Minimizing the effects of the digital divide

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Abstract
This research paper reviews the differences between technology deployment in affluent school districts as well as low-income districts. The attempt to bridge the digital divide is challenging to individuals, communities, and society at large. Students with limited or no access to computers are falling behind in developing skills that are needed in college and in the job market. The research cited in this paper addresses the existence of a divide, describes the affects of teacher philosophies and behaviors in urban school settings, suggests instructional strategies to train teachers, and provides factors that contribute to the Digital Divide as well as solutions for what currently exists.
MINIMIZING THE EFFECTS OF THE DIGITAL DIVIDE

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Introduction

Introduction to the Problem

In today’s educational setting, computer access is becoming a necessary element in providing quality education and in preparing students for the future. Computers are becoming fixtures in affluent classrooms just like calculators, and do not seem to be a passing fad (Wilhelm & Thierer, 2000). Through the Federal Communication Commission’s E-rate program, $1.5 billion has been made available to schools and parents. According to the National Center for Education Statistics (2000), 93% of public schools had Internet access but only 77% of instructional rooms were connected. Of all instructional rooms, 60% had Internet access in schools with high concentrations of poverty compared with 82% of instructional rooms in schools with lower concentrations of poverty. This suggests that students who attend poverty-stricken schools are less likely to have instructional rooms connected to the Internet than students in affluent, suburban schools. Furthermore, urban schools are more likely to have higher student to computer ratios than non-urban schools thus affecting the effectiveness of instruction. These differences among affluent schools and urban schools are symptoms of the epidemic known as the Digital Divide (Digital Divide Organization, 2000).

Statement of the Problem

The term, Digital Divide, came to public attention after a 1995 study by the Markle Foundation, (cited in Stoicheva, 2000) revealed that the same divergence found in society along cultural and racial lines is found online and offline. The civil rights issue of the new millennium is the Digital Divide (Carvin, 2000). Students who have limited or no
access to modern technologies will receive an inferior education thus excluding them from competition for quality employment (Davis, 1998). In particular, those who are members of minority groups may be negatively impacted in their educational endeavors, their participation in certain political forums, and in their capacity to access information about jobs and other opportunities that may enhance their existence and affect the contributions that they could make to society (West, 1997). Politicians and researchers optimistically suggest that the government is on schedule to meet its headline target of universal Internet access. Nowhere is this confidence expressed more clearly than former President Clinton’s aggressive objective to wire every classroom and library in the country by the year 2005 followed by every home by the year 2007 (Clinton, 1997). If Clinton’s objective is achieved by 2007, will this be an end to the problem known as the Digital Divide? Roberts (1999) states, “If you focus on access alone, you don’t get to outcomes” (p.77). Bamburg (1994) asserts, “Teachers and administrators are moving away from worrying about building the infrastructure, the question now is what do they do with the infrastructure?” (p.11). The phrase “Digital Divide” has quickly become a part of society’s terminology. The Digital Divide discussion initially focused on the basic issue of access to hardware and software in poverty stricken communities. Now other factors are being associated with the Digital Divide such as teachers’ training, teachers’ philosophies, and quality of resources. For the scope of this review, the Digital Divide has been defined as the gap between the affluent and poor in technology ownership and quality of education that breaks along familiar socioeconomic fault lines, such as race, education, and economic status (Wilhelm & Thierer, 2000). Research cited in this paper
addresses the existence of a divide, describes the affects of teacher philosophies and behaviors in urban school settings, suggests instructional strategies to train teachers, and provides factors that contribute to the Digital Divide as well as solutions for what currently exists.

Methodology

Search

To begin this research, an Internet search was conducted on the topic, Digital Divide. This preliminary search served as a basis that would lead to online journal articles. After the initial search to see what kinds of information existed on the Digital Divide, a search was then conducted on computer access, teacher training, teacher expectations, and teacher philosophies. Further investigation included using the University of Northern Iowa’s library database. A search of the Educational Resources Information Center database (ERIC) resulted in additional information. Due to the abundance of research found within the ERIC database, a more narrow exploration was needed. Education abstracts Full Text, Expanded academic ASAP, and Ethnic News was used. Boolean search terms were used to search these databases. The keywords were technology, training, schools, and Digital Divide. The majority of the information presented in this paper comes from journals found in the ERIC database and Internet.

Compilation of Data

Many articles and research dealt with the issue of the Digital Divide. However, there were not as many articles dealing with teacher technology training and Digital Divide. Therefore, many of the articles used dealt with technology training and addressed
instructional techniques that can be useful for working with teachers. To narrow down the list of articles that were found, a list of guiding questions was needed. Questions used included:

1. Look for articles that were up-to-date because information dealing with the use of technology is constantly updated.
2. The article should discuss the impact the Digital Divide has on students.
3. Look for articles that include statistics to give a better understanding of the impact on urban students.
4. Look for articles that include information regarding teachers' expectations of minority students.
5. The article should list past solutions or future solutions to bridge the digital gap.

Analysis and Discussion

Those groups on the wrong side of the Digital Divide are often called the technology have-nots and include a disproportionate share of people living in poverty, considered functional illiterate, American Indians, African Americans, or people in small rural towns (Digital Divide Organization, 2000). Should Americans be concerned about the misfortunes of these isolated groups? Charp (2000), states gaps between computer haves and have-nots will further put behind the underclass. Individuals or groups who are already disadvantaged will become more so through lack of computer literacy thus excluding them from the opportunities available through Internet access (National Center for Education Statistics, 2000). Cornel West (1997) suggests equality is threatened when groups are excluded based on socioeconomic background or ethnic orientation. Education
is valued the world over and is widely acknowledged as the most significant asset an individual can have to escape poverty. Technology is transforming education but resources for technology are not evenly distributed among communities. Inconsistencies such as these seem to become more visible when one takes a closer look at the factors that contribute to the Digital Divide. Most of the research that has been compiled deals with how African Americans compare to Caucasians so there will be more references to African Americans throughout this review.

Definition of Terms

- Digital Divide: The gap between the affluent and the poor in regards to ownership and access to informational tools, such as computers and the Internet
- Minorities: Any group of people who are not considered the majority
- Technology: Technical terminology for computers, hardware, software, Internet, etc.

Factors that Contribute to the Digital Divide

Carvin (2000), states there is no single, clearly defined learning technology gap or Digital Divide. Many overlapping gaps or factors contribute to the Digital Divide, which essentially do not have their roots in the technology itself. Hence, the Digital Divide is not one single gapping hole or problem but is actually several related factors caused by inconsistencies within society. The need to address the Digital Divide is multifaceted and has ramifications affecting society as well as individuals. The remainder of this paper will focus on factors that contribute to the Digital Divide followed by solutions to each problem.
Factor One: Computer Access. Many inconsistencies can be seen between wealthy communities and communities that fall below the poverty line. For example, schools in low-income communities have fewer computers and online access than schools serving wealthier districts. The children who need the most are getting the least. Insufficient hardware or network connections are not the only problems for schools in poverty stricken communities. The National Center for Education Statistics (NCES) tracked the rate at which public schools and classrooms connected to the Internet. The report was entitled *Internet Access in U.S. public schools and classrooms: 1994-1999*. This was part of the National Information Infrastructure (NII) proposal to have all schools and classrooms connected to Internet by the year 2000.

The NCES (2000) findings were as follows:

- Public schools in the U.S. have nearly reached the goal of connecting every classroom to the Internet. The percentage of public schools connected to the Internet has increased from 35% in 1994 to 95% in 1999.

- In 1994, only three percent of all U.S. public school rooms of instruction (classrooms, libraries, and computers labs) were connected to the Internet. By 1999, 63 % were connected.

- Schools with the highest concentrations of poverty had 12 students per computer with Internet access compared to five students in schools with the lowest concentrations of poverty.

- Seventy-seven percent of secondary schools and 72% of schools with the lowest concentrations of poverty were more likely to connect to the Internet using more
dedicated lines than 60% of elementary schools and 50% of schools with the highest concentrations of poverty.

These findings suggest that students attending poor and high minority schools are less likely to have access to most types of technology compared to students attending other schools.

Hoffman and Novak (1999) found that inequalities in home Internet access might be even more problematic than school access. Affluent households are over 20 times more likely to have access to the Internet than rural households at the lowest income levels, and are more than nine times more likely to have a computer at home (Digital Divide Organization, 2000). Race differences in home computer ownership are consistent across different levels of education. Within each education level, Caucasians are more likely to own a home computer than African Americans (Hoffman & Novak, 1999).

According to a study by researchers at Vanderbilt University in Nashville, Tennessee, Caucasian students (even when income is taken into account) were more than twice as likely to have access to home computers as African American students. Furthermore, the study reveals that White students who did not have home computers were more likely to log on to the Internet at other locations than their Black peers who did not have access at home. This suggests the importance of not only creating access points for African Americans in libraries, community centers, and other non-traditional places where individuals may access the Internet, but also publicizing and encouraging use at these locations.
The U.S. Department of Commerce (2000), issued their fourth report of a series of studies entitled *Falling Through the Net: Toward Digital Inclusion*. This report highlights the progress that has been made with technology as well as the progress that needs to be achieved so every American can participate in the digital economy. The extent of the digital inclusion was measured by households and individuals who have a computer and an Internet connection. The report indicated that overall digital inclusion is quickly increasing. The number of households with Internet access has soared to 60% compared to 28.2% in December of 1998. Fifty-one percent of all households have computers versus 42.1% in December of 1998. Nevertheless, a Digital Divide still exists between households based upon different levels of income, education, and racial and ethnic backgrounds.

*Solution One: Computer Access.* In recent years, many interesting partnerships have evolved between technology leaders and non-technical companies who provide funds and equipment so that the opportunity to have access to computers and to the Internet is readily available to communities that fall below the poverty line. More than 20,000 Digital Divide services are spread across the nation, providing everything from special computer training for school-age children to low-interest loans to help some financially strapped families of public school students buy home computers (Digital Divide Organization, 2000). However, there is a consensus that closing the Digital Divide in any community will require efforts that go beyond school programs. Gaps in general Web access and use between African American and Whites appear to be driven by whether or not there is a computer present in the home. Access to a personal computer,
whether at home, work, school or somewhere else, is important because it is currently the
dominant mechanism by which individuals can access the Internet (Hoffman & Novack,
1999). Therefore implying, that access translates into usage. Overall, individuals who
own a home computer are much more likely than others to use the Web. This suggests
that programs that encourage home computer ownership and the adoption of inexpensive
devices that enable Internet access over the television should be aggressively pursued,
especially for low-income communities.

While much remains to be done, communities around the country are using
information and communications technologies to fight poverty and digital isolation. Part
of the short-term answer lies in providing Internet access at Community Access Centers
(CACs), such as schools, libraries, and other public access facilities. Typically, these
sources tend to be used by groups that lack Internet access at home or at work; chiefly
minorities, people earning lower incomes, those with lower education levels, and the
unemployed (Benton Foundation, 1999). Households with incomes of less than $20,000
and Black households, for example, are twice as likely to get Internet access through a
public library or community center than are households earning more than $20,000 or
White households (U.S. Department of Commerce, 2002). Similarly, low-income
households and households with lower education levels are obtaining access at schools at
far higher rates. This underscores the importance of ensuring that all schools and libraries
have affordable access to the Internet. The Education rate (E-rate) program is perhaps the
best-known universal service initiative. It was established by Congress to make services
and technologies in telecommunication available to schools and libraries at discounted
rates based on the income level of communities in urban or rural locations (Carvin, 2000). As a result, the E-rate program is helping to connect more than 80,000 schools and libraries and is enabling children and adults to both learn new technologies and have new points of access. The data indicates that these community access centers are, indeed, used by people who lack access at home and merit further funding. Moreover, the same households that are using community access centers at higher rates are also using the Internet more often than other groups to find jobs or for educational purposes. Community Access Centers are, therefore, providing the very tools these groups need to advance economically and professionally.

**Factor Two: Teacher Philosophies.** Teachers' philosophies towards students' abilities and performance are also factors that contribute to the Digital Divide. It is misleading and inaccurate to state that teachers' philosophies guarantee a student success in a digital environment, however research clearly suggests that teachers' attitudes and behaviors do play a significant role in determining how well and how much students learn (Bamburg, 1994). Chaikins, Sigler and Derlega, (cited in Bamburg, 1994) conclude that teachers who believe that they are interacting with bright students smile and nod their heads more often than teachers who believe that they are interacting with slow students. Other behaviors include leaning towards and looking into the eyes of smarter students more frequently. For the most part, schools in the United States are based on the European, middle-class, and American majority culture. The number of students of color in our public schools increases each year. The percentage of graduates of teacher preparation programs who will work in racially diverse schools will increase over time,
with only 10% being minority teachers (Freeman, Brookhart, and Loadman, 1999).

Omrod (cited in Chisholm, Carey, and Hernandez, 1999), states that students from different cultural backgrounds are likely to experience a cultural mismatch, in which significant discrepancies appear between their home culture and school culture. Teachers sometimes add to this cultural mismatch by viewing these students through their own cultural window. Since African American students largely populate urban schools, this behavior typically fosters the misconception that minority children from low-income households are incapable of performing well in the classroom. Bamburg (1994), found that students labeled slow receive fewer opportunities to learn new materials than students labeled bright do and that slow students typically are taught less difficult material. In urban school settings, computers are usually used for rote learning or drill exercises compared to wealthier districts where more complex learning activities are encouraged. Students from poorer districts are learning to do what the computer tells them, while students from wealthier districts learn to tell the computer what to do (Benton Foundation, 1999). Teachers base this divergence in strategy upon an error, as how to implement a well-rounded technology curriculum. This misconception is the by-product of outdated philosophies towards technology integration.

Solution Two: Teacher Philosophies. Improving teachers' philosophies is a key element in making any technology integration successful (McKenzie, 1998). Both students and teachers roles will have to change. Maurer and Davidson (1999), suggest that many teachers' current philosophy in urban school systems could be described as, “I have the power and will give you bits of it as I see fit” (p.5) McKenzie asserts, “So long
as the majority of teachers value teaching above learning, we are unlikely to see dramatic changes in student performance” (1998, paragraph 33). Educators’ philosophies toward technology integration should reflect a hands-on approach; classroom instruction should be learner centered, focusing on student’s individual needs and learning styles and incorporate aspects of multicultural education. According to Gorski (2001), multicultural education calls for all aspects of education to be continuously examined, critiqued, reconsidered, and transformed based on ideals of equity and social justice. Teachers’ roles will also change from being dispenser of knowledge, to being the facilitator of knowledge. Students will no longer passively receive knowledge; rather students will be taught higher-order thinking skills thus empowering them to construct knowledge (Bhattacharjee and Chen, 2000). Students should be encouraged to alternate between the role of experts as well as active learners. By giving children opportunities to share their learning with peers, they are empowered as learners (Maurer & Davidson, 1999). Students should be given choices in their learning. By giving students choices, there is a greater opportunity for children to make personal connection with the material and make the material meaningful.

Burnette (1999) discussed instructional strategies that can build stronger teaching and learning relationships with culturally diverse students. A few of the instructional strategies and teacher behaviors are discussed below:

- Communicate expectations
- Focus on the way students learn and observe students to identify their task orientation.
• Build relationships with the students. Understand what students' lives are outside of the classroom, this enables the teacher to increase the significance of lessons and make examples more meaningful.
• Welcome and accommodate the similarities and differences among student's culture.
• Require mastery.

These strategies are not geared directly towards technology but they can be incorporated in existing strategies employed with minority students.

Carter (1998) addressed constructing stronger learning relationships. She found that it is imperative to inspire a sense of pride in the background of minority students. Educators should promote a more diverse curriculum. Implement cooperative rather than individualistic goal structures, highlight active rather than passive activities.

**Factor Three: Teacher Training.** School districts that spend vast sums on computer, software, and technical support without investing in teacher training negatively affect the integration of technology within the curriculum. Office of Technology Assessment (cited in Benton Foundation, 1998) suggests that schools should devote at least 30% of their technology spending to training. Due to inadequate teacher training, these schools may not be using the computers in ways that will have the greatest long-term benefits. A national survey of teacher quality conducted by the National Center for Education Statistics (2000) indicated that only 24% of new teachers (i.e. those with 3 or fewer years of teaching experience) felt very well prepared to integrate educational technology into the subject or grade level they taught. Teachers have not been receiving
the necessary exposure to technology that is vital both during pre-service and in-service training (Becker, 1994). When teachers are personally, uncomfortable using and teaching with technology, students are not learning technology skills. Universities do not require nor incorporate technology into their methods courses for pre-service teachers (Persichitte, Tharp, and Caffarella, 1997). Just 13% of schools require teachers to obtain training in advanced telecommunications (Benton Foundation, 1998). United States Secretary of Education, Riley stated (1999), “Teacher education and professional development programs are not addressing the realities found in today’s classroom. Many teacher education programs do not have the hardware or software to properly prepare aspiring teachers ”(p.5). In 1996, a technology survey was given to all National Council for Accreditation of Teacher Education (NCATE) member colleges responsible for teacher education programs. The survey disclosed 31% of students have no requirements to incorporate technology into their instruction during their student teaching experience (Persichitte, Tharp, & Caffarella, 1997). Why are colleges of teacher education not incorporating technology into their education certification programs?

Because technology changes so rapidly and many teachers are not abreast of technology updates, staff development and training opportunities need to be continuously provided (Roberts, 1999). Currently there is a lack of professional development in technology for teachers once they are in the classroom. Most professional development for technology still centers on how to use the tools, the software applications and resources. There is little focus on strategic teaching or guidance. To be most effective, computers should be strategically and seamlessly integrated into the curriculum rather
than being used for drill and practice (McKenzie, 1998). In the past school districts hurled the latest equipment into classrooms without preparing teachers in how to use it and without considering how these technologies will be integrated into the curriculum (Cuban, 1986). Resulting, in an environment in which classroom teachers either refused to use the technology or inadequately used the technology. In those cases, the classroom teachers made decisions that negatively affected the Digital Divide.

**Solution Three: Teacher Training.** While many teachers have the necessary intelligence and deposition to deliver instruction in a wired classroom, the teaching profession as a whole is prevalent with people who rather deliver prepackaged curricula, using traditional tools, and assessing student progress in traditional ways (Charp, 2000). An estimated 1.3 million of the nation’s 3 million elementary and secondary teachers feel inadequately prepared to integrate educational technology into their teaching (McKenzie, 1998). Thus, indicating the growing need for appropriate and effective technology training for pre and in-service teachers. Why are universities of teacher education programs not adding technology courses into their education curriculums? Evidence suggests that adding separate technology courses to the teacher education program of study will not be effective. According to McKenzie (1998), technology is not a tool that is designed to stand alone, and therefore should not be viewed as a separate subject. To increase the technology proficiency of new teachers in K-12 classrooms, training institutions should increase the level of technology integration in their own academic programs (ISTE, 1996).
NCATE guidelines state that candidates must complete a sequence of courses and/or experiences to develop an understanding of structure, skills, core concepts, ideas, values, facts, methods of inquiry and uses of technology for the subjects they plan to teach. (Kahn, 1996). In other words, pre-service teachers should be introduced to applications and content area software and understand the roles technology can play in the subjects and for the age groups they plan to teach. In order for pre-service teachers to acquire the knowledge and experiences necessary to integrate technology, university faculty members and professors should model and integrate technology within courses (Kahn, 1996). Teachers teach as they have been taught. Beginning teachers need to see instruction modeled in which technology is integrated throughout the curriculum. An ISTE study (1996), suggests that 50% of university faculty are not modeling nor integrating technology in professional education courses. The study further indicates that 50% or fewer teaching candidates routinely applied information technology in their field experience and practice teaching.

How can we guarantee that university faculty is well informed about current practices in technology and able to integrate computers into their own teaching? In the Task Force Report by the National Council for Accreditation of Teacher Education (1997), recommends increased emphasis on faculty development. This recommendation was aimed at improving the technology skills of current faculty. However, the University of Washington has proposed and implemented an additional recommendation into their Teacher Education Program (TEP): that the teaching assistants be targeted for
professional development in technology (Carney, 2000). The underlying principle is to ensure that future faculty is prepared to use technology in their teaching.

Conclusion

The digital divide is not an imaginary hole in which isolated groups are at risk of falling through; but it is a division apparent in our schools and society that affects the masses. Schools are designed to develop students socially and economically. We continue to fail our minority students. Gains on the Digital Divide would be seen when government officials and politicians apply pressure on public and private sector investors to advance the public's goals of equity and inclusion for all in the digital age.

The initial purpose of this paper was to inform the reader about the existence of a digital divide. The Digital Divide is a separation of races related to the use of technology. It is the separation of America's society into the information rich and the information poor. Significant gains on the Digital Divide in our public school system will not occur, until urban school districts are able acquire the necessary means and resources to drastically improve the quality of technology within their districts. Hence, universal service initiatives and programs such as the Education rate (E-rate) program, which provides affordable services and technologies to schools and libraries based on the income level of surrounding communities should be expanded to include Community Access Centers.

The second purpose of this research was to inform the reader of the need to improve the philosophies of teachers in urban school settings, regarding technology integration. Currently, urban school settings are dominated with philosophies that support
a teacher centered learning environment. The learning process that occurs in such environments is typically based on teachers dispensing knowledge to passive learners. Therefore, the process limits the learning potential of urban students to mastery of basic drill-and-practice exercises. The shift in philosophies from a teacher-centered approach to a learner-centered approach can positively affect the learning of students of poverty stricken districts. A learner centered approach to technology integration cultivates students higher-order thinking skills thus empowering them to construct knowledge. By providing students with opportunities to become active learners, there is a greater opportunity for students to make personal connections with the material and become lifelong learners.

The final purpose of this research was to suggest instructional strategies to improve the technology training of teachers. Presently, trends towards technology trainings in urban school settings centers on how to use computers as resources, rather than focusing attention on strategic teaching or guidance. Major improvements in teachers' abilities to integrate technology within the curriculum will not transpire until technology integration becomes a seamless component integrated within professional education courses and teacher training. Therefore, to fill this void there is a need to increase the emphasis on faculty development to include innovative approaches to integrate computers effectively within the curriculum.

Computers are becoming essential parts of our daily routines and without the necessary knowledge of computers skills students will be left behind. Online courses and job opportunities are available via the Internet. It is vital to provide our children with the
tools and know how to build a successful future and compete for quality jobs.

Technology skills are a necessary tool. Therefore, our schools must welcome changes to the curriculum and the way in which it is taught. They must also be willing to invest the time and money to train the teachers in inner-city schools to use the technology properly, and doing so we are investing in our students, thus improving our future.
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