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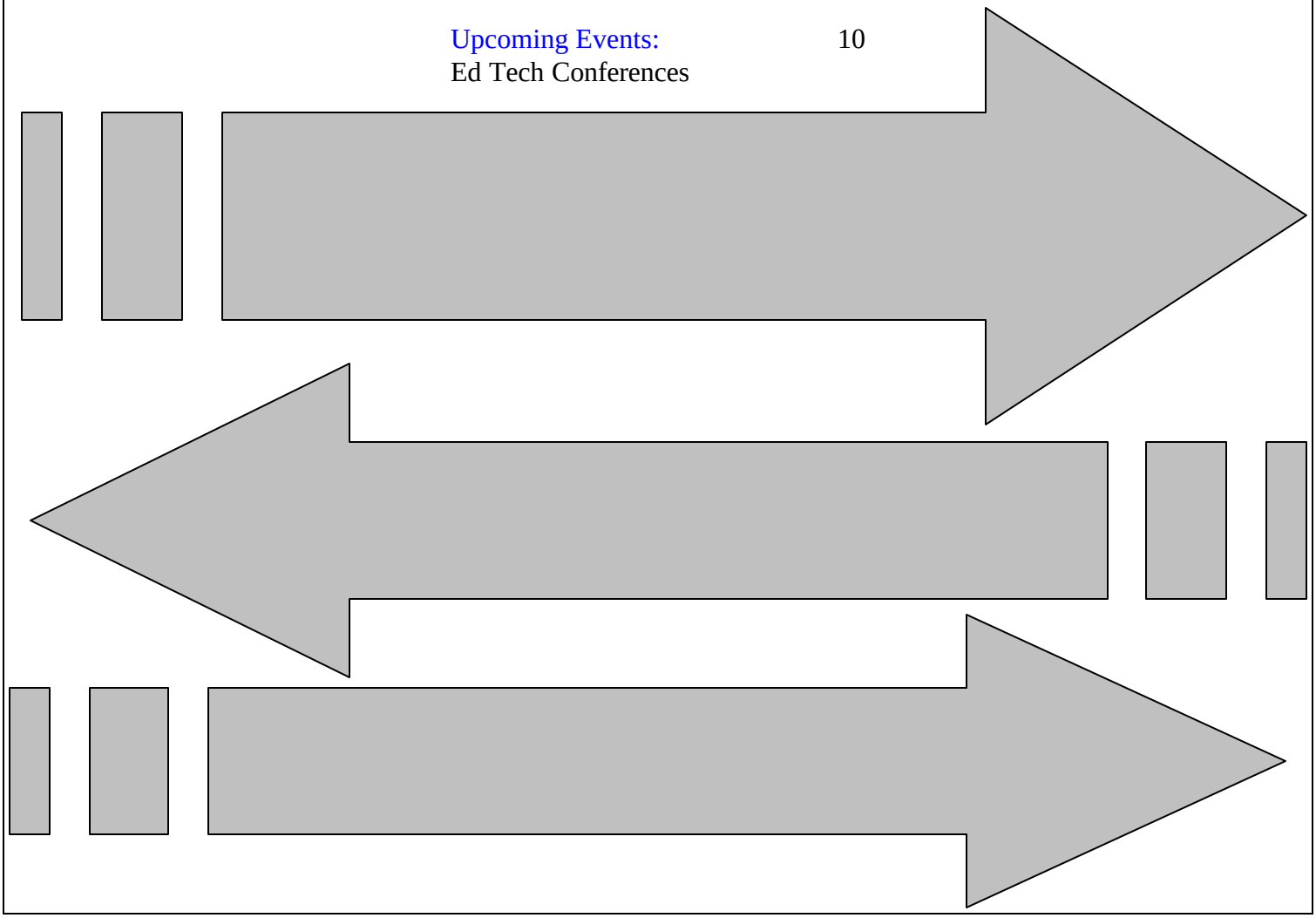

Journal of Applied Educational Technology

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Editorial

Waiting for the next new thing

- by John Rice

Having worked with a one-to-one laptop placement in a medium-sized high school not long ago, I became acutely aware of the shortcomings laptops hold for daily student use. Fragility, combined with portability, make for expensive prospects.

Handhelds overcome some of the problems. While not as expensive and more durable, they suffer from access problems and simply can't do what a laptop can. I'm a big fan of AlphaSmart devices, which are practically indestructible. Throw them against a wall, drop them, slam them on a desktop … and they'll still start up and work. Even with the newest iterations running the Palm OS, though, they still can't replace a full functioning laptop.

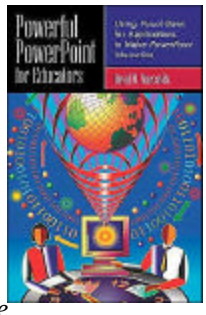
I'm also a fan of the "Baby Sony" laptops like the VAIO VGN-X505ZP, and its Dell competitor, the Latitude X300. Unfortunately, at prices hovering between $2000 - $3000, these will remain unobtainable for wide student use.

So, I'll wait for the next new thing for student computing. It has to be, first of all, indestructible like the AlphaSmart. It has to have a large (at least 10 inches wide) screen that is easy to see in any light. It has to have a full QWERTY keyboard which can be cramped for space so long as it is big enough to allow traditional touch typing.

It has to be powerful enough to run Microsoft Office software, surf the Web and run other mainstay applications. It doesn't have to be a powerhouse, doesn't have to have the fastest processor on the block, but it does need to be able to get the job done.

Finally, it has to come in at a price range under $800 for a single purchase, cheaper when purchased in bulk. So, will we see the next new thing for student computing anytime soon? Time will tell. In the meantime, drop me a line if you see anything approaching the guidelines above.

Book Review



Sock-knocking PowerPoint

Powerful PowerPoint for Educators: Using Visual Basic for Applications to Make PowerPoint Interactive. David M. Marcovitz. Libraries Unlimited, 2004. ISBN: 1591580951, 216 pp.

by John Rice

On occasion a book comes along trumping previous efforts in the field. *Powerful PowerPoint for Educators* by David Marcovitz is one such book.

Dr. Marcovitz is an assistant professor at Loyola College, where he serves as the Coordinator of Graduate Programs in Educational Technology. The book developed, as he puts it, when the handouts for his lectures and presentations on Microsoft PowerPoint® crested the 70 pages mark.

It is not a book for beginners. Unlike so many other software guides aimed at educators, this book assumes the reader is already proficient in the Microsoft Office® environment. Marcovitz nods at other books in the field, offering a useful list in the references section. But this book is aimed squarely at educators in the K-20 environment.

So what does the book do that makes it so different from previous educational offerings? Marcovitz introduces the reader to Visual Basic® for Applications (VBA). This Office-based programming language allows truly interactive and multimedia environments to be created by the end user. Content of presentations can be changed by student input. Interactive tests can be created. Short answer questions can be inserted into parts of the presentation, allowing formative assessment. Presentations can keep track of which sections students have visited, offering a summative assessment only after all sections have been viewed. Sophisticated applications become easy to produce when using VBA.

While Marcovitz understands the thought of learning a programming language may prove daunting to the reader, he patiently explains how to use scripts, short pieces of repetitive code containing common elements needed to produce desired results. Using scripts allows even a programming novice the opportunity to create astoundingly interactive presentations, going far beyond the typical level of interactivity most of us have gained using traditional PowerPoint tools in the past.

The book begins with a basic introduction to multimedia design. The author segues into traditional features of PowerPoint before introducing readers to VBA. Once the basic elements of programming are established, he leads us into scripting, detailing how to write basic scripts, tie scripts to buttons, and making PowerPoint perform tricks like forcing students to type in their names at the beginning of a presentation. He devotes a chapter to creating quizzes and tests, offers another chapter on a grab-bag of scripting tips, yet another on debugging, and concludes with a chapter on templates.

This book, I am convinced, is destined to become commonly applied in educational technology and teacher prep courses. It is also highly useful on the bookshelf of any PowerPoint-generating educator, regardless of the grade level or subject matter taught.

In the Classroom

Resources for getting things done

DriverGuide.com
Can't find a driver for a specific piece of hardware? DriverGuide.com likely has it. From the obscure to the recent, this site hosts an impressive array of drivers. Membership is required, but it's free.

CNET.com
Need product reviews to determine if a software or hardware product is right for your school? CNET's review section hosts thousands of reviews from staffers and netizens alike.

TheSnorkel.org
How-to's, shareware, current trends, and Web resources ... you'll find all that and more on this support site for K-12 tech coordinators.

In the Classroom

I did it with Linux

by John P. Conlon
El Paso Independent School District
El Paso, Texas

Some ancient history, technologically speaking

About five years ago, I replaced my home computer with a new one. Rather than dispose of the old one I took it to school for my students to use. Over time, I have continued to upgrade my home machine and turn the leftover old parts into computers. I also had some computers given to me such that I have ten computers in my classroom today. I started thinking about ways to make my life easier by doing such things as grading student work onscreen rather than in printed form. I acquired a network switch and connected all of the computers together. Then, I used the shared file folder feature in Windows 98SE and required that my students save their work in the folder with their name. What a nightmare that turned out to be. Yes, I saved time grading but the students found the holes in the security program I was using and stole from each other, deleted each others work, and erased the programs that they were supposed to use faster than I could plug the holes.

And along came a geek

I knew there had to be a better way and a friend introduced me to Linux one evening after a backyard barbeque. My friend works as a network administrator for one of the larger corporations where I live. Linux turned out to be an inexpensive way for me to accomplish what I wanted to do and to provide my students with a reliable safe place to do and save their work. I already had the computers that I could turn into terminals; all I needed was a server. So for a couple of hundred dollars I created a small network for my students to use and a place where I can grade their work without waiting for a printed copy and life has come close to being a fairy tale.

What is Linux?

Linux is an open source operating system that works in PC-type computers and newer Macs. Open source software is not "freeware." It is copyrighted under an open source copyright. Open source copyrighted software has one great advantage, it is cost free and all you need to do is download it, install it, and use it.

There are several versions of Linux but all of them work together without any conflicts. I use the version called K12LTSP (Kindergarten through twelfth grade Linux Terminal Server Project). When you download K12LTSP from their web page, http://www.k12ltsp.org/, you get more than just a high powered operating system. You also get a selection of very sophisticated application software. Part of the package is Open Office, which is the equivalent of Microsoft Office. The Gimp is the equivalent of Adobe's Photoshop. Browsing the network is done with Mozilla, which is Netscape or one of several other browsers. Tux Paint allows the student to create pictures from scratch. And the list goes on, including some extremely good quality educational games. Essentially what you can do using a Windows-equipped PC or a Mac, you can do with Linux. If you have decided that you just have to run a particular Windows piece of software, then there is an emulator called Wine from http://www.winehq.com/ that allows them to run in Linux.

But that's not all. The web page has complete instructions for setting up a K12LTSP network using either recycled computers as I have or brand new "thin client" terminals that cost a fraction of what a complete computer with software cost.

What are terminals and thin clients?

K12LTSP users don't use real computers. Yes, what they do use looks like a real computer but the differences are easy to spot. A thin client is a candy box sized device that has a monitor, keyboard, mouse, and an Internet connection. A terminal is a standard desktop computer with no hard drive or CD-ROM drive and sometimes no floppy drive. The hard drive and CD-ROM functions are not needed because the terminals get everything they need from a server when you turn it on. Terminals and clients depend upon the server for everything they do.

Virus proof, almost

On several occasions this school year my Windows and Novell run district has been hit with viruses that restricted operations drastically. My students never noticed because I wasn't affected. But there is occasionally a virus directed at Linux. The virus protection software is also Open Source and costs nothing to download and use.

Security and student proof … YES!

Mischievous students face a built-in security system in Linux that prevents them from stealing or being destructive. Each student has his or her own login and password that only allows them to use the programs and features that you want them to use and provides them and you a safe place to save work. As the network administrator for my classroom, I can turn on or off any features that are available by clicking on the appropriate icons and changing their settings and thus control what my students can and cannot do. In addition to that kind of control I can check to see what students are doing from my server using Teacher Tool. I do all of this with mostly recycled computer equipment and a users group that composed of the people who actually wrote all of the Linux software.

What can you and your students use?

The claim made in the Linux world is that if you can do it with a Windows program, you can do it with Linux. Look at the screen shots below and you will see this is a boast that, if not

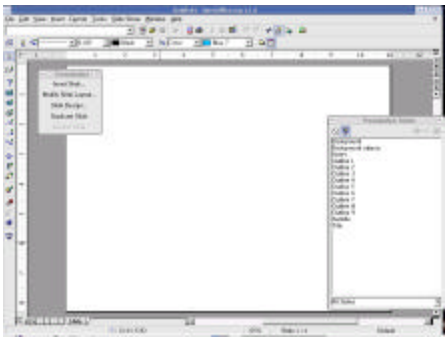
completely true, is certainly headed that way. Remember the cost of Open Source software as opposed to Windows software.

How about something that students do well?

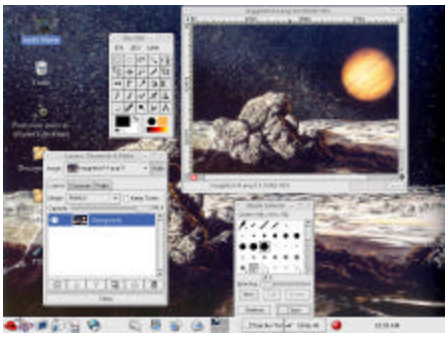
I feel that a large majority of us have had to deal with the problem of, "My file won't open," or the corollary, "My disk won't work." With Linux, and the fact that many of our students today have an e-mail account, I haven't heard either of those laments all year long. My students e-mail their work to themselves between school and home. The problem of late and incomplete work has decreased drastically. Now, you ask Linux at school and Windows at home? That is easy. Open Office will save in a variety of formats, including those used by Microsoft Office 98/2000/XP.

End results

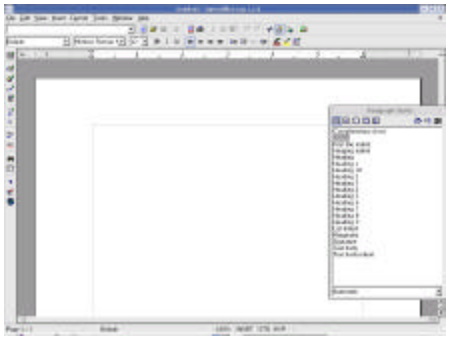
Think about the cost trade offs. My school installed a thirty terminal Linux lab. We looked at the cost of a full up Windows lab first. The cost of complete computers with software licenses results in a bill of about $65,000. With the Linux option, that dropped to just a little over $13,000. And that was all new equipment. My own home brew lab only cost me about $400 for the parts I needed to build my server. So I ask you: what could be better?



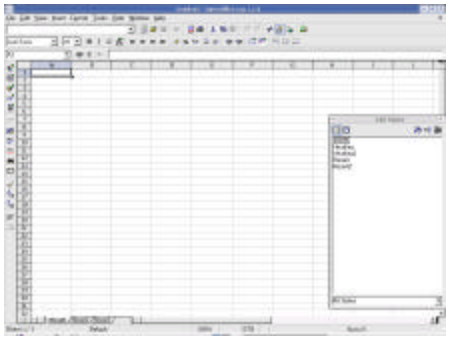
Open Office Presentation is just as powerful as PowerPoint. It also handles sound formats that PowerPoint won't and has a graphic library with a wider variety of images for backgrounds and such.



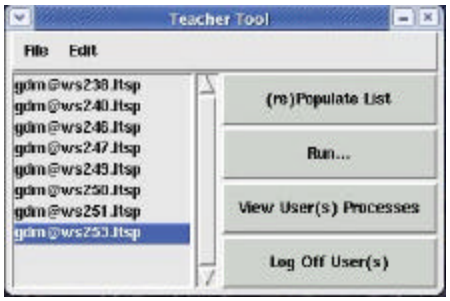
This is a screen shot of the Gimp, similar to Adobe Photoshop.



Open Office provides the same features found in MS Office XP. This is what the word processor screen looks like.



This is a screen shot of Open Office Spread Sheet. All the features and formula handling capability that Microsoft has are here.



In Teacher Tool, click on the user login at the left and then select View User(s) Processes. You can see what each student is using. Then, either close the application or log the student off entirely.

This is the Mozilla Web browser. If it looks like Netscape 7.1, that's because it is. The web page here is my own: http://www.finitesite.com/mrconlon

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Research

Special education teachers and their use of technology: Isolation, access, and inadequacy

By Dale Adams, University of Cincinnati
and Kathy Adams, Wright State University

Abstract

This article investigates special education teachers' perceptions regarding technology integration for lesson delivery. Case study qualitative research was chosen to ferret out these perceptions. Four urban high school teachers, who did not use technology in their classrooms, participated in a focus group and were observed. Data was coded and the themes that emerged included isolation within the building, lack of computer hardware, and inadequate technology training. Implications and suggestions for further research are discussed.

This study took place in an urban public high school in a large midwestern city and examined the perceived obstacles for technology integration by special education teachers for lesson delivery. This issue is important because prior research strongly indicates that technology holds benefits for students with special needs (Judge, 2001). The literature also indicates that the technology gap between poor districts and affluent districts has greatly narrowed over the last decade (Byers, Pugh, Sheldon, & Zhao, 2002; Lonergan, 2001).

Despite the benefits and increased accessibility, some special education teachers are still not using technology during their daily lessons, which prevents special education students from receiving the best education possible. It is important that we discover underlying causes for this reluctance to use technology and identify the perceived obstacles to technology integration for these special education teachers.

This study tried to answer the following research questions:

• What factors have created these perceived obstacles to technology integration?

• Are these factors consistent with prior research?

• How can these perceptions about technology integration be overcome?

The findings of this study indicated three major themes: feelings of isolation within the building, lack of computer hardware, and inadequate technology training. This research was important since it identified some of the barriers, as well as, indicated possible shortcomings with prior research. For example, the issue of isolation was not well documented by previous scholarship and the findings of this study identified a lack of adequate computers, which goes against prior research.

Literature Review

The prior scholarship on technology use in special education classrooms found that technology has benefits for special education students. The literature also found that the technology gap between affluent and poor schools has narrowed. Despite the benefits and increased accessibility, there is still some reluctance on the part of special education teachers to integrate technology into daily lessons.

Both Lewis (2001) and Scadden (1998) felt that technology helped students with special needs compete with their regular education peers. Byers, Pugh, Sheldon, and Zhao (2002) and Lonergan (2001) found that the technology gap between poor and affluent districts has narrowed. In other words, the number of computers available to students in affluent schools and students in poor schools is similar.

Researchers have tried several different approaches to understand the reluctance to use technology in the special education classroom. Several of the studies were experimental in nature and involved the implementation of a new strategy or technology. In these studies students or teachers were taught how to use a specific technology and then the researchers tracked their progress, personal perceptions, and experiences with that project (Dana, Friedrichsen, Munford, Tsur & Zembal-Saul, 2001; Sahl & Windschitl, 2002). A similar study concentrated on teachers learning a new teaching strategy (Newton, 2002). Sampling methods included convenience sampling based on observations (Sahl & Windschitl, 2002), teachers who returned surveys (Judge 2001; Byers, Pugh, Sheldon, & Zhao, 2002), or students who had enrolled in a college course (Dana, Friedrichsen, Munford, Tsur & Zembal-Saul, 2001).

Researchers also identified training as a barrier to technology integration. Researchers found that the teachers felt their pre-service technology training was inadequate. The teachers felt that even after the training they were left on their own to master the skills and how to incorporate the technology into daily lessons (Lonergan, 2001; Sahl & Windschitl, 2002). Some researchers found that after teachers were taught a new technology skill, the implementation of that skill depended upon the individual teacher for its success. Furthermore, if prior to learning the new skill the teacher was comfortable with technology, then they had a greater chance of success than if they were not (Dana, Friedrichsen, Munford, Tsur & Zembal-Saul, 2001).

Researchers have also found that attitude had an influence on technology implementation. The school environment can influence special education teachers. If schools are technology rich, then they are more apt to use technology. If, however, the administration of a school is not overly supportive of technology use, then the teachers may feel that they are on their own and

will not pursue the use of technology (Edyburn & Gardner, 1999). The personal experience of the teacher can also have an impact on technology integration. For instance, if teachers are experienced with technology themselves, then they are more likely to use technology in the classroom (Edyburn & Gardner, 1999).

There are limitations to the previous research that needed to be addressed. There is a great deal of study conducted on regular education teachers and technology, but the number of studies dedicated to the study of technology and special education is limited in comparison. For example, there are a number of studies created to find out why computers are not consistently used despite the benefits and accessibility for regular education teachers, but the number of studies that concentrated on this phenomenon for special education teachers is far fewer.

Several of the studies stated that the number of computers has gone up and that the digital divide between affluent and poor schools has narrowed considerably (Byers, Pugh, Sheldon, & Zhao 2002); Lonergan, 2001). These studies base this contention on the number of computers in a school. These same studies do not however identify the age or capability of these computers. In other words, does an Apple computer manufactured in the mid 1980s count towards these numbers? Computers without CD drives, Ethernet connections, large hard drives and RAM space are not capable of meeting the needs of today's students. Another area not addressed by the literature is the limitations in technology innovation due to infrastructure concerns. Technology integration requires access to electrical outlets, network lines, and adequate space. None of these issues were covered by the review of literature.

Due to the limitations of prior research in this area, it is important to conduct this study to fill in the gaps in this research. The perceptions of these teachers stand in the way of creating a technology rich environment for students with special needs.

Methodology

Research Design

In order to better understand the perceived barriers to technology use by special education teachers, qualitative case study research was chosen. Four special education teachers were selected to participate in this study. These teachers did not use technology in their classrooms. This study used classroom observations and a focus group where the informants were asked open-ended questions.

Population, setting, and sampling method

This study took place in a medium size urban public high school in a large city in Ohio. The high school served approximately 1,500 students, the majority of whom qualified for free or reduced lunches. The school was a magnet school that housed five different programs in the same building. Students were assigned to an individual team of teachers within programs. Approximately 75% of the population was African American.

The informants of this study were four special education teachers who taught in this school. Three of the teachers had ten plus years teaching in an urban public school district while one had two years teaching experience. Two were African American and two were Caucasian. Three of the participants taught students with learning disabilities and the other participant had students with noticeable physical and mental challenges. Pseudonyms were used throughout this article for identification purposes.

Convenience sampling was used to choose participants. Familiarity and prior observation were used to identify teachers who did not use technology for lesson delivery.

Instruments

Classroom observations as well as a focus group were used to collect data. One onlooker un-announced observation was used for each participant with the expressed purpose of watching the teacher's lesson delivery and possible use of technology. Observational mapping was used to determine the presence (or lack) of technology and supporting infrastructure. A semi-structured interview format was used for the focus group. These questions were general in nature, open-ended, and designed to encourage discussion within the group.

Data Analysis

Data from the observations and focus group was triangulated and coded based on emerging themes methodology. Emerging patterns between the literature review and theoretical framework were noted during coding. Similar data was grouped under the themes for analysis. For example, participant comments collected during the focus group were grouped according to similarities with comments from the other participants and the mapping, census, and calendar findings from the observations. These groupings were then compared to prior research to identify themes.

Limitations

This study was conducted using four teachers as a sampling from a population of 20 within the school. The findings from this study may not be applicable to the rest of the population in this school, much less the district and state populations. In addition, other methods could have been used such as individual interviews and quantitative methodology. More research is needed to find consistency for the entire population.

Findings

If special education teachers are to use technology consistently in the classroom, then it is important to identify the perceived barriers to implementation. Our review of literature presented several issues that deal with the relationship between special education teachers and technology. In addition, other issues were raised that deal with the perception of the benefits of technology, as well as the obstacles for technology use within the special

education classroom. The following themes emerged during the coding process.

Special Education Students Benefit from Technology

Judge (2001, p.31) argues that computer based learning has a positive influence on special education students, and she notes, "The use of computer technology can enable young children with disabilities to more successfully explore the world around them." Scadden (1998) agreed, stating that when technology is not present, special education students do not receive the same quality of education as regular education students. This was consistent with the perceptions of the participants in the study who all perceived a benefit of technology use in the special education classroom.

The participants felt that the use of graphic interfaces for computer interaction helped students with spelling and vocabulary skills. Ms. Jones felt that students read better on a computer because they will ask the teacher the meaning of a word instead of skipping over that word like they do while reading a book. "But up on that screen they will ask more. See they will ask more. That I do like." Ms. Straight felt that the graphics helped her students read. She said, "But on the computer, on an individual basis when they see pictures with the word and they have to punch in the spelling of the word."

The participants also saw a benefit with technology use in regards to student behavior. All of the participants felt that students saw computer use as a reward and that the students looked forward to using the computer. Ms. Jones felt that computer use also specifically cut down on talking in the classroom, which is a problem associated with some of her students who are labeled SBH (Severe Behavioral Handicap). "You know how, because they don't talk as much. They are more focused." They believed that the computer helps with behavior since the students understand that the use is dependent upon their behavior. While using the computer, students are more engaged and less likely to act out.

Alternatives to Computer Access in the Classroom or in a Lab

The participants felt that there were no adequate alternatives to in-room access to computers. In addition, few studies have addressed specific technology alternatives for computers located within the classroom of special education students.

When asked about alternatives to classroom computers or to a lab, such as taking their students to the school library to conduct research, the teachers felt that computer access in their classrooms was better. The teachers complained about the negative treatment that some of their students received in the school and library from regular education students, as well as from faculty members. Ms. Krammer felt that other faculty members do not understand the nature of the challenges that some of her students face. She stated that she sometimes had to track down faculty members to find out about an incident and to explain the behavior pattern of her students. "They get it enough from their peers and they get it from the administration and faculty members here." In addition, Ms. Jones felt that regular education teachers do not understand special education students, and in some cases even special education teachers. She listed this as a reason that special education teachers feel isolated. "Not only do they have reactions towards a student, they have reactions towards the teacher also. They really do. That is why special ed becomes so segregated. Because you as the teacher are protecting your students."

Lack of Computer Access and Infrastructure Challenges

Contradictions were found between the findings of this study and the findings of Dana, Friedrichsen, and Tsur (2001) and Lonergan (2001). Dana, Friedrichsen, and Tsur (2001) wrote that the number of computers in schools has gone up, but teacher usage remains low. Lonergan (2001) found that the gap in computers between rich and poor districts has narrowed.

The teachers interviewed did not have access to computers needed for technology integration into daily lessons. In the four classrooms observed, there was only one Internet-capable computer. Older computers were on hand in two other classrooms. Two of the classrooms had no computers at all. One classroom had older Apple computers that were not capable of connecting to a server. The one Internet-capable computer was an older model with a limited amount of RAM and an underpowered processor. No evidence was found that the digital divide had narrowed. Even if serviceable computers were available, there were infrastructure issues that needed to be addressed. Two of the four classrooms did not have LAN (Local Area Network) drops to connect the computers to a server. In addition, one of the classrooms had a single electrical outlet to serve the electrical needs for the entire classroom.

All of the participants identified the lack of computers as a major obstacle to computer use. Ms. Straight was adamant that computers should be accessible to special education students. She identified money as a major obstacle to computer access. "It doesn't feel right in a modern technological society. But it takes a lot of money." Without access to computers, the participants felt that technology cannot be used as a regular teaching strategy.

Ms. Bishop complained that when special education teachers actually received computers that they were cast off from other programs and were inadequate to meet their needs, "We have always had something that someone is giving away, but it is always outdated or something like that." Similarly, Ms. Krammer agreed that the computers they receive are not in the best working order, "Computers that work every day with printers that don't break down, paper and ink." The participants cited obsolete or inoperative computers as reasons for not using technology in the classroom.

The participants also identified infrastructure concerns. Ms Bishop listed obstacles to computer use even when she had computers in her room, "I have plugs and everything but I do not have the Internet hookup." Other participants stated that as special education teachers, they are forced to move classrooms from year to year. Ms. Jones said, "But then we never know if

we are going to be moved from one year to the next year." Ms. Bishop also identified the lack of consistency of having the same room as a challenge to technology use. "It is hard when you have your set up (classroom), and that has happened over the years. You have your set up then all of the sudden you are moved, and where you are moved there is no way to set your situation up." The participants identified infrastructure problems such as inadequate electrical outlets and lack of a LAN connection. The challenge of establishing a technology rich classroom is hindered by the inconsistency of moving classrooms from year to year.

Computer Training for Teachers

Computer training is inconsistent between the participants. Lonergan (2001) writes that teacher-training programs do not provide enough technology experiences. Some teachers might need training on the usefulness of using technology (Zhao & Cziko, 2001).

All of the participants stated that they had computer training in college, but there was disagreement as to the effectiveness of that training. Ms. Krammer, who was the youngest teacher in the study, felt that she had adequate training in college. She stated, "I feel incredibly comfortable with computers and technology because like I said I just got out of college and it was required of me in college to do a PowerPoint demonstration, to do Web pages." On the other hand, Ms Jones felt that the computer training she received during graduate school was inadequate. She explained, "When I came through it was almost a thing, like we are rushing to teach you this, just long as you get this, that it was a rush job."

Despite training in college, several of the participants again pointed to the lack of computers as an obstacle toward technology mastery. Ms. Jones complained that she did not have access to practice her skills, "Are you saying our comfort level? Um... sometimes for me the actual thing of using one is a problem because we don't have one to keep using." Ms. Bishop shared her own concerns about practicing her computer skills, "I think I am capable of using one. You know, I am capable of turning one on, keying it in, but I just get real nervous if I make a mistake. I don't know what to do, I don't know what steps to take to erase that and get back to the beginning." This finding is in agreement with findings from Newton (2002) who suggested that teachers need more time to work with technology for familiarity.

Administrative Support

Sahl and Windschitl (2002) wrote that the social environment of a school has more effect on teacher's use of technology than individual beliefs. Edyburn and Gardner (1999) found that limited leadership and a lack of common vision are perceived obstacles to technology use in special education classrooms. These findings were supported by the findings of this study.

As to the degree to which the school administration and the district supported and encouraged the use of technology, there were mixed opinions. None of the participants could point to a written policy that encouraged or required technology use, but the participants were able to cite several examples of how the district required teachers to use technology. For example, Ms. Bishop commented on the new online grading system and about the classes at the district training center. "Well, the training center offers a lot of classes. Also the new grading system that we use in the computer." Ms Krammer gave the example of how special education teachers could use the computer to save time writing Individual Educational Plans (IEPs), "But this district does have the IEP option on the Internet. And the teachers who have done it and mastered it just think that it is wonderful." Without a formal district policy, the district has somewhat required and encouraged technology use.

Discussion

The findings led to three interrelated conclusions: perceived isolation within the school, lack of adequate computer equipment/infrastructure, and inconsistent technology training. These perceived barriers stand in the way of technology integration for these teachers.

The first issue was perceived isolation within the school. The participants felt that they were often on their own as far as classroom innovation and direction. They felt that they did not receive support from the programs to which they were assigned. The participants were unaware of technology policies and available technology support from the district, building leadership, and from other teachers within the building. The special education teachers felt marginalized by this lack of support and were unsure how and where to seek help for technology-related issues and for acquisition of needed software. If the teachers were integral members of an academic team, then they could seek support from the other members of that team and from the program itself. The perceived lack of support from the school leadership and colleagues acted as a barrier to changing pedagogical teaching styles that would include technology innovation.

This situation led to mobility issues with the teachers. As stated in the findings, the participants often moved their room from year to year. This constant mobility caused them to feel some hesitation in acquiring and using technology. The teachers felt it was futile to acquire and set up a group of computers if their new rooms did not have the needed infrastructure to support them. The teachers might have to wait on work orders for the electrical and networking connections, which often took a year or more for completion. If the teachers were an integral part of a team or program, they would had more voice to express infrastructure concerns before they were moved from room to room every year.

The perceived isolation also prevented them from seeking technical advice and services from programs within a school. Technology coordinators may be dedicated to a specific program and may not have the time or resources to support special education teachers outside their program. The teachers did not know who to ask for assistance for equipment failure and technology integration into their daily lessons.

Computer labs were not a viable option for the special education teachers because the special education teachers felt uncomfortable taking their students to one of the computer labs. Labs in this school belong to specific programs and are often booked up weeks in advance. In addition, the teachers faced additional challenges moving their students to a computer lab due to the physical and behavioral demographics of their students.

The second issue confirmed by the findings is the lack of adequate computer hardware and infrastructure. The literature stated that poor schools had better access to computers than in years past, but the findings disputed this fact. The participants did not posses network capable computers, which is another reflection of their isolation. Programs must always make budget choices based on their needs and a finite amount of available funding dollars. Special education students are assigned to programs for accountability purposes only, and given the scarcity of budget dollars, the programs are not likely to fund technology upgrades to an outside entity. The school uses a site-based management system that is governed by an Instruction Leadership Team (ILT). The ILT, which is made up of representatives from the teams, programs and departments, makes all budget decisions in the school. Special education teachers do not have enough representation to have a strong voice in these budget decisions, which limits available funding for technology acquisition.

The literature claim that the number of available computers in poor schools has gone up may be misleading. The study participants stated that they were often offered older computers from programs that were updating their technology. These computers were typically fifteen years old or older. Great advances have been made in computer technology and these older machines often lack CD-ROM drives, Ethernet connections, as well as adequate memory to run even some of the more basic programs. If the literature conclusions were based on the number of computers, without taking into account the adequacy of these computers, then the actual number of adequate computers in poor schools has not risen significantly.

In addition to hardware, the participants had significant infrastructure concerns that prevented technology integration. Successful technology integration cannot occur if the classrooms do not provide the necessary infrastructure items such as electrical outlets and LAN drops. Two of the participants lacked working LAN drops and one of their rooms had only a single electrical outlet. Work orders, which often took a year or more to complete, would have to be submitted to install the needed outlets and LAN drops. The participants were unaware of this procedure, and if they were, they may not have made the effort based on the fact that they often have to move rooms from year to year.

The third conclusion is inconsistency in teacher training programs. All of the participants had attended computer technology training courses, either during their pre-service training or while pursuing a master's degree. The perceptions varied among the participants as to the quality and effectiveness of this training. The youngest teacher, who was only two years removed from her undergraduate work, stated that she felt extremely comfortable with technology. There are two logical explanations as to why she felt more comfortable than the other participants. First, being younger than the other participants, she has been immersed in a technology-rich culture that was far different than her more experienced colleagues. This culture included more computer access, both at home and in school. Second, someone who was only two years from her undergraduate work will be more computer literate than someone who was fifteen years or more removed from their undergraduate work. Technology is now integrated in pre-service teaching programs, which was not the case when the rest of the participants attended pre-service training. It should be noted, though, that even if she felt her training was adequate, she was still not integrating technology into her classroom.

The more experienced teachers expressed more frustration with their computer training experience. All of them learned computer skills during graduate school, but the effectiveness of this training was in question. They complained that they felt rushed while learning this new technology. Teacher training programs do not offer enough technology experiences and/or strategies on how to set up that technology in their classrooms (Longergan, 2000). Another teacher training issue was that the teacher training school provided training on technology skills, but they did not train them how to integrate that technology into daily lessons. For example, simply knowing how to use a program, such as PowerPoint, does not necessarily mean the teacher knows how to use PowerPoint to impart knowledge to his/her students. It takes time to master the technology, as well as creative thought, to use the technology as a tool to deliver knowledge.

The issue of training and comfort with technology was compounded by the lack of adequate computers. Teachers need access to computers to practice and master new skills, such as how to use multi-media presentation software. Teachers will not achieve mastery of the technology, nor feel comfortable enough to use it for lesson delivery, without opportunity to practice these skills. Paradigm shifts to technology integration cannot be accomplished without the basic technology equipment.

The sense of isolation in a school, lack of adequate computer hardware/infrastructure, and inconsistent computer training are all individual obstacles that are interrelated. If teachers are isolated, they do not have access to support and the needed funding. If they do not have the needed funding, they cannot acquire adequate computers for their classrooms. If they do not have the computers, they cannot practice learned technology skills. Individually any of these challenges could have been overcome, but in a group, it would take huge amounts of motivation, innovation, funding, and effort to create a technology-rich classroom environment for these teachers.

Implications

The perceived isolation speaks to a potentially larger issue of administration support and direction. There should be no isolated groups of teachers in a teaming school. Both district and

individual school administration need to address the fact that the perceived level of support is insufficient for any teacher, much less teachers who face the challenges of teaching students with special needs.

Hardware and infrastructure concerns are related to this isolation because the teachers are unaware of the alternative methods for acquiring computers. The district can install LAN drops and electrical outlets. Older network-capable computers can be acquired at a reduced price and the district can fix the infrastructure problems, but the teachers are not aware of the system for getting this accomplished.

The lack of computer accessibility has had an effect on teacher training since they cannot practice learned skills. However, computers are available in computer labs and the technology coordinators are probably willing to assist these teachers if they asked for help. Communication between all entities of the school needs to be improved if school officials want to provide access to the benefits of technology for special education students.

Conclusions

This study found evidence of a number of barriers, both perceived and real, that stand in the way of technology use in special education classrooms in large urban districts. Hardware and infrastructure issues are all problems that can be overcome if a district, and a school within that district, has a clear technology policy that is disseminated to all educators.

These barriers could be lessened if all the stakeholders had a common vision and were willing to make technology integration into special education classrooms a reality. Perceived isolation could be overcome with improved administrative support and direction. Used computers could be acquired through alternative means. Infrastructure issues could be resolved through existing district vendor contracts. Teachers could reinforce learned skills by coordinating time with the program technology coordinators.

The importance of technology integration in special education classes cannot be overstated. More research on this topic is needed to ensure that the findings of this study are consistent with larger populations.

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Upcoming Events

Ed Tech Conferences

Association for Educational Communications and Tech. (AECT)
Annual International Convention - All That Jazz
Chicago, Illinois, October 20-24, 2004

Texas Computer Educators Association (TCEA)
25th Annual Convention and Exposition (largest state conference)
Austin, Texas, February 7-11, 2005

Society for Information Technology & Teacher Ed. (SITE)
16th International Conference
Phoenix, Arizona, March 1-15, 2005

American Educational Research Association (AERA)
2005 AERA Annual Meeting
Montréal, Canada, April 11-15, 2005

National Educational Computing Conference (NECC)
NECC 2005: Digital Illuminations, the 26th Annual NECC
Philadelphia, Pennsylvania, June 27-30, 2005

World Conference on Educational Multimedia, Hypermedia, and Telecommunications: ED-MEDIA 2005
Montréal, Canada, June 27-July 2, 2005