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Technology integration within the elementary classroom setting

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Abstract
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School districts are addressing these problems to ensure that their students are getting an education that is enriched with technology. To overcome some of the barriers, like having time to learn how to use technology in the classroom, schools are providing staff development to support teachers in their learning. One-to-one computing and mobile labs are all different ways that schools can support technology integration. Colleges and universities are also developing programs so pre-service teachers will get technology training before entering the classroom. In order for students to compete in the 21st century they have to be taught with the 21 st century tools.

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ABSTRACT

The purpose of this paper is to examine technology integration in the elementary classroom setting. Technology is now considered to be an important part of a child's educational experience. Research has determined that students do not learn the same way they did years ago, thus schools are changing their methodologies on how to best serve the 21st century student. However, technology integration can not happen all at once; there are many barriers to technology integration. Some examples would be environmental barriers, curriculum issues, and the personal beliefs of the teachers.

School districts are addressing these problems to ensure that their students are getting an education that is enriched with technology. To overcome some of the barriers, like having time to learn how to use technology in the classroom, schools are providing staff development to support teachers in their learning. One-to-one computing and mobile labs are all different ways that schools can support technology integration. Colleges and universities are also developing programs so pre-service teachers will get technology training before entering the classroom. In order for students to compete in the 21st century they have to be taught with the 21st century tools.

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INTRODUCTION

Students graduating across the country need 21st century skills and problem solving techniques for jobs that have not yet been created. In effect this means that educators need to focus on student learning and provide 21st century experiences that will ensure students from the United States can compete in today's global market (Whitsett, 2007). In order to do so, schools need to evaluate their current practices and start transitioning to a curriculum that not only uses technology to teach, but makes it a critical part of the students learning through integration.

"Technology integration has been defined as [an] educator's use of technology to enhance instruction and to create rich environments to help each individual student develop a depth [of] understanding and critical thinking skills" (ChanLin, 2007, ¶2). The public education system needs to be reformed because schools are now faced with new social, cultural, and pedagogical phenomena due to the various types of technology with which teachers have had very little experience (Levin &Wadmany, 2008). ChanLin (2007) found that most teachers believe computers are a valuable tool for teaching and learning. But, the problem was most of the teachers did not have the computer integration skills or knowledge to enhance lessons they already teach. Schools are starting to create technology training models used for professional development. Teachers need proper training, but it is also imperative that teachers have the tools needed to integrate technology, such as access to the equipment, technical support, and incentives for using technology with their students.

Greer (2008) predicts that education majors in college will experience changes in the way they are trained. Education courses that provide the foundation for core curricular areas will also integrate technology. Preservice teachers will have exposure to a variety of media

within the classroom context. The goal is for future educators to take those technical skills and apply them to their classroom.

The literature reviewed in this paper is important because it examines school reform and how schools are creating 21st century classrooms in order to meet the needs of the 21st century student. It also analyzes the barriers to technology integration including the school environment, curriculum, and teacher perceptions. This paper reviews solutions in terms of what administration can do to foster technology integration within the elementary classroom as well as steps that colleges are taking to ensure their teacher graduates are prepared to infuse technology in their curriculum. It offers different methods that schools are attempting such as having students teach technology to teachers as well as having teachers train their colleagues. The last section of this paper focuses on how schools are using initiatives like one-to-one computing and mobile labs to integrate technology and allow students to have access to computers non-stop throughout the school day. This review will answer the following questions:

1. Why is technology critical for the students of the 21st century?
2. What are the barriers to integrating technology into the elementary classroom?
3. What initiatives are schools using to assist in increasing technology integration?

METHODOLOGY

This literature review will add to the wealth of knowledge on technology integration within the elementary classroom setting. This paper examines several different aspects of technology integration, for example:

1. Analyzing the 21st century classroom from the teacher and student perspective.
2. Evaluating the obstacles to integration.
3. Implementing effective technology integration.
4. Exploring the potential of integration through one-to-one computing and mobile laptop carts.

The Panther Prowler search engine was used to locate resources using a collection of databases from Rod Library at the University of Northern Iowa. Several of the articles came from the H. W. Wilson database. The United States Department of Education website was used to find information on the government's influence on technology integration. Some of the keywords that I used in my search included: (a) technology integration, (b) school reform, (c) 21st century classrooms technology and the 21st century student, (d) pre-service teachers and technology, (e) technology staff development, (f) mobile labs, and (g) one-to-one computing. The following criteria from Rodrigues and Rodrigues (2003) was used to form questions and identify creditable resources and information:

1. Does the source give detailed information on the topic?

Resource content was evaluated on the basis of depth of research. Information was examined for potential bias as well to ensure that there were not any ulterior motives for the article. Most of the articles were greater than ten pages, so the topics were covered in depth, had specific detail on the topic, and reflected that the author had done extensive research.

2. How current is the source?

When reviewing research literature, it is important to find the most current information on the topics. The oldest resource used in this literature review was written by Larry Cuban and was first published in 1980. This text provides valuable insight to the skepticism surrounding how technology would really impact classrooms from a historical perspective. The next oldest resource was written in 1999 by Yelland. It focused on the 21st century and technology in schools. This article provided insight on school reform and technology integration. Otherwise, the rest of the resources were written between 2000-2008.

3. Is the information reliable?

All of the articles used in this paper were peer-reviewed. The H. W. Wilson database had the feature of only browsing for refereed journals, which was beneficial in locating information.

4. Does the information relate to my topic?

Using the descriptors previously mentioned and the four standards for selecting information were critical in finding quality articles on the topic of technology integration in the elementary classroom setting. These four questions helped me find quality, current, and detailed information on the topic of technology integration within the elementary classroom.

ANALYSIS AND DISCUSSION

The world has changed dramatically over the years and is continuing to do so at a very fast pace. Schools are trying to prepare students for 21st century needs by focusing on students and how they learn. In the past the focus was primarily on the teacher; now the methods have changed as well as the assessments and expectations of educators. Constructivism, student centered learning, and technology integration are buzzwords in schools all across the country. These ideas are reshaping the K-12 experience for students in order to ensure they are prepared for the world in which they live.

School Reform

Today's world is a technological one. Technology is everywhere, and even daily living tasks are generally completed with some type of technology.

> Our society has changed dramatically in the way that we do business, communicate, and access information. Meanwhile, our schools seem to have been frozen in a time warp with change coming slowly and reluctantly, so much so that our experiences in them are often very different from the experiences of life outside. (Yelland, 1999, ¶3)

Due to the access provided by the Internet there is a significant amount of information available for students. Museums are now opening their artifacts and information to the world. This gives students access to primary resources that were never before available. Literacy is no longer a term that applies only to books. The use of the World Wide Web has redefined literacy which allows writers and speakers of all different languages to communicate with each other. Students use the Internet as a primary source for finding the information because the information is often seen as assumed to be the most current. This is why it is critical that students have the skills to retrieve, evaluate, and apply information into their everyday life.

One of the main goals of education is to build a strong knowledge and skills foundation so students can be successful in a competitive job market. Unfortunately, Society is outpacing schools when it comes to the skills and knowledge (especially technology) that are needed to succeed (Swain & Pearson, 2002). Even the government recognizes that technology should be an important part of a student's K-12 experience. The government is providing funding for schools in order for them to transition towards curriculum, standards, and teaching styles that will meet the needs of the 21st century student. "Empowering all students for learning and living in the 21st century has been a goal for stakeholders in the educational process for many years" (Swain & Pearson, 2002, ¶2). While President Clinton was in office, his goal was to ensure that every classroom had access to the Internet by the year 2000 (Flake, 2001). Statistics from that year showed that 98% of the classrooms had computers and 70% had access to the Internet (Swain & Pearson, 2002). Putting computers in classrooms is only part of the process; policy makers must insist educators utilize the technology available. Optimal student learning can happen when students have different types of exposure to media throughout their school day (Yelland, 1999). The government took a firm stance on technology in 2001 when the *Enhancing Education Through Technology Act of 2001* was passed. Its goals included:

> [The] primary goal of this part is to improve student academic achievement through the use of technology in elementary schools and secondary schools. [The additional goals are to] assist every student in crossing the digital divide by ensuring that every student is technologically literate by the time the student finishes the eighth grade, regardless of the student's race, ethnicity, gender, family income, geographic location or disability. [The other goal is to] encourage the effective integration of technology

> resources and systems with teacher training and curriculum development to establish research-based instructional methods that can be widely implemented as best practices by State educational agencies and local educational agencies. (U.S. Department of Education, 2004)

The *Enhancing Education Through Technology Act* was the only bill created that supported technology in the law *No Child Left Behind*; however, in 2004 the United States House of Representatives approved a $91 million cut to this program (Fletcher, 2004). Lack of funding by the government is making it hard for schools to embrace technology and to make the changes that are necessary in order for technology to make a significant difference in their schools.

Technology is forcing change within the school systems. Analyzing what students need to know and determining the most effective way to teach those concepts is not an easy task. In order to educate the 21st century student, the 21st century classroom and teacher must use different forms of methodologies than were used in the past.

The 21st Century Classroom: The Teacher

Teachers are facing many 21st century challenges in the new millennium. Those who were over the age of 30 in 2006 are now immigrants in their own country-digital immigrants (Cross, 2006). Some teachers even feel like digital immigrants in their own classrooms. The standards and criteria for what is considered best practice are changing as well as the curriculum. The demand and popularity of technology is forcing teachers to evaluate their own teaching practices which includes integrating technology and becoming the facilitator instead of the leader. In a 21st century classroom everyone is a learner, including the digital immigrant teacher.

> Built into the use of technology is a power dynamic that includes the tension between acceptance and denial of how to use technology and who will use the technology. Typically, adults are in the position of power within schools and are deemed educators, whereas youth are subjected as learners (Wexler, 2000, ¶3).

When computers were first introduced into schools many people believed that computers and other technologies would hinder the development of social and language skills. Handwriting, computation, and using creativity were believed to also be in jeopardy if computers were put into classrooms for students to use. Such views were often grounded in the developmental approach to learning which suggests that learners need to be able to manipulate materials in order to make sense of ideas and that using a computer without having such experiences would be detrimental to learning and the development (Yelland, 1999).

In general, most teachers teach the way they were taught which means veteran teachers use more of a traditional approach. In effect, districts are trying to implement training models so all teachers can learn skills necessary to feel comfortable using technology with the students (Batane, 2004). "Not surprisingly, teachers… find it difficult to prepare to learn and teach new content while also learning new methodology in computer-based learning" (Pasco & Adcock, 2007, ¶12). As the curriculum changes to meet the needs of the 21st century learner, teachers need to use a teaching style that aligns with the curriculum as well.

The whole learning process has changed and data reflects that traditional teaching methods are no longer considered best practice (Batane, 2004). In the past the teacher had been considered the "leader of learning" where most of the curriculum is driven by a text book. The student's role has been passive with a narrow focus limited within the confines of

the text (Pasco & Adcock, 2007). "...usually the teacher is considered the sole source of knowledge, and the students wait for information to flow from the teacher" (Flake, 2001, ¶ 9).

The 21st century classroom needs to have a teacher who facilitates lessons, not leads them. The lessons and activities need to be enhanced by using technology that fosters problem solving skills, discovery learning, and teamwork. Instead of technology being used primarily for presentations, information delivery, and management tools, educators need to evaluate its purpose and potential and allow opportunities for student use (Levin & Wadmany, 2008). The 21st century classroom should allow students to take ownership of their learning. Technology has helped educators rethink their goals and objectives; they are focusing more on the process of finding an answer, and not as much on the answer itself. The 21st century classroom builds on strategies that teach students how they can learn throughout their lifetimes (Valmont, 2003). In an ideal 21st century classroom, technology is integrated so that the "teacher consciously decides to designate certain tasks and responsibilities to technology, so much so that the lesson fails if the technology fails" (Bauer & Kenton, 2005, ¶7). Literature reflects the importance of the 21st century classroom and the impact it can have on student learning. Schools and educators need to transition away from the traditional methods and strive towards the 21st century (Batane, 2004).

Flake (2001) explained:

> Shifting from thinking about teaching in a classroom alone to conceptualizing a classroom without walls also is feasible in the future because of the presence of evolving technology. We no longer need to have desks in a classroom all lined up in

rows and columns waiting for knowledge to be handed down from the teacher with everyone working on the same page of textbook at the same time (¶10).

Zisow (2000) states: "It is not a question of technology making learning better. Research has settled that question. Instead, technology can enhance learning if the teacher himself is comfortable and knowledgeable in its use" (¶38). Teachers recognize the importance and support the data that reflects how technology can have a positive influence on their classroom. Most educators also support the idea that the students they taught twenty years ago are very different from today's students. The current students have grown up with computers, video games, cell phones, and the World Wide Web. This means that the teachers have to compete to get and keep their students' attention. Using technology in the classroom allows the students to view these technologies as educational resources (Batane, 2004). Teachers must ask themselves the question, "How can we prepare our children to lead productive and creative lives in the 21st century where new information technologies will impact on nearly every aspect of their existence?" (Yelland, ¶6, 1999).

The 21st Century Classroom: The Student

A child growing up in the 21st century has no memory of a time without the internet, cell phones, and iPods. Students of the 21st century have grown up with spell check, instant messaging, and Skype. These tools have changed the way students think, learn, and apply information. Teachers of the 21st century now have another aspect to their job, determining how these tools can be integrated into the classroom in order to help the students learn.

Due to tools like the Internet, the world is a much smaller place. There are hundreds of online programs which allow students to not only communicate with children from another state but with students halfway around the world. These technologies have had the

same impact on the job market. "We can no longer simply think in terms of small town America because our students are now part of a global society and will be competing with other students from around the globe" (Whitsett, 2007, ¶3). Yelland explained the importance of technology integration and the skills it can help foster within the students;

> Technology must be integrated into curricula in environments characterized by active learning, inquiry and problem-solving where higher order thinking skills are promoted. We need to use technology to represent ideas, and we need new definitions of play and what constitutes a manipulative. One example of this idea is one does not need to learn about a frog by dissecting it. Instead, children can be asked to design frogs, to build an animal with frog-like behaviour, to modify the behaviour, to simulate the muscles, to play with the frog (1999,¶37).

Swain and Pearson (2002) offer that providing opportunities where technology is integrated throughout the curriculum can help students develop the skills necessary for the 21st century. These skills include researching information and communicating using a variety of methods. Because much of the information comes from the Web, one of the most important skills that students need is evaluating online resources. The 21st century student needs to be taught strategies for finding quality information on the web and how it can be applied to their learning. Yelland continues this idea:

> It was once thought that many of the activities associated with computers would not encourage creativity and in fact required that the child press buttons. However, the potential of computers to enable children to encounter and play with ideas has been increased over the last five years with hardware and software that allow the child to

> not only manipulate objects and ideas that are available [in] the real world but also do things that are not possible (1999, ¶25).

Technology integration has many benefits. It increases student motivation for learning which in effect can decrease the amount of behavior problems within the classroom. Students communicate better with each other and it can reduce some of the barriers to group participation (Eifler, Greene, & Carroll, 2001). Gorder (2007) states,

> Studies in which students use computers for writing show that students who use computers when learning to write are more engaged and motivated with their writing, and they also produce written work that is of greater length with better quality. Using technology with subject content has shown that there is a modest increase in student reading and math ability and a substantial increase in student writing ability (¶15).

Cell phones, iPods, blogs, and wikis: the list of technologies that students use these days is endless. The 21st century student is not a stranger to technology; he/she cannot remember a time without it. Technology is a tool which can motivate the 21st century child to learn and research has shown that technology can increase student achievement scores (Swain & Pearson, 2002). Yelland (1999) states that society, communities, and parents are putting pressure on school districts to have the most up-to-date technology. Parents want their children to be exposed to technology because although they might not understand how it works, parents do know its importance to the world around them. This means schools just having the equipment is not good enough, parents are expecting their children to experience technology integration throughout their K-12 education.

States are also dealing with the issue of quality technology integration. West Virginia school leaders recognize the importance of technology in elementary classrooms. The state is

a leader in technology integration. The state's Governor Manchin and Superintendent of Schools Paine are working as a team to steer teachers away from traditional teaching methods and to use technology to enhance their curriculum and meet the needs of the 21st century student. They believe students during the 21st century need the skills to think critically, be effective problem solvers, and use and manipulate technology to gather, communicate, and decipher information. These men believe that a curriculum that focuses on technology integration and creating teacher training programs is the best way to educate for the future. Both the superintendent and governor are passionate about educating students that are capable of excelling in the 21st century (Williams & Cline, 2007).

Unfortunately, technology integration is not always easy and comes at a cost. There are many different factors affecting districts transitioning towards technology causing some to be slower than others.

Barriers to Technology Integration in the Elementary Classroom

Technology has been proven to increase student's achievement and motivation. Most schools acknowledge its importance, however, technology is still not used to its full potential (Bauer & Kenton, 2005). There are three main factors that hinder the use of technology and technology integration; they are (a) environmental barriers, (b) curriculum issues, and (c) personal beliefs of educators. It is critical that schools overcome these obstacles in order to guarantee they are providing their 21st century students with the best possible education.

Environmental Barriers

There are several environmental barriers that limit technology integration in the classroom. Time, administration, and lack of resources are all factors that impact how technology can be implemented into the classroom.

Time is one of the biggest environmental factors that hinders technology integration. Teachers need "guidance, support, and incentives" for technology use with their students because it is so time consuming (Eteokleous, 2008, p. 680). Research indicates that it can take as long as six years for teachers to fully integrate technology in the classroom at its full potential (Rosenfeld, 2008). Batane (2004) interviewed 15 elementary education teachers concerning their willingness to integrate technology. He found that teachers felt as though they were spending too much of their preparation time planning for and learning about new technology and that there were no incentives for doing so. The teachers also felt that the students did not have enough time or access to computers to work on projects, practice their typing skills, or use other software programs.

Administration can also be another environmental barrier to technology integration. Administrators must be the leaders and make it an expectation for their teachers to use technology within classrooms. They also must provide technical support through training and support staff who can trouble shoot technology problems. Administrators also must support technology integration financially by budgeting appropriate funds to go towards technology (Bauer & Kenton, 2005).

Unfortunately, money can also be another obstacle for school districts. The *Digital Divide* is known as "the difference in use of technology by schools based on ethnicity and socioeconomic status" (Swain & Pearson, 2002, ¶5). Schools and educators have the

opportunity to bridge the digital divide by integrating technology throughout the curriculum. It is important that all schools provide an educational experience enriched with technology or else the digital divide will become even further apart (Swain & Pearson, 2002).

> In times of financial restraint it is often difficult for educators to justify the expenditure of large sums of money on expensive pieces of technology. A new mind set is needed to view such machines as the basic equipment for an effective education rather than a luxury. (Yelland, 1999, ¶25)

Because technology changes so rapidly, it is difficult for schools to afford the cost of staying current on the latest technologies.

Cuban (1986) describes how historically various technologies, not just computers, have had little impact on student learning because they were not implemented effectively. So often schools ask *how* the technology can be used, instead questioning *should* technology be used. Cuban urged schools to seriously consider the objectives and goals for technology and evaluate how they fit with the bigger picture and the whole purpose for education.

Curriculum Issues

Another reason why technology is not integrated into the elementary classroom setting is that the curriculum teachers are using does not integrate technology. Even if it did, most veteran teachers have received minimal training on the current technologies (Bauer & Kenton, 2005). However, the 2001 No Child Left Behind Act (NCLB) is requiring that this change (Kingsley, 2007).

NCLB is requiring teachers to show evidence of how teachers are using technology in their classrooms. However, this law does not consider that all classroom teachers might not have the skills to do so (Yelland, 2002). NCLB currently requires that by the eighth grade,

students exhibit proficiency in using technology. In order to be considered proficient, the students must meet the technology standards that were created by the U.S. Department of Education and the International Society for Technology Education (ISTE) (U.S. Department of Education, 2006). State standards and federal regulations like NCLB require schools integrate technology in their classrooms. But not every school has enough equipment for all the classrooms to use. In order for technology integration to reach its full potential the equipment needs to be easy to access. Teachers are less likely to use technology if the computers are in a lab instead of in a classroom setting (Rosenfeld, 2008).

Schools are improving in areas like the computer-student ratio, but this is only part of the equation. There needs to be more focus on determining which technology skills are important for the students to learn and aligning them with appropriate grade level curriculum (Bauer & Kenton, 2005). Instead of integrating technology into their curriculum, teachers often use technology as a reward for students who finish all their work. This usually means that the same students are always using the computer, while the students who need the most exposure to computers and technology never have the opportunity. Most of the software used during these incentive times does not relate to the current curriculum, it is outdated, and often has little educational value. Teachers need to look at their current curriculum and enhance it by integrating technology, instead of designing a special lesson in order to use technology with their students (Levin & Wadmany, 2008). ChanLin (2007) found that teachers want to provide meaningful experiences with technology but they are not shown how. Most teachers are looking for a step-by-step curriculum that maps out how and when to integrate technology and currently curriculums are not designed that way which leaves the technology integration the responsibility of the teacher (Levin & Wadmany, 2008). Every state is

adopting technology standards to ensure that each child will at least have a solid foundation in technology skills. The technology standards will influence the methods and techniques of the teachers, and make technology integration a requirement instead of an option (Swain & Pearson, 2002). Yelland believes "that until the curricula change so that the use of technology becomes embedded in them, teachers will not use technology as a resource for learning with the children in their classes" (1999, ¶4).

Personal Beliefs of Educators

"A further difficulty with the introduction of the computer into the classroom was that teachers did not fully understand the role computers should play and often felt threatened with the possibility of being replaced by them" (Bauer & Kenton, 2005). Veteran teachers have been using the same techniques for years. Teachers can feel as though they are starting over by learning about technology and trying to utilize it within their classroom (Levin & Wadmany, 2008). Using technology can make teachers feel vulnerable and fear that their lack of knowledge about technology reflects on their teaching. Teachers are used to being experts and can be afraid to use technology with the students in fear that the students might know more then they do (Batane, 2004). And yet some teachers criticize technology as just another educational bandwagon that will soon pass, leaving no impact on teaching and learning (Holland, 2001).

Technology can be unreliable which is another reason why some teachers do not use it as a teaching tool. Teachers want reliability and feel as though too much instructional time is wasted if something goes wrong (Zhao, 2003).Teachers' perceptions of technology are based upon their past experiences, personal beliefs, and professional development. So, if a teacher has had a negative experience with technology and little or no training, it can be

concluded that this teacher will be less likely to integrate technology with his/her students (ChanLin, 2007). It is hard for teachers to change their beliefs about how technology fits into teaching and learning. Schools must address these barriers if technology is to be effectively integrated into the curriculum (Bauer & Kenton, 2005).

Technology Integration Solutions

In order for a school to integrate technology to its fullest potential, the desire has to start with the administration. The administration must acknowledge the importance of technology integration and believe that it is a tool without which students cannot learn. Administration must provide adequate resources in order to make technology integration possible. This includes access to support staff that can assist teachers with technical issues as they arise. Administrators have the ability to provide an atmosphere where technology is an easy process for teachers. By making technology integration a priority for the teachers, it can benefit everyone, especially the students (Rosenfeld, 2008).

Schools are experimenting with many different technology teaching models in order to get technology into the hands of students. "Research indicates that one of the largest factors which determines computer integration in elementary schools is the amount of knowledge the teacher possesses" (McCannon & Crews, 2000, p.112). One approach to increasing technology integration that was taken by Murdock Elementary School in Indiana was to have the students become the experts. The elementary librarian as well as college students from a local university trained elementary students in different technology skills. The students learned about troubleshooting problems and using different software programs. The idea was to save the classroom teacher time. It was expected that by training students

about using technology, the teacher would have extra help in helping the rest of the class use technology.

For Murdock Elementary this program did increase the amount of time the students used technology for two main reasons. First, since some of the students were so involved with the technology, the teachers felt obligated to use it. Teachers felt more comfortable using the technology knowing that they would have extra help. Another benefit of this program was allowing the students to be the experts and giving them a sense of leadership gave them the opportunity to take ownership of their learning (Hruskocy, Cennamo, Ertmer, & Johnson, 2000).

Van Cooley (2001) studied another training approach that was used in Westfield, Indiana, at Westfield Washington Schools to get more teachers comfortable with using technology. The model was called the *Teachers as Trainers* and was implemented in order to train the staff in technology integration. There were three main principles in this model: support, modeling, and accountability. *Teachers as Trainers* is a researched-based model that included participation from all faculty, teachers, and administration. This model involved a group of core teachers who worked together to establish the objectives of the trainings which were a combination of technology skills and integration ideas. This program helped develop technology standards and benchmarks as well as a technology curriculum. It also equalized the amount of time students spent on the computers. Parents knew whichever teacher had their child, there would be exposure to technology as the child was learning. Depending upon the size of the school, each core teacher trained five other staff members. Having colleagues train colleagues offered a sense of community and created a team environment. The teachers also created evaluation benchmarks to go along with this training model. Every teacher was

assigned a lesson that integrated technology. In the past, motivated teachers who participated in technology conferences, workshops, or other programs never had any follow-up afterwards. Using the *Teachers as Trainers* model addressed many barriers to technology integration because the trainers were down the hall, available to give support as needed. Schools are starting to put training models in place to train current teachers in the field; colleges are also being proactive in ensuring their teacher candidates have the skills to integrate technology.

Staff Development Focusing on Technology

Most schools recognize that their faculty does not have enough training to fully integrate technology into their curriculum. School districts often spend huge sums of money on all different types of equipment and programs with hardly any money left over to spend on staff training (Williams & Kingham, 2003). Research indicates that by training teachers on the basic computer concepts and by providing hands-on experiences with technology, teachers' anxiety levels are reduced (McCannon & Crews, 2001).

Training teachers on technology is very complex because not only do the teachers need to be taught the technical skills but they also need to understand that technology can be integrated into their curriculum (Eifler, Greene & Carroll, 2001). When training educators how to use and integrate technology within the classroom, it is important to provide hands-on experiences that allow teachers the opportunities to practice skills and ask questions. The environment should be very similar to that of a classroom of students. It is unfair to assume that teachers can learn how to use technology by observing a presentation. The training environment should be one where people have the opportunity to learn from each other.

Often teachers worry about their individual skill set and knowledge and how it measures up to their colleagues. Technology training designers need to remember that everyone has a different skill set and there should be different options from which teachers may choose. The instruction should match the ability level of the learners. It is also important to consider the needs of every teacher. If the extracurricular teachers (music, art, physical education and etc.) are expected to integrate technology into their curriculum then they need to be provided adequate examples and resources of how to do so. Data indicates that Saturday trainings or summer trainings are often ineffective. The most effective time is during the school day, during staff developments or by providing a substitute to allow the teacher to get training off campus (Cooley, 2001). The findings identified that providing incentives like college credit and recognition for increased use of technologies are other effective ways administrations can use to show their support for teachers who choose to integrate technology into their classrooms.

Another vital component that is typically left out is follow-up. Teachers need to have continuing support as they integrate technology into the classroom (Rosenfeld, 2008). Teachers often develop a negative attitude about technology because they do not have the technical support needed to help them overcome issues. Teachers need to know whom to contact when they have technology problems. Joyce and Showers (1981) introduce the idea of coaching in education, and this method is not just for technology integration. Coaching happens when two equals support each other in making improvements in their teaching. Technology could be a skill that both teachers are trying to improve on. These teachers not only train each other on the technical aspects, but also watch how it is being applied in the classroom and provide feedback. The goal is to build a relationship where the educators help

each other grow and provide the best education possible to their students (Joyce & Showers, 1981).

More Training for Pre-Service Teachers

Like most veteran teachers, most incoming pre-service teachers know little about how to successfully integrate technology into a classroom setting (Eifler, Greene, & Carroll, 2001). One initiative developed to build technology skills for pre-service teachers is *Preparing Tomorrow's Teachers to use Technology* (PT3). This was a grant funded by the United States government through its Department of Education. The grant's objective was to expose pre-service teachers to experiences with technology during their education courses and field experiences. In the past, most education students were required to take a technology course; now these courses are not only teaching the technical skills but how they can be integrated into the classroom (Mims, Polly, Shephard, & Ian, 2006).

Since 1999, 441 grants have been awarded which equal $337.5 million dollars in program funds. The PT3 program helped "52 of the nation's 100 largest teacher preparation programs" (United States Department of Education, 2006, ¶1). The money can go towards faculty development, course restructuring, online teacher preparation, electronic portfolios and mentoring triads. The grant money cannot be used to purchase major hardware expenditures.

In order to successfully train pre-service teachers, education professors had to be trained in using technology. One study analyzed thirty-four PT3 grants awarded that focused on teacher education faculty development. Fourteen of the thirty-four organized workshops that were designed to increase technology skills and expose faculty to various software and programs. The workshops offered, varied in skill level and levels of integration. The

workshops did spark an interest in technology among the staff. They increased the staffs' technical abilities as well as their ability to integrate technology within their curriculum. The other twenty grants awarded were divided evenly among mentoring, small groups, training modules, and mixed approaches. All of these techniques reported an increase in technology integration within their educational systems. These grants are evidence that different approaches to teaching technology to educators can be successful (Hall, Fisher, Musanti & Halquist, 2006).

The PT3 grants were also used to train many K-12 educators who served as hosting teachers for college students. The purpose was to allow pre-service teachers to observe technology actually being used with K-12 students. A college in Arizona used the PT3 grant to help pre-service teachers develop lesson plans that focus on technology. Once the students created these lessons, they were given the opportunity to implement their lessons through their field experiences (Mims, Polly, Shephard, & Ian, 2006).

The PT3 grants were successful in many areas. The PT3 influenced universities and schools to provide staff development on technology. This helped bridge the gap of technology skills of in the K-12 school setting and colleges. Because of the PT3 grants, curriculum was created that included technology and ideas on how it could be integrated into the classroom (Duffield & Moore, 2006). Unfortunately, much like the Enhancing Education Act of 2001, as of 2004 this program received no funding. Once again the government was sending school districts mixed messages: they believed technology integration for students was important, but were unable to support it for the long-term. The earlier funded grants however, did create many models of successful integration of technology into a classroom setting for pre-service and in-service teachers.

The Potential for Technology Integration

Technology integration in classrooms cannot happen unless it is embraced by educators. One way schools are ensuring that this happens is by putting the computers right in the classrooms. Some schools have carts which hold enough laptops for every student and are wheeled from class to class as needed. For other schools, technology integration means a laptop for every student that stays with the child throughout the school day and is also taken home. This initiative is called *one-to-one computing.*

> Laptops and tablet computers are both a window and a tool: a window into the world and a tool with which to think. These mobile computers provide unique ways of helping students in lifelong learning through guided interaction, exploration, and communication (Gorder, 2007, ¶2).

There are many advantages to having laptops whether in a cart or one-to-one computing.

Mobile computing allows the teachers to take advantage of the teachable moments and the mobility allows the students and teachers to work and learn anywhere within the school (Gorder, 2007). Classrooms can transform into computer labs in a matter of minutes without the students ever leaving the room. Mobile computing is also more effective for group work. Having the technology in the classroom also sets the tone that technology is a part of the curriculum and not a separate entity (McKimmy, 2003). Teachers reported when the computers are in labs, they did not use them as often due to scheduling and instructional time lost in the transition of leaving the classroom and getting settled in the lab (Penuel, 2006). Computer access is key to the integration process.

Classroom Connections is a program designed to increase the use of technology by the staff and students through providing a laptop/tablet to every student in high school. It

started in 2003 when Watertown High School in South Dakota gave its 1400 students and 85 staff members each a laptop. This high school trained the students to use the technology as a communication system. For example, students could read the daily announcements off the school's website. The students had e-mail that the teachers used to send academic material and information for the students to submit assignments. The students were easily monitored through special software that allowed the teacher to see the students' screens and collaboration was much more effective due to the communication tools available. South Dakota is providing these resources to their students with the goal that it will help them compete in this digital world (Gorder, 2007).

Technology has changed the world in which the 21st century students live. Twenty years from now it should be even more advanced in the realm of technology. The 21st century world demands that K-12 students have basic knowledge and a variety of experiences with technology. Through the process of school reform, focusing on adopting curriculums that integrate technology, providing quality technology training for teachers and pre-service teachers, and making technology a priority will affect how students in the United States perform. Once schools implement these elements into their districts schools will start producing students that have the skill to compete in the 21st century.

CONCLUSIONS AND RECOMMENDATIONS

This literature review on technology integration identified that most educators understand the potential impact technology can have in the classroom and the importance with regard to 21st century learners. Teachers recognize that they will have to change their techniques and style of teaching in order to fully integrate technology. Teachers have different feelings towards the technology that is being brought into the classrooms with the expectation that it gets used with the students. Some teachers embrace the technology, while others feel threatened by it.

The anxieties of educators who are expected to use technology are one of the main reasons that technology is not being used with the students. Another barrier is that the technology is not integrated into the curriculum. Teachers do not always have the appropriate resources to help them assimilate technology and their content area. Other issues are that teachers do not always have the access and technical support they need and schools having the funding to support technology.

School districts are beginning to develop solutions to the obstacles that stand in the way of integration. Some of these solutions include staff development for teachers, support and incentives provided by the administration, and ensuring that teachers have the proper tools for integration. Colleges and universities are also better preparing teacher-candidates by offering classes that focus on technology integration and by providing technology training to their college professors. The government has put programs such as PT3 in place to help ease the burden of the high cost of different aspects of technology. Unfortunately, these programs do not last for the long-term.

This literature review also analyzed the different ways that schools are putting computers into the hands of their students. One method is one-to-one computing where each individual student has his/her own computer. Another method is using mobile carts to wheel laptops into classrooms as needed. Either approach is a beneficial way to ensure that all students are learning in an environment that is enhanced with technology.

One area where the reviewer would recommend further research is the curriculum barriers that prevent technology integration. How is the curriculum changing to help teachers meet *No Child Left Behind* in regards to technology? Further research should be done into the topic of staff development that focuses on technology. Are schools developing a systematic approach to training teachers on new technologies? Will technology training be a permanent focus for staff development as there are always new resources? Or will technology training fade with time?

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