Effective technology integration strategies in an elementary classroom

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Effective technology integration strategies in an elementary classroom

Abstract
It is important for teachers to use technology to enrich and enhance their curriculums and to adequately prepare their students for the world of tomorrow. There are many factors that inhibit this use, but these factors can be reduced or eliminated by providing resources, such as computers and software, technical and administrative support and professional development opportunities. Action research was conducted to investigate using the computer as a learning station and an assessment tool in a classroom with limited resources and a teacher with limited experiences. The participants in the study were nine students in a combined third and fourth grade classroom in a small rural private school. Data collection consisted of a research log, student surveys, and attitude scales. Inductive analysis was used to catalogue and sort the data into related groups. The data indicated that the use of the computer as both a learning station and an assessment tool was a positive experience for the majority of the students. The computer was a motivational factor for students and provided instant feedback for both students and teacher.
Effective Technology Integration Strategies in an Elementary Classroom

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# TABLE OF CONTENTS

**ABSTRACT** ................................................................................................................ vi

**INTRODUCTION** ........................................................................................................ 1

  - Introduction.............................................................................................................. 1
  - Statement of the Problem ....................................................................................... 1
  - Research Questions ............................................................................................... 2

**METHODOLOGY** ....................................................................................................... 3

  - Introduction.............................................................................................................. 3
  - Subjects .................................................................................................................... 3
  - Data Collection Instruments ............................................................................. 3
  - Research Design and Procedures ........................................................................ 3
    - Activity One – Learning Station ........................................................................... 4
    - Activity Two – Learning Station .......................................................................... 4
    - Activity Three – Learning Station ....................................................................... 5
    - Activity One – Assessment ............................................................................... 5
    - Activity Two – Assessment .............................................................................. 5
    - Activity Three – Assessment ............................................................................ 6
  - Attitude Scales ....................................................................................................... 6
  - Statistical Analysis ............................................................................................... 6

**REVIEW OF THE LITERATURE** ............................................................................... 8

  - Introduction ............................................................................................................ 8
  - Methodology .......................................................................................................... 8
  - Review of the Research .......................................................................................... 9
Barriers to Technology Integration ................................................................. 10
Curriculum .................................................................................................. 10
Hardware .................................................................................................. 10
Student Skill Level .................................................................................... 10
Cost ........................................................................................................... 10
Teachers’ Beliefs ....................................................................................... 10
Professional Development ........................................................................... 12
Technology Integration and the Curriculum ................................................ 13
Elements for Successful Integration ........................................................... 14
Computers in Classrooms or Labs ............................................................. 17
Successful Integration Research ............................................................... 17
The Computer as a Tool ............................................................................. 19
Integration Strategies .................................................................................. 20
Classroom Tool ....................................................................................... 21
Productivity Tool ..................................................................................... 23
Presentation Tool ..................................................................................... 23
Learning Station ....................................................................................... 24
Assessment Tool ....................................................................................... 26
Role of the Teacher ................................................................................... 26
Conclusions .............................................................................................. 27
RESULTS ...................................................................................................... 29
Integrating the Computer as a Learning Station ........................................ 29
Teacher Reflections .................................................................................. 29
ABSTRACT

It is important for teachers to use technology to enrich and enhance their curriculums and to adequately prepare their students for the world of tomorrow. There are many factors that inhibit this use, but these factors can be reduced or eliminated by providing resources, such as computers and software, technical and administrative support and professional development opportunities. Action research was conducted to investigate using the computer as a learning station and an assessment tool in a classroom with limited resources and a teacher with limited experiences. The participants in the study were nine students in a combined third and fourth grade classroom in a small rural private school. Data collection consisted of a research log, student surveys, and attitude scales. Inductive analysis was used to catalogue and sort the data into related groups. The data indicated that the use of the computer as both a learning station and an assessment tool was a positive experience for the majority of the students. The computer was a motivational factor for students and provided instant feedback for both students and teacher.
INTRODUCTION

Introduction to the Problem

Research shows that integrating technology into the curriculum can not only enhance instruction and learning, but is an essential tool for education. It has also been found that teachers who integrate technology can find the results to be rewarding, both professionally and personally (Scaplen, 1999). Yet many teachers, including this researcher, have resisted the use of technology. Technology use needs to be more than students using the classroom computer as a reward when their work is finished. Action research allowed this researcher the opportunity to examine this problem within the actual classroom and to explore possible strategies that could be used to make the classroom computer an important part of classroom instruction and the curriculum.

Statement of the Problem

The purpose of this study was to determine what integration strategies work well in an actual classroom that has a minimal amount of hardware and software by a teacher with little prior integration experience. The teacher has made attempts in the past, but due to lack of knowledge, time, and experience, the computer had not been fully utilized or integrated within the curriculum. Students had basically used the computer for “play” when their work was completed. Due to the fact that there was essentially only one usable computer in the classroom, the teacher assumed that it could not be effectively used with a classroom of students for instruction or integrated within the curriculum. Action research was used to systematically study this problem area to find a solution for
integrating technology into the curriculum. This study specifically investigated strategies that use the computer as a learning station and as an assessment tool.

Research Questions

The specific action research questions used were:

1. In a one-computer classroom, what is the impact of the computer when used as a learning station?

2. What is the impact of the computer when used as an assessment tool?
METHODOLOGY

Introduction

Subjects

The participants in this study were nine students in a combined third and fourth grade classroom in a small private rural school. All students participated.

Data Collection Instruments

The hardware/software used in this study was that which was already available in the classroom or from the AEA. The computer was an iBook with wireless Internet access. Software included Kidspiration and a number of content specific programs: Geobee, Grammar for the Real World, Math Munchers, and Reading Munchers. The school computer lab with iMacs was also available.

Research Design and Procedures

The study used the action research design model, a planned methodical observation relating to teaching (Johnson, 2005). Even though research has shown that the integration of technology can enhance instruction and learning and can be a useful tool for education, technology has not been used in a significant way in the researcher’s classroom. Action research was used to systematically study this problem area and to find a solution for integrating technology into the curriculum. A review of the literature examined reasons why technology has not been integrated in elementary classrooms. In addition, research was done to examine strategies that have been used to effectively integrate technology in classrooms with limited resources. The research suggested that one computer might be used as a productivity tool, a presentation tool, a learning station,
and an assessment tool. This study investigated strategies that used the computer as a learning station and an assessment tool.

The data was collected over a two-week period in May. The data consisted of a teacher research log, student interviews, student attitude scales and written observations (Johnson, 2005). The strategies that were chosen and used were documented in a research log. The researcher recorded the strategies used, as well as any thoughts, observations, or reflections as to how the activity was received by the students. The reflections and observations were written using the Technology Impact Checklist (Roblyer, 2003) as a focus. This checklist helped the researcher to determine how well technology had been integrated.

Three activities were implemented to use the computer as a learning station. The students were rotated through the learning station, sometimes individually, and other times with a partner.

**Activity One – Learning Station**

The first activity used math to integrate the computer with the constant study of multiplication facts for third and fourth graders. Students were to use a specific Internet site to review and practice their basic multiplication facts.

**Activity Two – Learning Station**

For the second activity as a learning station, the students used a variety of computer programs for practice and review. The students have used computers in this way before, but this time a conscious effort was made to choose programs that were integrated with current units of study in math (Math Munchers), grammar (Grammar for the Real World), and map skills (Geobee). The students had a designated time to work on
the computer. It was treated as an assignment for class rather than an extra activity to do when work was finished.

**Activity Three – Learning Station**

For the last activity as a learning station, the students used Kidspiration to make an end of the school year web. The students had used webs before to organize their thoughts or information, but this had always been done on paper or poster board. For this activity students were to illustrate what they thought were the highlights of the year.

Three activities were also completed to use the computer as an assessment tool.

**Activity One - Assessment**

The first activity in using the computer as an assessment tool was to have students take an on-line test over the novel that they had completed reading for class, *Sarah Plain and Tall* by Patricia MacLachlan. For this activity the researcher opted to take the students to the computer lab due to time constraints. The students could have rotated through the classroom computer, and considering the technical problems in the lab that may have been easier. The computers in the lab were older iMacs and prone to freezing. The Internet connection was also very slow at times.

**Activity Two - Assessment**

For the second activity in using the computer as an assessment tool, the students and their partners compared the book, *Sarah Plain and Tall*, to the movie using a template in Kidspiration.
Activity Three - Assessment

The final activity using the computer as an assessment tool involved the use of CPS (Classroom Performance System) to assess their vocabulary. CPS is a wireless response system that allows communication between a handheld response pad like a remote and a receiver unit that is connected to the computer. The CPS was available from the local Area Education Agency (AEA).

Attitude Scales

The students wrote pre and post paragraphs at the start of the study and again at the end on their attitudes and thoughts about computer use. These paragraphs were based on questions that the researcher wrote on computer use (see Appendix A). In addition, the students completed attitude scales (Appendix B) that the researcher created, based on a format found in Johnson (2005). These attitude scales were completed by each student after each specific use for the computer. The scales’ data provided information on their attitudes as well as data that could be used to make comparisons (Johnson, 2005). Students also answered survey questions throughout the study so that the researcher could gain student feedback on their participation in and reaction to the chosen learning strategies. After the specific activity, they would answer the questions in writing. The questions would usually be answered on an individual basis, though if the students worked with a partner for the activity, they also completed the questions with their partner. The questions that were written and used are shown in Appendix C.

Statistical Analysis

Inductive analysis (Johnson, 2005) was used to catalog and sort the information from the student survey questions into related groups. This process allowed the
researcher to look at the data and to organize what she had observed. After listing the
student comments, she looked for recurring answers or any themes or patterns to emerge.
The categories that emerged were defined and described as: (a) how many student
comments were recorded, (b) how many categories there were, and (c) how many
comments there were in each category (Johnson, 2005).

Interpretation of the data, using inductive analysis, included analyzing the parts,
synthesizing the results to show how the parts were related, and theorizing as to what
could be made of it all (Holly, Arhar, & Kasten, 2005). The two chosen strategies were
compared based on the collected data to determine the impact when the computer was
used as a learning station or as an assessment tool. This allowed the researcher to make a
reasonable deduction as to what strategies were effective in integrating the computer into
classroom instruction and the curriculum.
LITERATURE REVIEW

Introduction

Why should teachers be concerned with using technology if what they are already doing is working? Students are learning with non-technology instructional strategies that have already proven to be successful. Due to this reason, many teachers may resist integrating technology into their instruction. It is important for teachers to use technology to enrich and enhance their curriculums to adequately prepare their students for the world of tomorrow. Technology integration provides benefits such as student motivation, improved interaction with content, and the development of cooperative learning skills.

This literature review opens by examining barriers that inhibit the integration of technology by teachers and how professional development opportunities can help to promote integration. It discusses how technology should be integrated within the curriculum and what elements are necessary for successful technology integration. Two successful examples of technology integration are illustrated. The review concludes with an examination of the computer as a tool and a variety of integration strategies for that tool in a one computer classroom.

Methodology

The method of identifying sources for this paper was to search a variety of online databases, Internet websites, and UNISTAR, the catalog for the University of Northern Iowa (UNI) Rod Library. The online databases used were ERIC (SilverPlatter), Academic Search Elite and ERIC through EBSCOhost, and WilsonWeb Full Education Text. The descriptors used for the search were: technology integration, elementary school, elementary education, teacher attitudes, factors, technology, technology in
education, one computer classroom, and one computer. These descriptors produced an adequate number of articles for perusal from all the databases. UNISTAR provided several books on technology that were very current, but not all were useful to the one-computer classroom situation. A member of the UNI’s Instructional Technology Division faculty was also instrumental in locating resources by recommending names of authors who had written articles that provided information for the topic. A Google search was done using the descriptor one-computer classroom which provided a significant number of websites on the topic. The procedure used to analyze the resources was to read the abstract and decide whether or not the information would help to answer the research questions. The information found was evaluated according to its relevance to the topic, whether the journal in which the article was found was peer reviewed, and to some extent, the date it was written. The websites were analyzed as to whether or not they were a reputable source. The information found was also evaluated according to its relevance to the topic.

Review of the Research

Technology is no longer an addition or extension of the curriculum. “Rather, technology-related skills have become essential tools in the learning process in virtually every part of the curriculum – as crucial to the acquisition of knowledge and to the development of lifelong learning skills as the ability to read and write” (Merritt, Beaudin, Sills, Oja, 2004, p. 10). The use of technology, however, is an intimidating challenge for many teachers.
Barriers to Technology Integration

Some of the challenges seen as barriers to the integration of technology into the curriculum are external, such as a lack of computers and software, a lack of time for planning, poor technical and administrative support, and a lack of convenient access to computers. Another issue is the pressure of covering the curriculum.

Curriculum

At the elementary level, where teachers have so many different subjects to cover, computer use was frequently seen as inhibiting the coverage of these topics (Becker, 2000). Teachers and other supervisors of curriculum were unwilling to drop any existing content. Becker (1994) reported that teachers who were classified as exemplary computer users were (a) four times as likely to introduce new topics, (b) five times as likely to deemphasize or drop particular topics, and (c) twice as likely to give emphasis to particular topics more than they did before. Becker’s survey suggested that computers may actually be a useful way to identify weak or outdated content within the curriculum.

Hardware

In a study done by Bauer and Kenton (2005), a major obstacle to integration was the hardware. Teachers found the computers that they used were old, therefore, slow and unable to be used with newer software applications. There was also a lack of technical staff to deal with computers freezing and other such problems. Whitehead, Jensen, and Boschee (2003) stressed the fact that there is also a need to have compatible equipment throughout the school. A study completed by O’Bannon and Judge (2004) recommended that schools must have technology plans to purchase up-to-date equipment and software to increase teacher confidence and ability in using technology.
Student Skill Level

Another concern that became apparent from the study by Bauer and Kenton (2005) was the effects of the computer skill levels of the students. Not all students were equally capable in their abilities in keyboarding or navigating the computer menus. Bauer and Kenton (2005) identified this as a type of “digital divide” with those students who had computer access at home surpassing those who did not.

Cost

A final inhibiting external factor was money. It takes money to purchase computers and software, to staff schools with support personnel to provide technical support, and for staff development (Becker, 1994). Many of the external factors can be eliminated by adding resources and providing training. As more classrooms gain computers, the external barriers are attended to, but the internal, or personal, factors are more difficult to address (Ertmer, Addison, Lane, Ross, & Woods, 1999).

Teachers’ Beliefs

Some examples of internal barriers are teachers’ beliefs about teaching and computers and an unwillingness to change (Guha & Leonard, 2002). Dealing with internal factors requires challenging teachers’ belief systems and established routines. Changes in instructional routines will not take place just by making computers available in the classroom. Other internal factors include limited skill or expertise and computer anxiety. Change can be very stressful and difficult. Teachers are resistant to change. Teachers often teach the way they were taught, and they are comfortable using the strategies from which they learned (Lever-Duffy, McDonald & Mizell, 2005). Fear of the known is preferable to fear of the unknown. Teachers already feel in control of their
instruction and the way it is provided. They must be convinced that technology is a change for the better (Waterhouse, 2005). Teachers must be shown how technology can enhance student learning and provide positive changes in their instructional styles.

Teachers’ attitudes and beliefs may be changed by sharing strategies for technology integration, but teaching teachers how to integrate technology is often overlooked. Attention is paid to learning how to operate the hardware and software. It is expected that teachers will automatically know how to integrate technology in the learning context. Technology integration is more than students using the classroom computer when their work is finished (Anderson, n.d.). Effective planning is a particularly important facet of technology integration and teachers need guidance (Scaplen, 1999). Technology also needs to be aligned with school standards and objectives (Staples, Pugach, & Himes, 2005). Teachers need time, creativity, and professional development opportunities. These opportunities must keep pace with the hardware (Edwards, Hilburn, & Crawford, 2001).

Professional Development

The Research and Policy Committee for Economic Development (1995) stated that teachers need professional development that helps to improve their comfort level, teaches them how to integrate technology within their curriculum, and allows them to become familiar with optimum instructional techniques in using technology. They also stressed that this should be ongoing, not short-term.

Traditional staff development has proven to be ineffective as these workshops have rarely been maintained over time and have had no relationship to the curriculum. It
was also stated that there has usually been no change in teacher practice upon return to the classroom (Ditzhazy and Poolsup, 2002).

To improve teachers' comfort levels, administrators must offer continued support and encouragement to teachers. They must provide thorough training with enough time to practice so that teachers can be comfortable with computers in the classroom. In addition, they should continually update resources and provide continual training due to rapid changes in the technological field (Guha, 2000).

One method of supplying ongoing professional development and on-site support involves using teacher mentors. The use of a mentor can build self-confidence and provide support that is relevant and ongoing in a safe environment (May, 2000).

Technology Integration and the Curriculum

When integrating technology, the technology used should support the curriculum. "Technology for the sake of technology is not appropriate" (Wetzel, Zambo, Buss, & Padgett, 2001, p. 7). Teachers should evolve from asking themselves "How can I fit some technology into what I am doing?" to "How can I use technology to effectively teach this content?" (p. 10). Dockterman (1997) suggested similar questions to be considered: "1) What do I want my students to be able to do? 2) What methods should I use to help them achieve those goals?" (pp. 11-12). Labbo et al. (2003) also stressed that technology use should be tied to the curriculum, not just used for its own sake. It should support or add value to the curriculum and the instructional objectives. Technology should support the curriculum, not become the curriculum (Hall, Dixey, Nierstheimer, & O'Brien, 1997).

A study done by Staples, Pugach, and Himes (2005) produced three scaffolds that can be used to help relate technology to the curriculum. The first scaffold is that
technology needs to be aligned with the school’s curriculum or mission. It should relate to the school curriculum, not just a matter of purchasing hardware and software. The second scaffold is teacher leadership. Teachers must share their expertise with others and take on the role of a coach. The third scaffold is to recognize technology users, both students and teachers who make technology use a high priority.

The study done by Wetzel et al. (2001) found that as teachers attempted to integrate technology in their classrooms, they started to question their approaches to teaching. Many moved from a teacher-oriented approach to methods that involved student collaboration. They also tried doing traditional assignments in a new way using technology.

**Elements for Successful Integration**

All teachers at the elementary level should be proficient with computers and competent in computer instruction. In addition, teachers need to have an expectation of success. Teachers who believe that they have the skills to successfully integrate technology and who attach importance to the results tend to higher users of technology. It may be useful for teachers who have been successful in the use of technology to share with others and to create communities of support (Wozney, Venkatesh, & Abrami, 2006). Guha (2000) suggested that research needs to be done to investigate the most effective method of technology integration at elementary grade levels.

Ditzhazy and Poolsup (2002) identified four crucial elements for the successful integration of technology: (a) culture of the school, (b) voluntary participation, (c) sufficient assistance, and (d) a secure environment in which to experiment. Labbo et al. (2003) also advised that teachers should carefully select and participate in technology-
related staff development opportunities. These opportunities are a key factor in making technology integration a success. In addition, teachers who were found to be the most positive about computers were those who possessed better computer skills, were inclined to use open-ended activities with students, and had a readiness to question their own attitudes about teaching (Higgins, Mosely, & Tse, 2001).

The International Society for Technology in Education (ISTE) (2005) described essential conditions for the effective integration of technology that repeat many of the previously mentioned requirements. The conditions they felt were necessary include:

- support and leadership
- teachers skilled in technology use for learning
- content standards and curriculum resources
- student-centered approaches
- assessment of effectiveness
- access
- technical assistance
- community partners
- ongoing financial support
- supporting policies and standards.

With these conditions in place, a learning environment can be created that will engage students in activities that connect technology skills with curriculum content (http://cnets.iste.org).

Becker (2000) found a relationship between instructional style and the use of computers, the objectives of computer use, and the types of software frequently used.
Teachers with a traditional approach tended to find computers incompatible with their instructional goals and used a limited range of applications. Teachers who had above average technical skills and used computers themselves professionally often used them in more extensive and sophisticated ways. He also found that for teachers to be comfortable with using computers as an instructional tool, they should feel comfortable and skilled with computers, have a daily schedule that allowed time for students to use the computer as part of class assignments, equipment that was available and convenient, and a personal philosophy that supported a student-centered constructivist view including collaborative projects. Whitehead, Jensen, and Boschee (2003) also indicated that if teachers are allowed to develop ownership of technology in the school, they will then be ready to move on to advanced levels of technology use.

One method of providing support and leadership is to promote a program within the schools where teachers act as mentors. May (2000) found that having teacher mentors close at hand for support increases teachers' confidence in their abilities to integrate technology. It also increased their capacity to work through a range of technical problems. Riel and Becker (2000) also suggested that mentoring programs provided a non-threatening environment and encouraged the development of local expertise.

Rogers (1995) stated that “getting a new idea adopted, even when it has obvious advantages, is often difficult” (p. 1). There are five characteristics that help promote change. Roblyer (2003) discussed these characteristics in relation to the use of technology. First, teachers must see the relative advantage. The use of the technology must have clear benefits over the former method of instruction. The second characteristic is compatibility. The use of the technology must be compatible with a teacher's beliefs.
values, and current needs. The third characteristic is complexity. The new approach must be easy to learn and implement. The fourth characteristic is trialibility. This allows teachers to try out new methods at their own comfort level. The last characteristic is observability where teachers have the opportunity to see others using the technique. Preferred levels of each of these characteristics will help a teacher integrate technology and promote a change in a teacher’s instructional style.

Computers in Classrooms or Labs

Using computers in the classroom may be more efficient than using them in a lab situation. Some difficulties encountered with the use of computer labs are: (a) limited access, (b) nonalignment with class schedules, (c) less integration and cooperative learning, and (d) reduction in time to complete assignments (Whitehead, Jensen, & Boschee, 2003). There is also a reduction in teacher ownership. Teachers have more confidence and feel more competent when computers are placed in the classroom. They also spend more time using them (Ringstaff & Kelley, 2002).

Successful Integration Research

A low performing elementary school raised its third grade reading scores by 124% by integrating a technology-based instructional program (Eaton, 2005). Due to their low performance status, this school qualified for the NCLB Title II D: Enhancing Education through Technology Grant. Up until then, technology consisted of students going to the lab to use CD’s for supplemental enrichment activities or as a reward for completing their work. The teachers were involved very little with technology. Using the money from the grant, technology was chosen that would be a tool for teaching an entire class. This technology needed to provide interaction between not only teachers and
students, but especially between students. It was believed that student-to-student interaction was a powerful part of learning. A lab setting was not wanted where students would interact with the computer. The solution was an Apple iBook G4 laptop with a wireless airport card and a reading software program that engaged students in reading instruction. Due to this experience, teachers branched out to using email, presentation tools, personal web pages, digital cameras and video in the classroom.

Another study, Project ImPACT, promoted teacher use of technology and their ability to integrate within the curriculum (O’Bannon & Judge, 2004). The model used provided participating teachers with access to technology in their classrooms, professional development, and technical support. The results showed significant increases from the pretest to posttest in how teachers rated themselves in terms of their own ability, expertise, and technical skills in using technology. Their access to technology was considered vital. It allowed them to use technology in their instruction. Their computers had been old and would not run current software programs. New laptops allowed small group work. This increased use by the mentor teachers transferred to other teachers. There were also changes in student interest, time on task, and enthusiasm, confidence and motivation. Students felt comfortable using computers for research. They would often use them to look up words they did not know that they had encountered in their reading. This in turn increased their vocabulary. A participating veteran teacher felt that the integration of technology into the existing curriculum added a new dimension to learning for both her and her class. It gave fresh energy to monotonous lessons and challenged them to be inventive problem solvers. The study recommended that in the future, schools must have
technology plans to purchase up-to-date equipment and software, network access, and to place computers in the classroom with the teacher and students.

The Computer as a Tool

Teachers feeling pressure to use technology often put the computer at center stage, but it should take on a supporting role. Previously, teachers did not create lessons to showcase the filmstrip projector (Dockterman, 1997). As a matter of fact, teachers who used film and television as a motivational tool were in the clear minority (Cuban, 1986). According to Healy (1998):

“Technology” is any tool or medium that helps people accomplish tasks or produce products more efficiently, and computers are only the latest in a long line of innovations – going back to axes and fire – that have changed the way humans interact with the world and each other (p. 30-31).

The computer is a tool, a tool that can be added to books and other classroom materials. The use of one computer as a tool can add to the ability to differentiate instruction by challenging the gifted students and assisting the struggling ones (DuBois, 1998). Scaplen (1999) stated that teachers should always have students use the computer with definite assessable tasks in mind. Kahn (1998) suggested using the computer as an alternative medium to other materials in the classroom. Students may work on the same objectives or activities, but some at their desks and others at the computer. Teachers may discuss how activities such as publishing, drill and practice, research, reading, and art differ when experienced on and off the computer; discussing similarities and differences in the tasks and how the medium changes the work. She stressed that all activities should encourage
thinking and problem solving. Labbo et al. (2003) stated the following in terms of technology use:

The principles of effective technology use, as I see it, would be teacher involvement first and foremost. I believe strongly that the use of computers alone will not enhance any curriculum. It is only with the careful choices made by the teacher that software and websites will provide children with enriching and useful experiences (p. 304).

Dockterman (1997) added that “a tool is ultimately only as good as the user” (p. 22).

Integration Strategies

What about the classrooms that have only one computer? The one-computer classroom is the norm for many schools. Soo Boo Tan (1998) stated that this classroom can be just as productive and enriching as those classrooms with several computers. The one-computer classroom has the “potential to be dynamic, with new possibilities unfolding as time, creativity, and comfort allow. Perhaps most exciting of all is how the computer opens the door to new roles and relationships: student-as-instructor and teacher-as-facilitator” (DuBois, 1998, p. 44).

The classroom computer may be used as a tool, a tutor, or a tutee (Taylor, 1980). In using the computer as a tool, students may use it for calculations or word processing. Using the computer in this manner saves time for both students and teachers. In using the computer as a tutor, students are presented material, they make a response, and in turn, the computer assesses their response. As Taylor states, both these uses will enrich the classroom environment, but they require minimal computer experience by the user. For
the third use, as a tutee, students and teachers must be able to program the computer to do the tasks they desire.

A single computer can be used as an administrative tool and an instructional aid (Dockterman, 1997). He suggests using the classroom computer to:

- Manage paperwork and responsibilities
- To make presentations
- To lead discussions
- Manage cooperative learning activities
- Communicate with parents
- Prepare classroom materials
- Gather information

He suggested that the computer can take you as far as you are willing to go.

To get the most out of the single classroom computer, teachers need to re-think how they teach and to plan and organize lessons around group activities (Sun Associates, 1997-2005). For example, while one group of students use the computer; other groups are participating in the non-computer parts of an activity. Scaplen (1999) described an advantageous arrangement as a computer in the classroom as well as access to a lab. By having at least one computer in the classroom, it is easier to use for instruction and to relate activities to ongoing themes. Scaplen also stated that teachers must learn to work with what they have.

Classroom Tool

Cuban (1986) defined instructional technology as the use of any device that teachers may use to teach students in a more stimulating and efficient way. For a
computer to be effectively integrated, Healy (1998) pointed out that implementation
guidelines are necessary and these guidelines are best elaborated by those who are very
knowledgeable in the area of instructional technology. Scaplen (1999) suggested looking
at the objectives and beginning where one feels most comfortable. Teachers should take
advantage of the special capabilities of the computer, not just do the same thing as before,
using the computer as a substitute. Technology integration strategies involve rethinking
how one teaches (Sun Associates, 1997-2005). The computer can be effectively used as a
teacher productivity tool, a presentation tool, a learning station, and with interactive
group software (Edwards, Hilburn, & Crawford, 2001). Teachers must plan to expand the
effectiveness of the computer in such ways as accessing the Internet, using educational
application software, enhancing lectures and presentations, using it as an information
resource or creation tool, and as a teaching assistant or tutor for individual students
(Shelly, Cashman, Gunter, & Gunter, 2004). Scaplen (1999) suggested using a learning
center approach, contracts, and cross-curricular projects. She stated that these strategies
have one common element. The students become more responsible for learning and
develop an understanding of the many resources and how they may use them. The teacher
evolves from a supplier of knowledge to that of a facilitator. “One computer can be a
powerful tool to support learning” (Kahn, 1998, p. 46).

“Constructivist educators urge us to design environments in which students can
identify important and engaging problems, organize resources to address those problems,
and present their solutions (Kahn, 1998, p. 42). This may be accomplished on just one
classroom computer by using a type of software called interactive group software. With
this type of software, students interact with each other, not the software. Students use the information from the software to work together and solve problems (Dockterman, 1998).

**Productivity Tool.** When teachers use the classroom computer as a productivity tool, students are not directly involved, but it does have an impact on their learning. The jobs that teachers must perform such as grading work, parent/teacher communication, lesson preparation, and creation of classroom materials are an important component of the teaching and learning process and determine the success of what happens in the classroom (Dockterman, 2002).

**Presentation Tool.** The computer as a presentation tool has many advantages over a chalkboard or overhead projector. The computer is faster and more efficient, motivational, easier to edit, provides a change in how lessons are conducted, work can be saved for later, and it provides an appealing presentation. Most research recommends connecting a projection device to the computer. The use of a large screen TV and scan converter can be the least expensive and the most versatile (Tan, 1998). Higher-end options include a LCD panel, projector and smart board. The advantage of using a large monitor or projection device is that in addition to being easier for students to see, the teacher can control the pace and the content. The disadvantage may be that the students may not be as actively engaged as they would be at their own computer (Anderson, n.d.) He added that using the computer with a projection device would be a good method of providing an overview of websites, so that the students may make better use of their limited time at the computer later. In using the computer as a presentation tool, teachers may present textual information that later may be printed out for absent students. It is also a good way to assist visual learners (DuBois, 1998).
Students may also prepare presentations. The presentation software should be easy to use so that students may focus their attention on organizing the presentation, not on learning the software (Kahn, 1998). Robinette (1996) suggested that student presentations do not always have to be content based. Learning to use the computer is also an important skill.

Learning Station. Using the computer as a learning station for students can provide enrichment, remediation, and additional practice (Wilson, Jones, & Hail, 2003). The computer learning station may be just one of many multiple activities or tools that students are using to solve a problem. The Internet and CD-ROMs are important, but they are not the only source of information (Anderson, n.d.). The computer learning station may also be used for skill practice and review. Teachers should be selective when choosing programs for extra practice. Often publishers of a textbook series will offer computer programs or websites to support student practice (Wilson, Jones, & Hail, 2003). When integrating software, it should complete or enhance the lesson. It may also be beneficial to have students drill and practice in pairs (Scaplen, 1999).

When selecting software, the teacher should become familiar with what is available. It should be developmentally appropriate to have impact on student learning. “Using developmentally appropriate digital content (software and Internet resources) that support the instructional objective(s) will provide opportunities for developing higher order reasoning and problem solving skills” (Labbo et al., 2003). The use of humor is also good. Students use and remember that software.
Sun Associates (1997-2005) suggested five basic universal applications that teachers should have:

- Word processor (preferably in package with spreadsheet and database programs included)
- Presentation software (such as PowerPoint)
- WWW Browser
- Email program
- Number of content specific programs (the number depending on the content area, grade level, and instructional strategies.)

These five programs are applications that the average teacher has taken the time to learn. They are also used most often by students.

A web-enhanced computer is another computer use for teachers to meet instructional goals (Edwards, Hilburn, & Crawford, 2001). “Organized and purposeful activities can open doors for students to engage in enriching and enhanced learning experiences” (Labbo et al., 2003). The Internet should not be used just because it is there. It should be integrated within the existing curriculum, not as an extra subject. Johnston (1997) suggested that when integrating Internet use to start with the basics and establish a foundation on which to build. She suggested starting with how the Internet works and how to follow links and ending with students researching with little guidance from the teacher. Websites can motivate students to investigate more deeply into topics (Wilson, Jones, & Hail, 2003). It is also important to teach students to evaluate a website’s usefulness and the validity of the information (Scaplen, 1999). When using the Internet with students, teachers also need to be aware of ethical, behavioral, and privacy concerns,
such as plagiarism, copyright violations, and use of unacceptable materials (Robyler, 2003). In addition, the use of the Internet requires teacher attention and supervision to ensure student safety (Labbo et al., 2003).

Assessment Tool. Using the computer as an assessment tool provides an alternative form of assessment. Software may be used, providing quizzes with immediate response and feedback. Teachers may use slide shows to prepare their own assessments. Students' learning may be evaluated by having them construct graphs or create graphic organizers (Dockterman, 2002). Students may also keep electronic portfolios, saving their work on disk or CDs (Robinette, 1996).

Role of the Teacher

Students often learn computer skills by playing. Teachers also need to play and become comfortable so that they may increase their effectiveness in classroom instruction. They may start by using the computer for keeping grades, attendance, and preparing handouts and tests with graphics (DuBois, 1998). Also, as students observe the teacher manipulating the computer and using various programs, they subconsciously learn how to do it themselves and increase their computer literacy for when they use the computer on their own. They become more confident and faster learners (Tan, 1998). Teacher should also select and participate in staff development opportunities. This is a key factor in making technology integration a success (Labbo et al., 2003). Implementation depends on the teacher (Scaplen, 1999). The influence of the instructor is the only difference between technologies and their appropriate and effective use in the classroom (Edwards, Hilburn, & Crawford, 2001).
Roblyer (2003) offered the following guidelines when planning effective technology-integrated instructional activities. She suggested matching the instructional needs with the integration. The use of the strategy should be appropriate to each specific need. For example, if the instructional need is to provide skill remediation, directed strategies might work best or if the instructional need was to foster creativity, it might be more appropriate to use constructivist strategies. Also, the assessment should be matched to the type of learning activity they have done. Students need to be aware of how they will be assessed and the assessment should be similar to the learning activity. In addition, she suggested that teachers allow enough time when introducing technology-integrated activities. New instructional methods often take longer than those that are familiar and routine. Students also need more time to complete new learning activities. Teachers must also be flexible and not afraid to experiment. They may need to make changes in the lesson or try something different.

Planning is important when designing technology-integrated curriculum. It is also important to be willing to make changes as needed and when necessary.

Conclusions

There are many factors that deter a teacher from using and integrating technology. The external factors, such as lack of computers or technical support, are more easily resolved than the internal ones. A teacher’s attitudes and beliefs are the primary reasons why technology may or may not be integrated. Internal factors such as these are not so easily changed. These are the factors that must be changed, however, for technology to be integrated within the curriculum. Teachers must be shown how technology can enhance student learning and provide a better learning environment, as teachers are ultimately the
ones who will implement any changes within the classroom. They need to achieve a feeling of success and comfort in their use of technology for changes to take place.

There are many conditions or factors that need to be met for teachers to feel successful in the integration of technology and to allow them to achieve a comfort level in its use. The challenges that teachers face need to be lessened or removed so that they may achieve that comfort level. Schools need to provide optimum conditions to allow teachers to integrate technology. Opportunities for professional development in the area of technology need to be provided, as well as ongoing technical support. Teachers in one computer classrooms should not feel limited by their solitary access. They may only be held back by their own lack of knowledge or creativity. It is possible to use the computer successfully as a learning station and an assessment tool to have an impact on student learning. A solitary computer may provide many opportunities and challenges for students and effective methods of enhancing instruction and learning. Once these and other conditions are addressed, teachers may start to effectively integrate technology into their instruction and realize the many benefits and ways the technology can enhance instruction and learning.
RESULTS

Integrating the Computer as a Learning Station

To use the computer as a learning station, students participated in activities that allowed them to review and practice their math facts, practice and review a variety of skills, and to make an end of the school year web. They would not have had difficulty accomplishing lesson objectives without the technology, but the use of the computer was a motivational factor. Another benefit was the immediate feedback when practicing skills and math facts.

Teacher Reflections

There were three activities using the computer as a learning station. Data on the students' interaction with these activities was taken from the teacher's research log containing her observations and reflections.

Activity One-Learning Station

The reason for using the technology was to provide drill that would be less monotonous than using flashcards. The students seemed to be motivated by the fact that they could be timed and that they earned a score. They wanted to earn a "good" score. Feedback was immediate.

Activity Two- Learning Station

Most of the students were able to focus on the learning and not the technology. One student commented that it was easier to proofread on a computer than it was on paper. Again, the objectives of the lessons could have been accomplished without the technology, but the computer was a motivational factor. Students worked with partners for this activity and that seemed to be beneficial. They were able to help one another if
one did not understand either the concept or how to navigate the program. They also kept one another on task.

**Activity Three- Learning Station**

The benefits of the technology for this activity were that everyone was on the same level. The non-artistic students were able to have illustrations that were equal to artistic students because they could use pictures from the program, rather than having to draw them. Also the process was more difficult and took longer to do on paper. Students would get caught up in making the web. If they wanted to erase or move an item, it was easily accomplished with the Kidspiration program.

**Student Attitude Scales**

The students completed attitude scales on using the computer as a learning station. Students responded to statements with a strongly agree, agree, no opinion, disagree, or strongly disagree. The results for each statement on using the computer as a learning station are displayed on Table 1.

Based on the attitude scales, most students (81%) seemed to enjoy using the computer as a learning station, and they were anxious to use the computer in this way again. Most preferred working with a partner on the computer, but this is often the case with activities that do not involve using the computer as well. The problems that were indicated in using the computer were due to the slow Internet connection rather than difficulty in performing the actual activity. It appeared that the use of the computer as a learning station had an impact on their learning as 70% of the students indicated that working on the computer helped them to learn.
Table 1: Student Attitudes toward Computer as a Learning Station

<table>
<thead>
<tr>
<th>Question</th>
<th>SA</th>
<th>A</th>
<th>NO</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I liked working on the computer:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning Station:</td>
<td>6</td>
<td>11</td>
<td>5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>I learned more working with the computer than I would have by myself:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning Station:</td>
<td>5</td>
<td>9</td>
<td>7</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Working on the computer helped me to learn:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning Station:</td>
<td>7</td>
<td>9</td>
<td>5</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>I would like to use the computer in this way again:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning Station:</td>
<td>13</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Using the computer was fun:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning Station:</td>
<td>6</td>
<td>11</td>
<td>5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>I had no problems using the computer:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning Station:</td>
<td>1</td>
<td>8</td>
<td>5</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>I like working with a partner when using the computer:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning Station:</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
Integrating the Computer as an Assessment Tool

To use the computer as an assessment tool, students were assessed on their reading comprehension, their ability to identify similarities and differences, and their vocabulary. The primary benefits of having students perform assessments on the computer were the immediate feedback for the students and the correction and scoring of the assessments for the teacher. Also, depending on the assessment, preparation time can be minimal which was another advantage for the teacher. The use of the Classroom Performance System (CPS) was highly motivating for the students. It was also motivating for the teacher. Set up took some time initially but once the information was entered, it could be saved for future use. Once again, the majority of the students enjoyed the use of technology when doing assessments.

Teacher Reflections

There were three activities using the computer as an assessment tool. Data on the students’ interaction with these activities was again taken from the teacher’s research log containing her observations and reflections.

Activity One- Assessment

This activity was done in the computer lab. Students encountered problems with computers freezing and a slow Internet connection. The teacher researcher could see why some teachers might refuse to use technology after an experience like this. If this had been this teacher’s first attempt at using technology, she probably would have been very hesitant to use it again. The quiz was a readymade one available at Bookadventure.com. This same test could have been done with paper and pencil, so lesson objectives could still be accomplished without the technology, but the benefit of using the computer was
that the tests were corrected and scored immediately. The students were able to see their scores as soon as they finished. The teacher could log in to see a class report with all the scores. For this particular site, preparation was minimal.

*Activity Two- Assessment*

The advantages to using the computer and the Kidspiration software were very similar to those described previously for the end of the school year web. The template was ready to go so they did not have to spend time in preparing an organizer. They could start at once discussing the similarities and differences between the book and the movie. Their work could also be easily printed and both students could have a copy. Kidspiration provided a platform in which the students could share their knowledge with each other and the rest of the class.

*Activity Three- Assessment*

The benefit to assessing students with the computer and CPS was the immediate feedback from each and every student in a way that did not embarrass anyone for getting an answer wrong. It allowed the teacher to know right away which vocabulary words the students knew and which ones the majority did not. It was also extremely motivating for the students. It was not the dull drudgery of taking a quiz to them. It was fun. The use of CPS would also be an excellent method of assessing students during instruction to see if they comprehend the concept you are teaching. The teacher would know immediately if students understand the concepts or if they need further practice.

*Student Attitude Scales*

The students also completed attitude scales based on using the computer as an assessment tool. Once again, students responded to statements using a strongly agree,
agree, no opinion, disagree, or strongly disagree Likert scale. The results for each statement on using the computer as an assessment tool are displayed on Table 2. They show that students were equally enthusiastic about using the computer as an assessment tool as they were in using it as a learning station, if not even more so. Students often do not like the thought of a test or assessment, but the addition of the computer seemed to make it less of a task, and may have even added the element of fun.

_Student Interviews_

Inductive Analysis was used to organize student answers from the interview into related groups. The researcher then looked for recurring ideas and thoughts to emerge from these groups.

**Question One: For what purpose have you used the computer?**

One hundred percent of the students were able to identify the subject area and/or task. For example, students could identify the task as learning their multiplication facts for math rather than referring to the activity as “playing” on the computer. Now they seemed to be aware of the specific purpose for which they were using the computer.

**Question Two: How did the computer help you accomplish your learning goal(s)?**

Three categories emerged from the data and are defined as follows:

- **Computer as teacher** - fifteen answers (63%) pertained to the computer providing instruction or explaining how to do something.

- **Computer for practice** – five answers (21%) pertained to the computer giving the opportunity to practice a skill with no real instruction.
Table 2: Student Attitudes toward Computer as an Assessment Tool

<table>
<thead>
<tr>
<th>I liked working on the computer:</th>
<th>SA</th>
<th>A</th>
<th>NO</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Tool</td>
<td>6</td>
<td>12</td>
<td>4</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I learned more working with the computer than I would have by myself:</th>
<th>SA</th>
<th>A</th>
<th>NO</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Tool</td>
<td>8</td>
<td>12</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Working on the computer helped me to learn:</th>
<th>SA</th>
<th>A</th>
<th>NO</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Tool</td>
<td>11</td>
<td>9</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I would like to use the computer in this way again:</th>
<th>SA</th>
<th>A</th>
<th>NO</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Tool</td>
<td>12</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Using the computer was fun:</th>
<th>SA</th>
<th>A</th>
<th>NO</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Tool</td>
<td>6</td>
<td>11</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I had no problems using the computer:</th>
<th>SA</th>
<th>A</th>
<th>NO</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment Tool</td>
<td>6</td>
<td>12</td>
<td>4</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I like working with a partner when using the computer:</th>
<th>SA</th>
<th>A</th>
<th>NO</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
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<td>7</td>
<td>10</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>
• Change in attitude – four answers (17%) pertained to a change in their attitude toward a particular skill, such as, “grammar is important”, “learned to like map skills”.

Student answers seemed to show that in general the students regarded the computer as a type of tutor or teacher. The computer helped them achieve their learning goals by teaching them how to do the skill on which they were working.

**Question Three: Did the computer make it easier or harder to understand the objective.**

There were seventeen responses (74%) for easier and six (26%) for harder. The reasons given for why it was easier were arranged into four categories:

• Technical reasons - seven responses (41%) were related to the technological aspects of the computer and/or software program used. For example, the computer indicating a problem is wrong and giving students an opportunity to redo it.

• Instructional reasons – four responses (24%) related to the computer explaining what to do.

• Gaming reasons – three responses (18%) related to the game portion of the software. For example, using program characters to “eat” the correct answers.

• Skill or ability reasons – three students (18%) responded that it was “just easy.”

The answers for those who responded that the computer made it harder to understand the objective were arranged in two categories:

• Concepts – five students (83%) responded that difficulties were due to the particular concept on which they were working.
• Computer skills – one student (17%) responded that difficulties were due to personal computer skills.

The special technological aspects of the computer seemed to be an advantage. Most of the students felt that using the computer made the activity easier. The computer was there for them constantly in a way that a human teacher usually is not. The computer could let them know right away if they were doing something wrong or often explain something if they did not understand.

Question Four: What was the best part about using the computer?

Four categories emerged from the data and are defined as follows:

• Enjoyment or fun – ten answers (40%) were concerned with the game aspect of a program, the opportunity to earn points, or going to a new level.

• Learning – seven responses (28%) related to some aspect of learning, for example, “getting things right”.

• Working with a partner – four students (16%) responded that the best part was working with a partner.

• Ability of the computer – four responses (16%) related to the capabilities of the computer. For example, these answers referred to the computer showing pictures or photos or the use of the response pads.

Students enjoy participating in games in the regular classroom, and games on the computer are no exception. Using the computer adds an element of fun and engages the student in the activity. Students also seem to appreciate the immediate feedback that a computer may give such as “Good job!” for correct answers.
**Question Five: What was the worst part about using the computer?**

There were five categories that emerged as to what was the worst part about using the computer.

- **Defeat** – twelve answers (50%) were concerned with losing at a game, getting answers wrong, or going back a level.
- **Difficulties of the activity** – eight answers (33%) were concerned with not understanding what to do or frustration with time limits.
- **Technical problems** – two answers (8%) indicated difficulty in navigating programs, freezing, etc.
- **Dislike** – one student (4%) indicated that he/she did not like an activity.
- **Nothing** – one student (4%) responded there was not a worse part.

In the same way that students enjoyed winning a game or receiving a “Good job!” comment, they did not like losing or getting answers wrong. Students also often became frustrated if there was any type of time limit on answering, especially if it was a skill with which they had difficulty. The game aspect could seem to have either a positive or negative impact depending on how competent the student felt with the skill or activity.

**Question Six: How would you change this activity to make it better?**

When asked how students would change the activity to make it better, five categories became apparent.

- **Difficulty levels** – eight students (32%) wanted the program to be easier, harder, more answering choices, etc.
• Aspects of software – seven answers (28%) indicated that they would change something in the computer program such as no time limits or eliminating annoying characters.
• Level of enjoyment – five students (20%) wanted the activity to be more fun, have more games, be longer, etc.
• Instruction – three answers (12%) were concerned with a need for clearer directions, hints, etc.
• Nothing – two answers (8%) indicated that no change was needed.

The answers for this question aligned with what they did not like about the activities, such as a dislike for time limits or the difficulty of the program. When choosing software or Internet sites, it may be beneficial to choose those that have a variety of difficulty levels to match the student using the program.

Pre- and Post-Paragraphs

Before their participation in the study, the students wrote paragraphs to share their thoughts about computers based on the pre and post survey questions on attitude and computer use (see Appendix A for list of questions). The majority of the students indicated that they liked to use computers and felt somewhat skillful. They identified the purposes of computer use to be learning, playing games, email, and finding information. They thought computers helped them at school to do research, help with homework, and to type and print.

At the conclusion of the action research, students again wrote paragraphs in response to the questions on attitude and computer use. The post-paragraphs were analyzed to identify how they had changed from those that were written at the beginning.
of the study. In general, students continued to show that they liked using computers, although one student explained that some activities she did not like at all and others she liked a lot. Another student stated that it was a fun way to learn and that he accomplished more than he thought. All responses indicated that students felt skillful in the use of computers and several felt more skillful than they had been. The responses to the purposes of computers and how they helped you learn at school were basically the same, although one student stated that he could learn more with the computer than by himself. The lists of things that computers help them do were also very similar to the lists produced at the start of the research, such as help with homework, research, how to take a quiz, reading, and typing.
DISCUSSION

Conclusions

The purpose of this study was to investigate the research questions:

1. In a one-computer classroom, what is the impact of the computer when used as a learning station?

2. What is the impact of the computer when used as an assessment tool?

Going into this study, this teacher faced many of the same barriers that were described in the research. Resources were very limited and technical assistance was basically non-existent. Lack of time for planning was also a problem. This teacher wanted to use computers in the classroom but just did not have the time or expertise to make it happen. There are many other teachers that are in the same position. Money was also described as an inhibiting factor to integrating technology (Ertmer et al., 1999). This drawback may be lessened by using what is already available when beginning efforts to integrate technology. Taking advantage of local resources such as the AEA can be an excellent way to become familiar with what is available in the world of technology.

The data collected from the students indicated that the majority of the students felt that the use of the computer was a positive experience. In using the computer as a learning station, 74% of the students liked working on the computer and 87% thought that using the computer was fun. Using the computer as a learning station also had a positive impact on their learning. Seventy percent of the students agreed that the computer helped them to learn and 60% felt that they had learned more using the computer than they would have learned by themselves. The majority (87%) liked working with a partner when using the computer. Also, teacher observation showed that
the students did not seem to mind taking turns in using the computer as long as they knew that they would get a turn eventually. Seventy-six percent of the students indicated that they would like to use the computer as a learning station again.

In using the computer as an assessment tool, 72% liked working on the computer and 68% thought that it was fun. Again, there was an impact on student learning as 80% of the students agreed that using the computer as an assessment tool both helped them to learn and that they learned more working with the computer than they would have by themselves. Eighty-seven percent indicated that they would like to use the computer as an assessment tool again.

When using the computer as a learning station, 42% disagreed that they had no problems when using the computer and 12% disagreed when using it as an assessment tool. Having reliable equipment seemed to be more important than the amount of equipment. Students were much more frustrated when using the computer lab and dealing with technical issues such as having the computers freeze than they were having to share one computer in the classroom. The freezing issue was the basis for students responding that they had difficulty using the computer rather than a lack of computer skill.

As this teacher reflected on the experience, she agreed with the opinions (Research and Policy Committee, 1995; Guha, 2000; Dizhazy & Poolsup, 2002) that training and professional development are an important facet of technology integration. Her classes in educational technology gave her the courage to attempt computer integration. The more attempts that she made, the more comfortable she became with technology and more willing to experiment with integration strategies. Finding the time to experiment is also an important consideration. It takes a lot of time to plan and become
familiar with the computer and its capabilities. She felt that this was the largest hurdle for her own integration attempts as she is sure it might be for other teachers as well. Doing the research project at the end of the school year was probably not the best scenario due to all the end of the school year responsibilities.

Recommendations

Scaplen (1999) recommended that teachers should look at the objectives and begin where they felt the most comfortable. This strategy proved effective for this teacher as it provided a good point at which to start. Scaplen also recommended taking advantage of the computers’ special capabilities, not just doing the same thing as before, using the computer as a substitute. Possibly this is an area in which this teacher could improve. Many of the activities chosen may perhaps have been done without the computer, but the computer was a motivational factor for the students. Also, the computer had the ability to provide instant feedback for both the students and the teacher. This feedback is not always possible in a regular classroom.

Based on observations and student responses to the survey questions, this researcher thought that the use of technology was motivating for the students, and they were eager to repeat the experiences. Also, most students found working with a partner to be beneficial and felt that they learned more using the computer. This researcher would recommend that in a small school with limited resources, or in larger schools actually, those teachers who have experience with technology integration should mentor and support those who are inexperienced and just starting out to ensure that their first experiences are positive. The researcher also recommends that teachers explore other strategies of integration and continue to integrate technology as they become more
experienced and also to share their experiences with their colleagues. She feels that the
time and energy it takes to integrate limited technological resources is worth the effort.
SUMMARY

While attempting to integrate technology within the classroom and curriculum, it was found that using the computer as either a learning station or an assessment tool seemed to have an impact on student learning. Research shows that the use of technology can not only improve instruction and learning but is a necessary tool in education. For the activities used in this study, the computer was not absolutely necessary, as the activities could have been conducted without the use of the computer, but the computer did aid in instruction, primarily as a motivational factor.

When using the computer as a learning station, the primary benefits were the motivational factor and also the immediate feedback that was provided by the computer. The students felt that using the computer was a profitable experience and their attitudes toward its use were mostly positive. The use of the computer as a learning station also provided an opportunity to differentiate instruction by providing extra practice in skills for some students or providing a challenge for others.

The use of the computer as an assessment tool seemed to have been even more of a positive experience. It made assessment more of a fun activity, rather than a daunting one. The capabilities of the computer were also advantageous for the teacher. Correcting and scoring of the assessments could all be completed effortlessly by the computer.

The students did not seem bothered by the limited access to the computer as long as they eventually had their turn. They seemed much more frustrated by technical difficulties, such as the computers that were freezing in the lab, than they did by the limited computer usage. The class who participated in the study was quite small though. In a larger class, students may not be so patient.
As research has shown (Sun Associates, 1997-2005; Scaplen, 1999), planning the use of one computer does take time and a re-thinking of how one teaches. The more experience one has in planning activities, the easier it seems to become. The use of just one computer and available resources can also be less threatening for the beginning teacher. The one computer provides a good starting point for integrating technology, and then teachers can expand their use of technology as they feel ready and capable.
REFERENCES


Connecting students to a changing world: A technology strategy for improving mathematics and science education: A statement by the research and policy committee of the committee for economic development. New York: Committee for Economic Development.


APPENDIX A

Pre and Post Survey on Attitude and Computer Use

1. How do you feel about computers?
2. How skillful are you in the use of computers?
3. For what purposes do you use computers?
4. How can computers help you learn at school?
5. Please list some things that computers help you to do.
APPENDIX B

Student Attitude Scale

Computer Use:

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Key: SA = strongly agree; A = agree; NO = no opinion; D = disagree; SD = strongly disagree

1. I liked working on the computer.
   SA .... A .... NO .... D .... SD

2. I learned more working with the computer than I would have working by myself.
   SA .... A .... NO .... D .... SD

3. Working on the computer helped me learn.
   SA .... A .... NO .... D .... SD

4. I would like to use the computer in this way again.
   SA .... A .... NO .... D .... SD

5. Using the computer was fun.
   SA .... A .... NO .... D .... SD

6. I had no problems using the computer.
   SA .... A .... NO .... D .... SD

7. I like working with a partner when using the computer.
   SA .... A .... NO .... D .... SD
APPENDIX C

Survey Questions about Integration Strategies

1. For what purpose have you used the computer?

2. How did the computer help you to accomplish your learning goal(s)?

3. Did you computer make it easier or harder to understand the objective? Why?

4. What was the best part about using the computer? What was the worst part about using the computer?

5. How would you change this activity to make it better?