Overcoming the Digital Divide: The Story of an Urban Middle School

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Abstract

Access to appropriate technological resources in schools has become an issue, commonly labeled the "digital divide." While the debate ensues in regards to an explicit definition for this phenomenon, research overwhelmingly demonstrates that students of marginalized populations remain on the lower end of ***access to*** *and* ***innovative use of*** *current digital technologies. Accordingly, advocates of social justice point to the disparities of resources and quality learning opportunities experienced by students in poverty, including their exposure to dynamic technology integration in teaching and learning. This study narrates a five-year struggle to impact the digital divide on an urban middle school campus.*

A Tale of Two Middle Schools: Setting the Stage for our Story

To get a glimpse of what is meant by the term "digital divide," one only needs to journey less than 20 miles from our university campus. Travel northwest and you will soon arrive at a public middle school of 600 students, grades seven and eight. Situated in an open, country setting, this school provides students with what can easily be described as a *technology-rich* environment. A hub of 6-8 computers is located in each classroom, with students and teachers using these machines in a variety of ways to explore curricular concepts. In addition, students have opportunities to take courses in computer labs, such as *Web Creation* and *Design and Video Journalism*. The course description for the web creation class states,

> The Web Creation and Design is a class that engages students with relevant assignments that solve real-world communication needs. Immersed in an authentic learning environment, students acquire important communication skills while becoming proficient in project planning and production, graphic and user interface design, JavaScript, HTML and XHTML programming, and more. The class is divided into groups that create real websites for non-profit organizations. The experiences obtained in this class prepare students for the real world. (Anthony Wayne Technology, 2005)

At this school, opportunities for learning with computers are supported by an attentive and responsive district technical staff. Hardware, software, and networks are upgraded and maintained. Teachers are confident that their equipment will be functional when needed.

Not far down the road, however, Ravine Junior High students (about 850 in all) encounter a vastly different scenario. This urban middle school is supplied with one computer lab and 4-5 computers in each classroom. The classroom computers contain a variety of operating systems, some which are 10 years old. The district network configurations force teachers to log on to one server if they need to print, another if they want to connect to the Internet, and another, if they need to access their grade books. Besides these complications, the network itself is often down, leaving teachers and students unable to access software, printers, and the World Wide Web. Because of this reality, some classroom computers are covered with plastic and never turned on. Work orders for various computer-related problems are taped to machines and remain there for months, with no response. Those teachers who do attempt to use the computers are encouraged to use the district's adopted curriculum software package to provide students with individualized practice in key subject areas.

Why are the computer experiences for these seventh and eighth graders so different in public schools that coexist only a few miles apart? What forces are shaping the policies and practices regarding technology integration at these schools? What, if anything, could be done, to make the Ravine experience more equitable? Does it matter? These are the questions we would like to address in the following article, as the process of school restructuring is explored. This study focuses **only** on Ravine Junior High, and the efforts employed to provide students and teachers with increased opportunities to utilize digital technologies for teaching and learning.

Working Toward Reform

Ravine Junior High School is the site of a federal Gaining Early Awareness and Readiness for Undergraduate Programs (GEARUP) grant that brings together resources from Bowling Green State University, the University of Toledo and a range of community organizations committed to change. The reforms at Ravine are based on what teachers and administrators have identified as student needs. These needs have been documented through ongoing and completed action research projects and literature reviews (Bernauer, 2002; Fullan, Bennett, & Rolheiser-Bennett, 1990). The evolution impacting

the digital divide that is documented in this article spans the work done by Ravine teachers, alongside university partners, from 2002 until the present.

The reform work at Ravine is based on the belief that school change and restructuring can be process-oriented. Researchers have worked to identify the key aspects of process-oriented change. Their analysis positions the work that the Ravine Junior High GEAR-UP team is engaging in as part of the range of "new" forms of work emerging: professional networks and school university collaborations which create job-embedded professional development opportunities (Grant, 1997; Guskey, 1998).

Funded through a GEAR-UP grant ("GEAR-UP," 2005), the original grant proposal laid out the goal of the work:

> Throughout what was formerly called the rust-belt, public schools and school districts are struggling with issues of accountability, achievement, standards, assessment, and equitable funding. As educators within public universities in the region, we identify a special responsibility to look at the link between the shifting economic conditions in our cities and the status of our public schools. Our overarching aims are to learn from each other, to offer mutual assistance based upon our experience working for educational change, and to capitalize upon the specialized knowledge that each agency brings to this partnership. (Kretovics, Armaline, & Klonsky, 1998)

A Review of the Digital Divide

While the exact origin of the term *digital divide* cannot be determined (Foster & Borkowski, 2004; Wikipedia, 2005), it has been in use for over a decade. Politicians, scholars, educational leaders, policy makers and activists frequently employ this phrase when addressing issues of empowerment and democracy (Williams & Alkalimat, 2002). These discussions preceded the interest in documenting the digital divide phenomenon through the use of various identifiers, including types of Internet or computer access (both quality and quantity), and available and/or actual uses of these technologies (Angus, Snyder, & Sutherland-Smith, 2003; Attewell, 2001; Moghaddam & Lebedeva, 2004; Morse, 2004; Solomon, 2002).

Access has been traditionally defined as *the right or ability to log on to a computer system or use a computer program*. When focusing on *access,* data is often collected regarding the number of computers present in a certain geographic space (school, library, home, community), the ratio of people to computers, or the number of computers equipped with Internet connections. While the United States, as a whole, statistically surpasses most other nations in these measures, stark inequities have been documented within its borders. Minority and low SES populations have consistently been shown to have less access to technological resources (Gorski, 2002; Hayden, 2003; Norris & Conceicao, 2004). These inequities are present, regardless of the unit analyzed. Be it home, school, or community, the wealthy and powerful, without fail, enjoy the benefits of more computer resources.

Beyond *access*, however, lies the reality of *opportunity for use* in the digital divide debate. Those who collect statistical data on the number of computers and Internet connections oftentimes interpret this information as reflecting progress in narrowing the divide. However, just because computers are present, one cannot immediately assume that they are functional and put to use. Especially in school settings, studies have shown that marginalized student populations receive little or no opportunities to use computer technologies in productive and creative modes (Bull & Bull, 2003; Milone & Salpeter, 1996; Swain & Pearson, 2001). For example, computers used for primarily word-processing or "drill and kill" exercises represent low-end experiences for students. However, computers utilized for more constructivist activities such as research, project development, or collaboration demonstrate challenging experiences for students. Oftentimes, students lacking the most resources receive little or no quality opportunities for use in their school settings. As these practices persist, students are being denied experiences that have been shown to increase their chances for meaningful employment and educational opportunities.

Multiple factors have been shown to impact effective technology integration in schools. The International Society for Technology in Education identifies these factors, labeling them "Essential Conditions" (ISTE, 2009). These include:

- Shared Vision
- Empowered Leaders
- Implementation Planning
- Consistent and Adequate Funding
- Equitable Access
- Skilled Personnel
- Ongoing Professional Learning
- Technical Support
- Curriculum Framework
- Student-Centered Learning
- Assessment and Evaluation
- Engaged Communities
- Support Policies
- Supportive External Context

Obviously it would be extremely difficult to address all of these topics in one study. This research focuses on Ongoing Professional Learning and Technical Support as two of the conditions addressed for digital divide impact. The following paragraphs summarize the Ravine Junior High School's approach in addressing these digital divide issues in their reform initiatives.

As a part of the restructuring efforts of the GEAR-UP team, issues of equity were explored, to determine the most acute student needs, related to supporting students in con-

tinuing their education. From this analysis, the team targeted student access and use of computer technologies as an area of need. The majority of Ravine students are part of low SES and minority populations; as noted earlier, research has shown that most of these students do not have home access to up-to-date computers or Internet services (Bull & Bull, 2003; Gorski, 2002; Moghaddam & Lebedeva, 2004; Morse, 2004). Besides the lack of home technology resources, students did not have a great deal of computer access while at school and were not challenged to use computers at school in a concerted manner.

The conditions at Ravine mirrored the disparities that have been documented extensively, in the past decade, and the term *digital divide* is commonly used to identify these issues. As delineated above, key aspects of the digital divide phenomenon for marginalized populations include limited or no technology access apart from school, limited or no technology access as a part of school and school technology use focused on drill-and-practice applications or word-processing. While teachers couldn't significantly affect student home computer access, they have begun to strategically provide students with technology-rich experiences at Ravine, targeting the latter two elements for change.

Access Defined: Technological Landscape of Ravine

Prior to GEAR-UP at Ravine High School, the school received a grant from the state named "Raising the Bar." The grant provided monies to install wiring and purchase computers, projectors, digital cameras, and various other technologies for the school. Although training and support were offered to staff, two key issues arose following the completion of the grant that caused the application of technology to decrease. The first issue involved teacher turnover. In the core academic areas, approximately 63% of the educators either transferred or retired after Raising the Bar was introduced. This left only 37% of the teachers in the building active since Raising the Bar. Of these 37%, many were 'elder statesmen' who either were unwilling or afraid to incorporate technology in their classroom. Realistically, teachers who remain at Ravine Junior High and incorporate technology in their classrooms represented only 11% of the staff.

While new faculty might have been open to integrating computer technologies in their classrooms, they had many obstacles to overcome. Besides lack of training, the unreliability of their classroom computers was a major hindrance. As identified in the opening vignette of this article, many machines were non-functional. Some lacked the software needed for the learning activities identified. Some were unable to connect to classroom printers or the Internet, because of various district network and server issues. Some would not even "boot up." Work requests to fix these problems could go unanswered for weeks, even months. Teachers learned quickly that they could not depend on their classroom computer systems, and opted to teach without them.

While the units in Ravine's computer lab were more stable, network issues made Internet access a precarious enterprise. The servers were "down" weeks at a time, and when connections could be made, they were oftentimes excruciatingly slow. The district's security systems and firewalls also blocked many of the websites teachers desired to use with their students, so most became discouraged and refused to incorporate Internet use in their lessons. In fact, most teachers would not even attempt to access their school email account, because of the instability and slow connections in the system.

The district's illogical labyrinth of networks and servers further exasperated the teaching staff. For example, Ms. Black may have scheduled the computer lab, as her students began a research project on Greek Mythology. Students were to use their time in the lab to explore several key websites that she had identified and collect information to be used in their final class presentations. For this activity, the technology instructor suggested that students log into the district's App Server, in order to get a faster connection. Once connected to this server, however, students could not save their work to their 205 Server (the server that their classroom computers could save to). They could not print from the App Server, either, as the printing configurations were routed through the District Server. To further complicate matters, teachers could log in with specific identifiers to access their gradebook software, but in this mode could not access the server where student work was stored, or navigate to other applications. If a student or teacher was using the scanner (logged in on another server), the file couldn't be saved in a shared server space or printed. These situations reinforced their distrust and disinterest in incorporating computer technologies in their classrooms.

Interestingly, if data on *access* had been collected at the Ravine site, it would have showed positive growth over the past six years. More computers had been added to the building and in core classrooms. All computers, in the lab and in classrooms, were wired for Internet access. The ratio of students to computers was significantly lower. The district could certainly make the case that issues of the digital divide were being addressed in this school. However, lack of adequate tech support, because of strained budgets in city schools, kept the computer systems in a non-functional state. While schools in wealthier areas continued to have their computer systems well-maintained, this urban middle school struggled to acquire adequate assistance. Thus, students were denied *access* and *use* of technologies that could impact their future educational and employment opportunities. Supporting Ravine's teachers through years of job-embedded professional development has begun to make a difference in these inequities.

Deeply Embedded Professional Development

Job-embedded professional development has been the primary method for combating the digital divide present at Ravine Junior High. This deeply embedded professional development (DEPD) (Fischer & Hamer, 2004) arises from

careful examination in the field of staff development. Traditional professional development opportunities, characterized by one-shot, one-way programs are not effective; these should be replaced with long-term, collegial work. (Hixson & Tinzmann, 1990; Sparks & Hirsh, 1997; Stronge, 2002; Wood & Thompson, 1993; Zimmerman & May, 2003) DEPD requires commitment over time, an entry stance of active listening, and a dedication to the transformation of teachers and reformers into significant partners/equals in the professional development process.

Many professional development efforts are built on the notion that teachers are the only ones who need to improve, and that inservice should only respond to immediate needs. Traditionally, professional development activities have not been carefully evaluated in terms of overall value or effect on instruction (Guskey, 1998). In many urban districts the assumption is that inservice should be district wide rather than focused on the unique needs of a school, that teachers will automatically transfer what they learn into their classrooms without assistance (Wood & Thompson, 1993). However, more recently staff development planners have recognized the need to consider content, format, and duration of participation. Stronge (2002), for example, notes that "high-quality professional development activities….must be collegial, challenging, and socially oriented" (p. 64). Researchers increasingly note that teacher networks and collaborative structures between schools and universities hold promise (Darling-Hammond & McLaughlin, 1995). To that end, the Ravine teachers were charged with the task identifying the path of professional development that would impact the challenges with digital technologies that they faced.

Modules and Other Modes of Professional Development

Professional development at Ravine Junior High, then, has been formulated within multiple constructs of job-embedded, democratic school change. University partners have worked to become "finely attuned to the realities of teachers' everyday experiences and the practical tasks they face" (Fischer & Hamer, 2004). Since 2002, Ravine teachers have identified representatives from their instructional teams to convey their needs and ideas to a professional development committee. These committee members are in regular communication with the teaching staff that they represent; needs and issues are shared and possible solutions are brainstormed. Each summer the professional development committee composed of twenty-plus teachers has met to begin planning the next year. A survey of staff is collected as well as reflective essays from each teacher/faculty participant in the previous year's professional development activities. From the surveys, reflective essays and general discussion on issues and directions for school change the members of the committee begin to generate a list of modules to be offered to the staff. Over the last five years a significant series of offerings have focused on technology use and integration. When describing the purpose for these module 'courses' we identified the main purpose as "to assist middle school educators at Ravine Junior High in looking at their own practice and educational institution." The courses focused on specific modules each with an action research component as a means of inquiry into our own daily experience as educators.

During the 2002/2003 school year our first specific technology module was developed. It was focused on teacher 'tools,' computer uses that were teacher-centered and tied to their daily experiences and work. Software that kept electronic grade books, use of the district e-mail system, accessing the Internet through the district server, and basic PowerPoint were central to the goals of the module. Modules lasted for seven weeks, meeting for two-and-half hours, one day each week. The instructors, including the junior high's technology teacher and three university faculty members, team-taught the modules.

Much to our surprise, the twenty seats available in the school lab for the modules were quickly reserved and we had a waiting list. We had attracted a significant number of teachers to the issue of technology use. Could we begin to increase the technology's use in day-to-day classroom life? Over the course of the module it became clear that participants were interested and willing to learn. The completed electronic files with examples of their work with each tool were submitted at the end of the course. At the same time, they began to critique the technology in their building, and share their frustration and struggles to use it and keep it working. This significantly increased the number of times classroom academic teachers were calling on the technology teacher to help fix something, submit a work order for equipment, or access lines that were not working. The winds of change were beginning to blow.

During the 2003/2004 academic year the professional development committee agreed to offer a second section of the tech tools module now to be called Tech 1. We also agreed to begin developing a second module called Tech 2 that would shift the focus from teacher tools to teacher use of technology with students. Tech 2 encouraged teachers to ask "What computer software or Internet research skills might be utilized by students?" and "What did the International Society for Technology in Education (ISTE, 2004) standards and Ohio Academic Content Standards in Technology ("Ohio academic content standards for Technology, " 2004) outline as goals for teachers and their students?" These questions became the focus of our second module. The following table iterates the topics for both modules (refer to Table 1).

As a part of the technology workshops, teachers were challenged to complete a lesson *in their own classrooms,* rather than the computer lab, that integrated computer technology. This lesson had to address specific curricular goals, as well as a component of the National Educational Technology Standards for Teachers (NETS-T) (Kelly, 2002). In this way, students experienced digital technologies that supported their learning, and also developed their technology skills. Teachers showcased these lessons at a celebration event in the spring, displaying posters, websites, and video that documented

Table 1
Tech Module Topics

Agenda for Technology Module 1 'Teacher Tools'	Agenda for Technology Module 2 'Technology and Curriculum'
Making the Grade (2 Sessions) GradeBook Section 2nd Session – Lab Time Accelerated Reader (1 Session) Internet & Email (1 Session) Training on email, search engines, Boolean logic Using Digital Cameras in the Classroom Microsoft PowerPoint (1 Session) The 4-6 Computer Classroom *Others, as requested by the participants (Examples: Microsoft Excel, Advanced PowerPoint)	Smart Boards Webquests Day One: Introduction & Research Day Two: Build a webquest. Making the Grade Advanced Options Standards/Distance Learning Standards (ISTE & Ohio) Distance Learning Tech Project (2 Sessions) Participants will create their own project to use with the students *in their classroom.*

their technology integration success stories. The excitement generated through this sharing of their accomplishments in technology integration became contagious, as other faculty members became interested in designing lessons that included technological components. They looked toward the next school year, and challenged themselves to increase student experiences with computer technologies in their classrooms.

Digital Storytellers

Ravine teachers were introduced to the concept of digital storytelling when a team from the Center for Digital Storytelling (Lambert & Mullen, 2004) in Berkeley, California visited the school in January, 2004. This team was invited after a few of the Ravine faculty had experienced a digital storytelling presentation at a nearby university. These teachers wrote a mini-grant proposal to fund the short residency. The visitors worked directly with a small group of students and teachers in creating digital stories that combined written and recorded text with still images and music. Teachers began to see how students could become media makers, expressing their thoughts in new and powerful ways. When the Digital Storytellers departed, faculty began brainstorming ways to get the equipment and tech support needed to provide these types of media-writing opportunities for students. Several wrote grants for laptops and digital cameras, while others lobbied for additional training. From these efforts, and in conjunction with the technology modules, a professor in classroom technology began to work with teachers and students in the area of digital storytelling.

During the 2004/2005 school year, in an effort to facilitate the teachers' implementation of expanded technology use, the technology professor (Dr. B) who had worked with them during the previous semester committed one full day each week to Ravine. Dr. B spent every Tuesday at East Toledo Junior High, co-teaching with teachers, as they explored new ways to support student learning through the use of computer technologies. She assumed the role of "Jack of All Trades," and relied on the teachers to identify the projects, software, and technology needs of their classrooms. In addition, Dr. B worked as a liaison between the teachers and district tech support staff to communicate issues related to technology integration.

These "Technology Tuesdays" served to keep teachers encouraged, as they struggled to use equipment that was still unreliable and outdated. Teachers began to check their school email accounts, since Dr. B used the system to communicate with them about tech plans and problems. They were sometimes rewarded for these efforts with blank CD's, technology magazines, or pieces of chocolate. Various student projects were shared via email and posted on the website developed by Dr. B to celebrate the progress being made. And when teachers just didn't feel like being positive, Dr. B served as a sympathetic ear, listening to the frustrations of those faced with downed networks and faulty printers. Over time, equipment was serviced (at least some of it) and students were offered increased access to technologies in the building. Currently, several teachers, as well as the school principal, have transitioned into these roles of informal technology support, providing teachers with daily access to encouragement and hands-on assistance for technology integration.

Some of the projects Ravine students and teachers completed, with Dr. B's support, are listed in Table 2. These projects represent a shift from little use of computer technologies in the classroom to creative and powerful uses of digital technologies in the classroom. While these projects were completed in the 2004-2005 school year, these ideas have expanded and morphed into additional digital technology activities continuing into the 2007-2008 school year.

As teachers began sharing their ideas and experiences in using classroom technologies, those who had not specifically participated in the yearly workshops also became more vocal regarding technology integration in their classes. During the 2005-2006 and 2006-2007 school years, several Ravine teachers spent time offering updated technology sessions on using district resources such as United Streaming (a media database) and student email. The school building committee members, as well as the principal, have encouraged the efforts of teachers to continue to explore and implement various technologies. Teachers also eagerly provided tech support to their colleagues, helping to offset the frustrations of downed

servers or lost printer connections. The Ravine staff identified tech-savvy students that were able to assist them in keeping the computers up-and-running. Access and use continued to increase, as communication about technology integration and comfort with the technologies available spread.

DEPD Impact on the Digital Divide

As a result of their continued professional development regarding computers in the classroom, teachers evaluated *access* and *use* issues related to educational technologies in their building. Just a few years ago, lack of school computer access for students was apparent at several levels. Early on, computers were not physically present in most Ravine classrooms, but as various state initiatives provided the hardware, other issues of access emerged. Many classroom computers were not reliably operational. Connections to printers and the Internet were sometimes non-functional for months, needed software was not installed, and "mice" were constantly unusable because of student removable of the mouse balls. Even if these issues were resolved, many teachers did not work to provide students with activities that allowed or required the use of the classroom computers. Thus, students had little access.

Change Over Time

Now, as teachers have become more concerned and vocal about using computer technologies for teaching and learning, local tech support is improving. While issues still exist, most classrooms have machines that boot up, connect to the Internet, and print. The increased attention to technologies by teachers and their GEAR-UP university partners has resulted in some positive interest from the school district's technology staff. In addition to getting the computers operational in the building, student access has been improved as teachers plan lessons that utilized digital technologies on a regular basis. The interest and expertise now evident among the leadership and staff at Ravine insures the sustainability of the work, even as GEAR-UP grant funding is coming to an end.

Previously, most of the experiences students did have with the computers only incorporated drill-and-practice type software or word-processing. This limited use of computer technology for marginalized populations has been cited as a major source of inequity, when compared to more privileged student groups (Gorski, 2002; Milone & Salpeter, 1996; Morse, 2004; Swain & Pearson, 2001). The need to balance drill and practice activities with rich technology experiences requiring higher-level thinking was apparent. As teachers identified and pursued a course of action to address this digital divide issue, more creative uses of computer technologies have been integrated into their lessons.

Teachers at Ravine Junior High, supported by the GEAR-UP team, have begun to provide their students with what Gorski (2001) would identify as "equality in access" and "equity in opportunity." Efforts to make computer hardware accessible and functional in most classrooms, as well as the computer lab, have provided students with more hands-on technology experiences in school. DEPD has allowed teachers to direct their own professional growth in the use of digital technologies for teaching and learning. Because of this, students are being challenged to use computers in "intellectually exciting educational experiences" (Becker, 1992) that parallel experiences shared by most non-marginalized student populations. The process has been slow, and many frustrations have been encountered along the way, but the evidence is clear. The digital divide can be bridged, or at least narrowed, as

Table 2
A Sample of Technology Integration Projects at Ravine

Digital Video	The creation of a 10-minute digital video about Ravine's summer experience for incoming 7th graders
Web Design	An academic team's website containing webpage resources for all content areas
Webquests	A Webquest for a Unit on Greece
Smartboard	Incorporating the Smartboard in various units of instruction
Digital cameras and digital audio	Digital stories created in language arts classrooms
Digital cameras and DVD	DVD creation targeting the Elements of Art in an art classroom

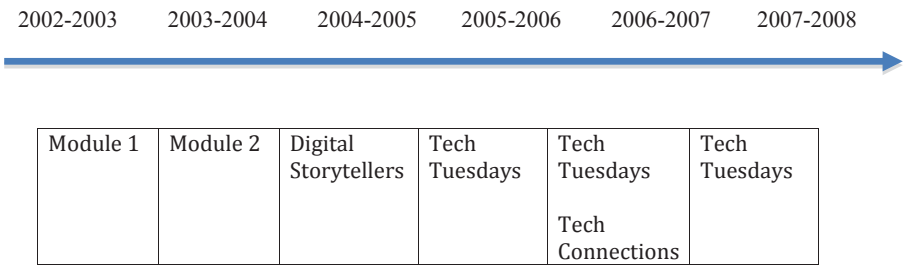

Figure 1. Ongoing Professional Development & Technical Support

educators continue to challenge themselves and their students to integrate digital technologies into their curricula.

Implications

Districts, and the schools in them, face many competing policy decisions as they work to improve academic performance. In the area of technology, school district personnel must make choices concerning the purchase of hardware and software, what type of networking systems to provide, what type of access to the Internet will teachers and students have, and, based on this study's findings, what ongoing professional development and technology support will be provided to the instructional professionals at the point of instructional use.

It is clear from this study and ongoing data collection that one or two courses—the quick and dirty 'how to' workshops, are a starting point but not sufficient for deep technology integration into the teaching and learning process. Five years working with Ravine Middle School have told us that overcoming the digital divide takes:

- Initial hardware and software purchases—the technology must be present
- Circularity—workshops focused on training teachers on best practice software and hardware and then making that hardware and software present in their instructional environment
- Develop teacher interest and desire (intrinsic motivation) to apply technology knowledge and skills through explicit classroom and curriculum-based support and professional development
- Ongoing technology support—significant, one on one support that trouble shoots and builds confidence and skills
- Deeper professional development for those ready to move beyond novice uses of technology over time

We are ever aware of the enormous implications and the impetus to dismantle the digital divide (Gorski, 2002). And aware of the struggle to provide urban yo eople use of technology that is creative, and generative (Bull & Bull, 2003; Gorski, 2002)Ultimately, this study has shown that overcoming the digital divide is possible. Time, dedication, money and respect for the lives of urban teachers all being essential to the future impact of technology in schools that find themselves on the short side of that divide.

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