few words that were not locatable within the online dictionary and glossary. Following the station worksheets, as a whole group, the students completed a vocabulary looping activity entitled Trees-A Loop and completed a ticket-out-the-door in which they chose (checked) which station they liked best.

At completion of the original lesson with Class A, it was apparent that the time limit per station would need to be increased (for the second lesson with Class B) to afford more time for the students to complete each worksheet. In addition, it was evident that two of the worksheets would need to be revised; students were taking too much time locating words within the dictionary and therefore the worksheet would be changed to reflect the matching of words to their definitions. Further, when students were using the online dictionary they were becoming confused when choosing the correct definition when multiple definitions were provided for a particular word and therefore this worksheet would be changed to reflect some of the words with definition specification (by number of definition to use).

Throughout the lesson, students from Class A seemed to be most excited and enthusiastic to use the online dictionary (over the other stations). However, it was quite apparent that teacher guidance was needed for the online dictionary station; students had had very little previous experience with using an online dictionary. Student performance
Technology as a Tool

and gender differentiation for performance was invariable when assessing the worksheets from each station. The ticket-out-the-door revealed that 100% of the students from Class A preferred the online dictionary over the other stations.

The lesson with Class B was revised to reflect the worksheet changes which included matching words to their definitions using a dictionary and definition specification when using the online dictionary for particular words. In addition, the time limit was increased to twenty minutes for each station and *Trees-A Loop* was not used due to time constraints. Class B consisted of seventeen students; eight of the students were male, and nine of the students were female.

At completion of the revised lesson with Class B, it was apparent that the time limit still needed to be increased so that all students would be able to complete their work at each station, although the revised worksheets seemed to aid the students in their progression at the three stations. Class B also seemed to be the most enthusiastic and excited to use the online dictionary although the students' ticket-out-the-door revealed that 76.4% of the students preferred the online dictionary over the other stations, while 11.1% of the students preferred the glossary and the dictionary respectively. As with Class A, Class B's performance and gender differentiation for performance was invariable when assessing the worksheets from each station.

At the conclusion to each lesson, a computerized assessment on *Tree Vocabulary* was used as an additional component to determine the degree of student understanding for the material. The assessment was created using a program entitled CPS or Classroom Performance System. CPS was a program that this particular school provided to their teachers and was essentially an easy-to-use IR response system that obtains immediate
feedback from every student. The program consisted of hand-held interactive student response pads, also called clickers, which were intended to engage students in the assessment. Each of the fifteen multiple choice and true/false questions in the assessment were displayed on a Smartboard for all students to view. At the conclusion of the assessment, the CPS system provided a grade report which revealed that Class B, as an average, scored better than Class A – 84.44% out of 100% as opposed to 82.12% out of 100%. However, it must be noted that the difference in scores are not significantly different and therefore may not be substantial enough to sway the study in one direction over another.

Lesson Study 2

The second lesson study was entitled Two and Three Digit Subtraction Using Calculators and was a lesson focused on the Engage, Extend, and Evaluate portions of the 5 E Lesson Plan design. For the lesson, the students were introduced the use of a calculator to find the correct answer to two and three digit subtraction problems. Students were given a worksheet with fourteen problems and were to estimate subtraction problems and then find the exact answer to the problem using a calculator (the teacher reviewed the concept of estimation and subtraction and completed a few examples on the chalkboard prior to individual student work). At the completion of the lesson, the teacher handed out a short worksheet that served as a ticket-out-the-door which consisted of two subtraction problems to be answered by using a calculator and a short answer question asking the student if they enjoyed using a calculator with support for their answer.
For the original lesson with Class A, there were seventeen students present; seven of the students were male, and ten of the students were female. The teacher completed the first two problems from the worksheet as examples and assigned the rest of the worksheet to the students to complete individually. When the students completed their worksheet, they were given the ticket-out-the-door sheet to complete.

The lesson revealed that two revisions needed to be made for the second lesson with Class B; the worksheet was reduced to reflect twelve problems rather than fourteen, and the teacher examples were changed so that they were not problems from the worksheet.

It was apparent that the students thoroughly enjoyed using a calculator. This was the first time that the students were given a chance to use a calculator in the third grade. In addition, the students from Class A were very diligent in their work – they strived to do a good job. There were no gender discrepancies within the class regarding preference or performance within the lesson. When reviewing the worksheets it was revealed that their performance was very high, but this may be due in part to their unit on two and three digit subtraction coming to a close. The ticket-out-the-door revealed that 100% of the students enjoyed using a calculator for various reasons, but the most prevalent reasoning used was that the calculator made subtraction easier.

The lesson with Class B was revised to reflect the changes to the number of problems on the worksheet and the teacher example problems. Class B consisted of eighteen students; nine of the students were male, and nine of the students were female.

At completion of the lesson with Class B it was apparent that this third grade class was also very enthusiastic and excited about using calculators in their learning, although
the students seemed to be rushing through their work. However, students were pleased to complete the work for their math lesson of the day. There were no prevalent gender discrepancies in the student work or attitude toward the calculators. The ticket-out-the-door revealed that 100% of the students enjoyed using a calculator for various reasons, but the most prevalent reasoning used for this class was that the calculator made subtraction fun.

Lesson Study 3

The third lesson study was entitled Animal Research and was a lesson focused on the Explore and Evaluate portions of the 5E Lesson Plan design. Within the third grade curriculum, students are to learn about the rainforest, including the creatures that live within its habitat. This lesson satisfied that particular portion of the unit. Prior to the lesson the students were given a rainforest animal to focus on throughout the unit. For the lesson, the students were given a research packet to fill in with various characteristics of their animal using Internet search engines and encyclopedias. This completed packet was then used as a student reference for other portions of the rainforest unit.

For the original lesson with Class A, there were twenty students present; ten of the students were male, and ten of the students were female. The students were broken up into groups of two, with half of the class beginning their research with encyclopedias and the other half beginning with the Internet search engines. The Internet search engines that the students could use were referenced on the chalkboard and included www.EnchantedLearning.com, www.google.com, and www.yahooligans.com. The students were showed how to use the search engines before exploring them in their
groups. Thirty minutes into the lesson the students were notified and moved so that all students had a chance to work with both research tools.

Throughout the lesson, the students from Class A were very excited and focused on their work. They enjoyed using the Internet search engines as a research tool, but also enjoyed using the encyclopedias which may be due to the students' high interest in mammals. When it came time to stop the class work time, the students were very disappointed. As with the other lesson studies, this lesson did not disclose any gender discrepancies with student performance or excitement toward the technology component.

The lesson revealed that one revision needed to be made for the second lesson with Class B; the students from Class A had asked many questions regarding new words that were present in the research packets, and therefore students were interrupted a few times to clarify definition/meaning of the words. Therefore, the lesson was revised so that at the beginning of the lesson the teacher reviewed the meaning of each word in the research packets so as to prevent any confusion.

Class B consisted of twenty-one students; twelve of the students were male, and nine of the students were female. In addition to the one revision noted, an additional search engine was added to the Internet sites for the students' research - www.AmericaZoo.com.

At completion of the lesson with Class B it was apparent that these students were also very excited about working with the Internet search engines. This particular group seemed more excited and had a greater desire to work with the computers/Internet rather than the encyclopedias.
Teacher Questionnaire

An optional questionnaire was given to all teachers throughout the school regarding the inclusion of technology tools in their classrooms. There were a total of sixteen questionnaires completed. There were four survey questions, one question regarding technology tools used during instruction, and a section for any additional comments regarding technology in the classroom.

The first survey question asked ‘How often do you use technology in your classroom?’ The teachers’ answers varied somewhat for this question with 56% answering Daily, 38% answering Weekly, and 6% answering Monthly. The second survey question stated ‘The use of technology improves student academic performance during a lesson, test, etc.’ The teachers could choose from Always, Sometimes, or Never for their responses. The teachers overwhelmingly chose Sometimes with 88%, while the remaining 12% chose Always (none of the teachers chose Never). The third survey question stated ‘The use of technology improves student morale during a lesson, test, etc.’ The teachers could choose from Always, Sometimes, or Never for their responses. Half (50%) of the teachers who filled out the survey chose Always, while the other half (50%) chose Sometimes (none of the teachers chose Never). The fourth survey question stated ‘I am comfortable including technology in daily lessons/activities.’ Again, the teachers could choose from Always, Sometimes, or Never for their responses. The surveys revealed that 69% of the teachers chose Always, while 31% chose Sometimes, with none of the teachers choosing Never.

There were varied responses from the teachers for the question asking ‘What technology tools do you use during your instruction?’ The responses included the use of
computers (most prevalent in the questionnaire), overhead projector, television, calculators, SmartBoard, camera, iPod, and cassette player (least common in the questionnaire). At the end of the questionnaire the teachers were given the option to add any additional comments or feelings regarding technology in their classroom. Their responses included a desire for more updated technology tools to use in their classrooms and more information on how to incorporate computers in daily lessons (especially with a limited number of computers in the classrooms). Some of the quotes from the teachers in response to technology in their classrooms included that “technology is valuable and a necessity with young children,” and “technology is a great tool when reliable.”

Classroom Observations

Throughout the normal course of study, classrooms were observed for information pertaining to the inclusion or omission of technology components. It was revealed that when a classroom teacher, librarian, etc. included technology within the lessons, the students’ morale was greatly improved; the students’ desire to learn was quite obvious and constant as opposed to a lesson that was without a technology component, wherein the students would normally complete the work without the fairly constant excitement and focused attention. The students’ excitement and interest seemed to be directly related to the inclusion of a technology component. Student comments during such lessons include “Woo-hoo,” “Cool,” “Wow,” and “Awesome.” However, when the students were using technology, including computers and the Internet, they would become quite frustrated when that particular piece of technology would not work. For example, while completing research in the school library, the students were given
instruction as to how to operate and navigate programs using a laptop. It was clear that some of the Internet connections for the individual computers were not working and the students would become frustrated and disheartened with their task for the lesson. Therefore, throughout the remainder of the lesson, their excitement and desire were somewhat dissolved when this would occur.

The observations did not reveal necessarily that a technology component could improve student performance during a lesson. It was revealed, however, that the students who had a more difficult time with traditional learning formats (those without a technology component) typically had an easier time completing their work, when compared to their performance within the traditional classroom format.
Discussion and Conclusion

There were many similarities to the past literature and the research completed in the study. The intent of the research was to fill any of the gaps in the past literature, while at the same time seek clarification as to technology's role in a student's performance and morale. The conclusions to the lesson studies and observations were homogeneous in nature in that they helped to show that technology can in fact improve student morale when included in a classroom lesson or activity, which therefore provided evidence that technology can be fun and entertaining in the classroom. Technology's ability to enhance student performance in the classroom, however, came up lacking in (enough) evidence to support such an argument. Past literature has taken the stance that technology can in fact benefit student performance when used correctly. For example, Krentler & Willis-Flurry (2005) stated that "the use of technology can and does enhance student learning" (p. 321). This stance did have some validation derived from the research observations; students who had a difficult time with a traditional learning environment were benefited by the inclusion of technology in the lessons. These students who may not have typically completed their assignments, were able to complete their work perhaps due in fact to their excitement to work with a computer, calculator, etc. An additional explanation for this could be that these students worked better when a technology component was involved for the work became easier for them when presented or completed in a different format. However, the research did not present enough substantial evidence to support the view that technology benefits student performance in the elementary classroom.

Another aspect that both the literature and research presented was one concerning attitudes toward technology. The sources seemed to support the opinion that a teacher's
negative attitude toward technology can be transferred to a student or may hinder a student’s success with technology in the classroom. Czubaj (2004) wrote that “when educators are hesitant to implement technology within their classrooms, their students are provided limited exposure, at best, to the full range of uses of the technology in the educational setting” (p. 676). This was validated with the results from the research. Throughout the classroom observations it was evident that when the teacher was less comfortable including technology, so in turn were most of the students and therefore their attitudes were somewhat negative toward technology whether they were hesitant, uncomfortable, or lacking in desire to use the tools.

When examining gender discrepancies toward the inclusion of technology in student learning environments, the research overwhelmingly refuted the possibility for any such discrepancy. The literature tended to support the belief that there is such a discrepancy. Christensen, Knezek, and Overall (2005) stated that “some technology-related areas exist in which girls are measurably higher than boys, even after the transition to lower computer enjoyment” (p. 35). However, throughout the lesson studies and observations, both the females and males were excited to work with the technology tools and were equally as successful in their utilization and work with such tools. It must be noted however that this may be due in fact to the age of the students studied and/or the classroom subjects of focus (mathematics, science, etc.).

The results from the lesson studies revealed that by combining technology or a technology tool within a lesson, the students’ overall impression of the lesson will be enhanced. Past literature also agreed with this statement; Carter, Sumrall, & Curry found that a potentially less enthralling lesson could be heightened by the inclusion of
technology (2006). By combining technology within a students’ learning of a subject such as Mathematics, the students’ attention will more than likely be heightened through all components of the lesson – even those portions that do not include a technology component. By merely incorporating technology in a lesson, the students’ morale and desire to complete the work will be profound.

The teacher questionnaires revealed much to benefit the existing research; with most teachers stating that they use some form of technology on a daily basis with the computer being the most common in their lessons, teachers are growing more and more comfortable with including technology in their lessons and therefore teachers and students are better prepared for the increasing existence of technology in their lives. What was quite relevant from the questionnaires was many of the teachers felt that they needed additional assistance or training related to the inclusion of technology in their daily lessons. This perception was also discussed in past research and was determined as one of the main causes for the lack of technology use in some existing teaching environments. Eskicioglu and Kopec (2003) wrote that, “although computer and communication technologies have unique capabilities for enhancing learning, the infrastructure of a multimedia-enabled classroom is complex and implies many radical changes in all areas including curriculum development, pedagogical approach, faculty training, and organizational matters” (p. 218). By educating the faculty within various schools, perhaps technology will be more prevalent in daily activities and teacher and student comfort levels will increase for the inclusion of technology. In addition, the questionnaires revealed that some of the teachers felt that they were in need of updated technology tools for their classrooms. Perhaps administration must take a closer look at this factor and
work to get it resolved so that teachers and students can be learning more about and utilizing more up-to-date technology tools.

The research assisted in affirming certain aspects of literature that has benefited the realm of technology inclusion in the classroom. It is quite evident that additional research must be done in order to answer various remaining questions or fill loopholes in the research that exists, such as the ability for technology to enhance student performance, and the availability of (updated) technology in the classroom relating to the inclusion of technology in the classroom by our schools' educators. By providing more information and validation for the benefit of technology for student performance and morale, educators will be given the opportunity to feel more confident in including technology in their daily lessons and activities and students will be better prepared for the expanding realm of technology in their lives.
References


Appendix A

Lesson Study 1 – Worksheets

Tree Vocabulary - Using a Glossary

<table>
<thead>
<tr>
<th>Name ___________________________</th>
<th>Date ______________</th>
</tr>
</thead>
<tbody>
<tr>
<td>life cycle ________________________</td>
<td></td>
</tr>
<tr>
<td>seedling __________________________</td>
<td></td>
</tr>
<tr>
<td>leaf _______________________________</td>
<td></td>
</tr>
<tr>
<td>sapling ___________________________</td>
<td></td>
</tr>
<tr>
<td>conifers __________________________</td>
<td></td>
</tr>
<tr>
<td>adaptation _________________________</td>
<td></td>
</tr>
</tbody>
</table>
Tree Vocabulary - Using a Dictionary

Name ____________________ Date ______________

sap ____________________

bark ____________________

photosynthesis ____________

chlorophyll ________________

seed ____________________

cone ____________________

trunk ____________________
Tree Vocabulary - Using an Online Dictionary

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>deciduous</td>
<td></td>
</tr>
<tr>
<td>tree ring</td>
<td></td>
</tr>
<tr>
<td>seed dispersal (disperse)</td>
<td></td>
</tr>
<tr>
<td>life span</td>
<td></td>
</tr>
<tr>
<td>phloem</td>
<td></td>
</tr>
<tr>
<td>heartwood</td>
<td></td>
</tr>
<tr>
<td>nutrients</td>
<td></td>
</tr>
<tr>
<td>I have...</td>
<td>Who has...</td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>deciduous</td>
<td>all the stages in an organism's life</td>
</tr>
<tr>
<td>life cycle</td>
<td>a baby tree or plant</td>
</tr>
<tr>
<td>seedling</td>
<td>a part of the plant where the food is made</td>
</tr>
<tr>
<td>leaf</td>
<td>each ring represents one year in the life of the tree</td>
</tr>
<tr>
<td>tree ring</td>
<td>the method of seeds being moved about in nature</td>
</tr>
<tr>
<td>seed dispersal</td>
<td>the part that holds the seeds on the evergreen</td>
</tr>
<tr>
<td>cone</td>
<td>stem of a tree</td>
</tr>
<tr>
<td>trunk</td>
<td>the process of making food by plants; chlorophyll in the leaf mixes with water and carbon dioxide</td>
</tr>
<tr>
<td>photosynthesis</td>
<td>the pipeline through which the food flows from the leaves to the rest of the tree</td>
</tr>
<tr>
<td>phloem</td>
<td>it holds the food as it passes through the tree and helps protect the tree from insects and damage when cut</td>
</tr>
<tr>
<td>sap</td>
<td>the beginning life of a new plant</td>
</tr>
<tr>
<td>seed</td>
<td>a very young tree</td>
</tr>
<tr>
<td>sapling</td>
<td>the years something is alive</td>
</tr>
<tr>
<td>life span</td>
<td>it is what is in the leaf ready to mix with water and carbon dioxide. It gives the leaf its green color</td>
</tr>
<tr>
<td>chlorophyll</td>
<td>hard layer of wood covering the trunk; protects the tree</td>
</tr>
<tr>
<td>bork</td>
<td>evergreen trees- they keep seeds in cones and have thin needles all year</td>
</tr>
<tr>
<td>conifers</td>
<td>a special characteristic that helps an animal or plant survive</td>
</tr>
<tr>
<td>adaptation</td>
<td>the central supporting pillar for the tree</td>
</tr>
<tr>
<td>heartwood</td>
<td>found in the soil and needed by the tree to grow healthy; dead trees release more when they decay for newer trees to use</td>
</tr>
<tr>
<td>nutrients</td>
<td>broadleaf trees- they lose their leaves in fall and grow new ones in the spring</td>
</tr>
</tbody>
</table>
### Tree Vocabulary - Using a Dictionary

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. sap</strong></td>
<td><strong>a. stem of a tree</strong></td>
</tr>
<tr>
<td><strong>2. bark</strong></td>
<td><strong>b. the process of making food by plants: chlorophyll in the leaf mixes with water and carbon dioxide</strong></td>
</tr>
<tr>
<td><strong>3. photosynthesis</strong></td>
<td><strong>c. the part that holds the seeds on an evergreen</strong></td>
</tr>
<tr>
<td><strong>4. chlorophyll</strong></td>
<td><strong>d. the beginning life of a new plant</strong></td>
</tr>
<tr>
<td><strong>5. seed</strong></td>
<td><strong>e. it holds the food as it passes through the tree and helps protect the tree from insects and damage when cut</strong></td>
</tr>
<tr>
<td><strong>6. cone</strong></td>
<td><strong>f. it is what is in the leaf ready to mix with water and carbon dioxide; it gives the leaf its green color</strong></td>
</tr>
<tr>
<td><strong>7. trunk</strong></td>
<td><strong>g. hard layer of wood covering the trunk; protects the tree</strong></td>
</tr>
</tbody>
</table>
Tree Vocabulary - Using an Online Dictionary

Name: 

Date: 

deciduous: 

tree ring (use definition #3):

seed dispersal (use dispersal):

life span (use definition #1):
Appendix C

Lesson Study 1 – Ticket-out-the-door

Name_____________________

___ I liked using the glossary the most.

___ I liked using the online dictionary the most.

___ I liked using the dictionary the most.
### Appendix D

#### Lesson Study 2 - Worksheet

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
</table>

Directions: 1) Estimate each subtraction problem. 2) Using a calculator, find the correct answer to the problem. The first one has been done for you.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>- 43</td>
<td>- 40</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>54</td>
</tr>
<tr>
<td>2.</td>
<td>73</td>
<td>- 49</td>
</tr>
<tr>
<td>3.</td>
<td>42</td>
<td>- 17</td>
</tr>
<tr>
<td>4.</td>
<td>68</td>
<td>- 51</td>
</tr>
<tr>
<td>5.</td>
<td>54</td>
<td>- 19</td>
</tr>
<tr>
<td>6.</td>
<td>88</td>
<td>- 63</td>
</tr>
<tr>
<td>7.</td>
<td>91</td>
<td>- 34</td>
</tr>
<tr>
<td>8.</td>
<td>156</td>
<td>- 67</td>
</tr>
<tr>
<td>9.</td>
<td>842</td>
<td>- 296</td>
</tr>
<tr>
<td>10.</td>
<td>555</td>
<td>- 378</td>
</tr>
<tr>
<td>11.</td>
<td>912</td>
<td>- 654</td>
</tr>
<tr>
<td>12.</td>
<td>766</td>
<td>- 405</td>
</tr>
<tr>
<td>13.</td>
<td>398</td>
<td>- 192</td>
</tr>
<tr>
<td>14.</td>
<td>829</td>
<td>- 599</td>
</tr>
</tbody>
</table>
Appendix E

Lesson Study 2 – Revised Worksheet

Name____________________________ Date________________

Directions: 1) Estimate each subtraction problem. 2) Using a calculator, find the correct answer to the problem. The first one has been done for you.

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<td></td>
</tr>
</tbody>
</table>
Appendix F

Lesson Study 2 – Ticket-out-the-door

Name________________________

Use a calculator to find the correct answer.

\[
\begin{array}{cc}
93 & 687 \\
-36 & -222 \\
\end{array}
\]

Did you enjoy using a calculator? Explain why or why not.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Lesson Study 3 - Worksheet

Name ____________________________

**Animal Research**

Animal name _______________________

Kind of animal _______________________

Layer _______________________________

Home _______________________________

Color _______________________________

Features ____________________________________________________________

Size _______________________________________________________________

Life span ___________________________________________________________

Enemies ______________________________________________________________

Favorite food _________________________________________________________

Other foods _________________________________________________________

3 Interesting facts ____________________________________________________

____________________________________

____________________________________
Appendix H

Teacher Questionnaire

**Classroom Technology Survey**

Grade(s) / Subject(s) ____________________________________________________________

Please answer the following questions to the best of your ability and knowledge. In this questionnaire, the term technology includes the use of a computer, overhead projector, television/VCR/DVD, camera, camcorder, calculator, etc. (any form of technology).

1. How often do you use technology in your classroom?
   - Daily
   - Weekly
   - Monthly
   - What's Technology?

What technology tools do you use during your instruction?

______________________________________________________________________________

______________________________________________________________________________

2. The use of technology improves student academic performance during a lesson, test, etc.
   - Always
   - Sometimes
   - Never

3. The use of technology improves student morale during a lesson, test, etc.
   - Always
   - Sometimes
   - Never

4. I am comfortable including technology in daily lessons/activities.
   - Always
   - Sometimes
   - Never

Any additional comments/feelings regarding technology in your classroom:

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

Thank you!