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Full Length Research Paper

Initiating technological and pedagogical shifts in low achieving urban minority classrooms

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This study explored the introduction of multi-modal teaching strategies alongside technology implementation in high poverty schools. Teachers were provided with scientific tools, simulations, and teaching stations and provided with training and opportunities to practice teaching strategies developed in conjunction with special education and literacy experts. Teacher interviews, classroom observations, and student focus groups comprised the bulk of the sited data supplementing the student achievement scores and pre and post content tests administered for each unit. Findings suggested not all teachers incorporated multi-modal strategies into lessons incorporating technology and that lower achieving students interpreted lessons quite differently than their teachers in these contexts. Implications for ways technology implementations may explicate emerging literacies are discussed.

Key words: Science education, technology, multicultural, urban, teacher education, reform

INTRODUCTION

Research has identified many specific pedagogies and innovations for science teaching that increase student engagement, are aligned with National (NRC, 1996) and NYS science standards and increase student achievement (Crawford et al., 1999; Lee and Anderson, 1993; Newmann, 2003; Songer et al., 2002; Tobin et al., 2001). Among the most recent are multimodal technologies and multidimensional approaches to develop diverse students' understanding of science concepts. These include but are not limited to students' joint construction of knowledge composing understanding through digital videos, hands-on/minds-on developing literacy strategies, and learning to appropriate science discourse.

The learning of science content is challenging when presented only as abstract concepts conveyed primarily through text in typical science textbooks. It represents complex set requisites that are challenging for all students, especially for those with disabilities, who often see science as a random, unrelated collection of concepts and facts (Aikenhead, 1996; Carnine, 1989; Lemke, 1990). Research has demonstrated that designing science instruction to meets the needs of a wide range of wide range of learning abilities is best done by expanding to multi-dimensional science instruction that includes the use of (a) multiple methods of presenting science content, including multimodal ones; (b) multiple means of motivating and engaging students in learning activities, including technological ones; and (c) multiple ways for students to show mastery of content, including through digital multimodalities (Cawley et al., 2003). Moreover multidimensional strategies which build age-appropriate conceptual understanding for middle-grade students includes computer simulations, investigations, projects, hands-on activities, video, role plays, demonstrations, games, and written and oral presentations. These are demonstrated in a variety of contemporary national curriculum projects including: Science Education for Public Understanding Project (SEPUP, 2007), and Investigating and Questioning our World through Science and Technology (IQWST, 2007). Through inquiry projects such as these pedagogical and technological recommendations are woven together into specific lessons intended to promote both National and State Science Standards.

In the 1990s, cognitive psychologists began to study collaboration and the role of social context in learning, while educational researchers began to study collaboration in school settings (Sawyer, 2006). Since that

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time many authors are touting approaches to learning which emphasize a social network approach as an approach to building science expertise through learning communities (Griffin, 1994; Pink, 2005; Rodriguez and Kitchen, 2005). This study is an examination of promoting such an approach with teachers to embrace this new approach and attempt to shed on limitation of more traditional approaches to teaching science. We argue it is difficult for new teachers to initiate changes to a 21st century model of teaching unless there is evidence of buy in and alignment of vision at all levels from students through administration. We further argue that without such shifts in wholesale vision, technology implementation in classrooms will live up to critics' view of technology as an underwhelming development for modern classroom instruction (Mehan, 1989, Cuban, 2001; Oppenheimer, 2003).

The purpose of this study was to examine how teachers effectively integrate technology and inquiry-based teaching into their science lessons in an urban junior high school. It was expected that this study would ascertain the best practices that could be duplicated throughout classrooms to increase student achievement. To examine our project outcomes and impact on classroom practices we asked the following questions:

1. How do teachers of urban students interpret inquiry oriented teaching strategies steeped with the implementation of technology?
2. What aspects of urban school contexts limit the effectiveness of technology implementation and teacher professional development?

REVIEW OF LITERATURE

Wenglinsky (2002) argued the effectiveness of learning tools is more contingent upon the quality of the content being taught than it is on the medium used in teaching. His work used multiple and various teaching strategies in the classroom. Wenglinsky showed that teachers who used the technology in their classroom for things such as inquiry and similar problem solving probes had students that performed better than those students whose teachers used no technology, or who simply used it as a memorization tool.

The National Assessment of Educational Progress [NAEP] (2005) demonstrated the need for an increase in scientific knowledge for urban students as the gap with their non-urban contemporaries continues to grow. This report indicated that this need may be due to many factors including both (the lack of) technology in the classroom and (the absence of more) effective teaching strategies. In late 2006, science test scores were released from the 2005 science test administration by the NAEP. These results clearly demonstrated that, nationwide, urban school districts were underperforming at both the elementary and intermediate levels. Using a 300-point scale, the mean score nationally at the elementary level was 149. The highest urban score was 147. In eighth grade, the top urban score was 144 while the national average was 147 (Cavanagh, 2006). The federal government made an effort to lessen this achievement gap in 2001 with the Enhancing Education Through Technology (EETT) Act written as part of No Child Left Behind (NCLB, USDOE, 2004). The goal of EETT was to create students with technological literacy by the time they reached high school. This would be accomplished through significant teacher training and with local and state curriculum modification. According to the National Center for Education Statistics (NCES), 98% of all public schools and 77% of all instructional classrooms had some type of Internet access (NCES, 2001). This is up from 50 and 8%, respectively in 1995. Now, many years later, those numbers have certainly risen. This has brought about scrutiny into the availability and usage of technology in schools, the equity of such, and the foundational structure for the use of technology in a given district, building, and classroom.

With the coming of the computer age and the increased prevalence of technology in our society, we see a growing gap or a 'digital divide' that exists between populations in terms of access to information and communication technologies, literacy skills and the availability and accessibility of high quality, relevant content; and importantly, opportunities to produce it. Given the poverty levels found in most of the larger urban centers in America, the divide is growing by the day. The most glaring statistic with regard to science education comes from the 2000 NAEP which reported that 8th graders who were eligible for free/reduced price lunches obtained lower scores in 2000 than in 1996, while the average scores for students who were not involved in the free/reduced lunch program increased during the same period. A tremendous disservice is being thrust upon those who so desperately need assistance. When looking at the effect that this has on science education in the urban setting, a new term: the 'pedagogy of poverty' (Haberman, 1991), becomes clearer. Such a characterization of teaching strategies refers to the increased frequency and intensity of power struggles in the classroom played out through directed and limited lectures, directives, and basic control-oriented management of children narrowing content learning to disseminating factual information through didactic means. The net result of such practices erode the collaborative work in the science classroom: an integral part of the inquiry and student-directed learning called for in much of current science education reform (NRC, 1996). It is an unfortunate, yet seemingly perpetual, cycle of teaching in the inner cities of America (Fordham, 1996; Kozol, 1995).

The cynics would argue that an increase in the availability of technology does not guarantee, nor even imply, that the technology is useful or even being used. Larry Cuban's 2001 book *Oversold and Underused* and Todd Oppenheimer's 2003 book *Flickering Mind* are two indictments on the major investment America has made in technology on behalf of schools. Both argued that there is no significant student-centered learning occurring, even when computers are being used as a tool in the classroom. Rather, the computer is simply an alternative method for students to learn a concept in a narrow, directed, traditional, and didactic fashion.

Our intent was not to fix problems in urban science classrooms through technology, but rather provide the teachers with tools that students have responded to in other educational settings and give teachers different strategies for engaging children in science. Consistent with the literature we emphasized practices not tools. Through substantive professional development and pedagogical shifts, the implementation of technology in these low achieving classrooms may turn around a school in need of an academic lifeboat. We examined how 7th and 8th grade science teachers who are provided with professional development opportunities from our research team effectively integrate both the technology that was purchased for them and inquiry based teaching into their science lessons. The planned professional development was rooted in deepening teacher's knowledge about the integration of technology, linking this to practice, providing professional support, giving opportunities for reflective practice, and finally connecting practices to student achievement. Over the course of this project, the professional development that was provided consisted of a focused, coherent program that provided ongoing support to science teachers.

During the sessions, teachers actively engaged in hands-on training in an integrated multimodal and multidimensional model approach to teaching science with cutting edge technologies to develop deep conceptual understanding. Teachers were also introduced to a research-based, integrated approach to using new technologies for the purpose of enhancing the science literacy and conceptual knowledge of the adolescents involved. In addition, the participating teachers were provided with in-classroom mentors for 4 to 8 h weekly. These were graduate assistants (GAs) who were science education content and pedagogy experts. GAs assigned to assist teachers' integration of the multi-modal, multi-dimensional model (M3) strategies into their instruction. Bi-weekly school-based meetings continued the support for integrating new technologies into teaching and learning. The responsibilities of the embedded coaches and the science technology support teacher included: 1) Coach teachers on effective integration of the technology components into the science curriculum through just-in-time right-at-hand support; and 2) Collaborate with faculty and graduate assistants in professional development for teachers in the use of the classroom multimedia equipment for multimodal, multidimensional strategies.

METHODOLOGICAL DESIGN

The methodological stance our research team took toward viewing the problem of technology implementation was one of ethnographic inquiry, which by definition is "intensive empirical investigation of everyday lived cultural reality" (Foley, 2002). Ethnography is a naturalistic approach requiring careful study of people in context to explore and understand everyday actions and interactions and and their meanings (Van Maanen, 2006; Zussman, 2004). It generally relies upon prolonged periods of fieldwork and it draws upon a wealth of rich data rather than relying upon a single source. Those included in this study are participant observations, in-depth interviews, and artifact analysis. Our research team developed a "thick description" (Geertz, 1973) of a particular setting (Agar, 1996; De Laine, 1997; Savage, 2006; Wolcott, 1999) into which we had immersed ourselves for a period of two years.

Part of our data came not only as a result of observing but actually involving ourselves in the teaching and implementation of technology alongside the teachers of our grant. It is described as a tradition of workplace ethnography that uncovers the complexities of knowledge drawn upon in context. In contemporary ethnography, reflexivity about the researcher's own positionality forms a significant element of this descriptive account (Madison, 2005; Skeggs, 2001) and the researcher's reflexive abilities, through direct participation: "laboring side-by-side workers in their natural settings" (Smith, 2001) allows them to translate beliefs and practices into explicit forms of shared knowledge. Observing the context of practice also highlights incongruities between what people say they know or do and what they actually do; and this brings into focus the relational processes of knowledge co-production. In educational contexts this is particularly important since there has been such a large quantity of educational research demonstrating the inconsistencies between what teachers professed beliefs are and enacted practices (Parke and Nugent, 1997; Czerniak et al., 1999).

Data collection

This project is two-year collaboration between a state-funded public university and its local urban school district, and was funded by a large regional grant. Science teachers who worked in schools that had been identified by the district superintendent as being in the greatest need of academic improvement participated; that is to say schools which had the highest percentage of children living in poverty and the highest percentage of students scoring below the state standard for science achievement.

During professional development sessions held on Saturdays and after school and in a 5-day summer institute, teachers were actively engaged in hands-on training in an integrated approach to teaching science. Teachers were introduced to a research-based, integrated approach to using new technologies for the purpose of enhancing the science literacy and conceptual knowledge of the adolescents involved (Becta, 2007; Cawley et al., 2003; Speitel et al., 2007; Smith, 2001; White and Smith, 2005). Fifteen 7 to 8th grade science teachers participated in this study which was a subset of a larger data set. To construct an early account of our effectiveness, we invited a subset of teachers to participate in this initial study. What is presented is research data collected only from teachers who agreed to participate in this early evaluation.

Data sources

The need to elevate the study of science in poor urban districts has never been greater. Like many schools in the current national fiscal shortfall, the district of this study suffered cutbacks, limited resource purchasing, few incentives for teaching excellence, and other morale lowering factors. During the timeline of this study, budget issues drove financial and professional support down. Despite consistently low science achievement scores, professional development in science was limited to a few sessions per year which were offered during the district's conference days. Thus, in this economically and emotionally depressed environment, urban science teachers are often left with few coordinated opportunities to strengthen their science instruction and the result is a teacher's lack the necessary pedagogical and technology skills which in turn results in major gaps in student competency between fourth and twelfth grade. However, the select group of teachers we worked with did not suffer as much as their peers. Each was fitted with over $20,000 of science teaching equipment, strategies, and more than 35 full days of training. The tools implemented during the course of this study included brand new Macbook computers, Pasco probeware, and Promethean Interactive Whiteboards. Teachers were introduced to multiple teaching strategies during nearly dozens of hours of professional development. Within the framework of these teaching strategies were included the training on how to use the tools as well as the best practices associated with each product and software application package.

For this study, videos of teachers' instruction, teachers' notes and lesson plans, as well as both formal and informal interviews with the teachers were collected to develop a deeper understanding of their approach to their students. As part of the formal interview process, protocols were developed by the research team, and the specific questions were asked of each teacher. There were questions asked of the teachers regarding their use of technology in previous years prior to the implementation of technology during the lesson of the teachers' choosing. After the lessons were completed, post-interview questions were asked in an effort to ascertain teachers' views on the relative effectiveness of the technology. Field notes kept by the participant observers were also used in data analysis. Finally, student artifacts were kept and used as a tool to demonstrate the learning that was taking place in the classroom. All data were transcribed from pre and post teacher interviews, classroom videotapes, and the informal teacher interview.

Data analyses

The data collected, including formal and informal teacher interviews, daily field notes from observations, student interviews, and artifacts, provided a bounty of rich information which was archived and coded after collection. Axial coding was useful in organizing data and assigning meaning to the various events. In turn, these codes were then assigned to one or more research questions as appropriate. As Spradley (1980) noted, analyzing a specific question around data that has occurred repeatedly allows the researcher to create domains of knowledge around that activities. In addition to coding the transcripts of interviews surrounding the teaching events conversation, we cross-checked field notes with interviews, artifacts, and observations from classroom activities. As described in the research design, it was important to deeply immerse ourselves in individual cases before attempting to work across cases (Stake, 2006). The phases of analysis allowed for that rich and fluid interaction within the data. This process focuses connecting individual case findings to the original research questions and then generating cross-case assertions that work towards answering the larger goals of the study (Stake, 2006).

FINDINGS

Case 1: Scott the student advocate and role model

This case study focuses on two teachers who have actively participated in this grant. Now a 16-year veteran teacher, Scott was reluctant to enter the field. Scott wants to convey to his students the necessity for science in their education and enrolled in the grant to improve the opportunity in science for his current students. "Science is everywhere; in their homes, while they're cooking, and watching television," he shares. "They are not yet keen on the formal basis of science, but they are getting there." However, when Scott was asked if he wanted to be a science teacher all his life and his response was an emphatic, 'No.' A positive force in his life led to his career choice as a science educator. "A fraternity brother was a principal out of state," he recalled, "and said that because there was such a shortage of African-American males in teaching science and math that I should consider it". After being a substitute teacher for some time, Scott received his certification and thoroughly enjoys his occupation. He has been the science educator at Hope school for the past four years, and has already taken on an administrative position in his building. "They put me on as assistant principal when our usual A.P. is at a meeting or not here," he smiled. "With that, my colleagues have come to expect me to lead many activities including our upcoming field trip, I do it happily because I feel if I put in that extra time and that extra effort and help them then they will help me in the classroom because they will know that I care about them and in the classroom they will respond to me that much better now. They will say 'okay, he volunteered his time and he gave up his valuable time and helped us so we are going to help him out.' And they do, they respond to me like that". His biggest challenge at this stage in his career is the paperwork. "The paperwork that comes from the office – there is a lot of record keeping – way too much, in fact. I have ironed out a lot of the other stuff - planning is the key," he nods. Continuing, "If you have good planning skills, teaching works itself out". In the same thought, Scott shared that "some kids come in and they are very low, but I am able to make science interesting and they pay attention; in fact, they do better in science than pretty much all the rest of their classes, so that is what it is; come in every day, I perform, and they learn".

This performance came with very little in the way of equipment and technology at his disposal. In fact, last academic year his equipment was limited to microscopes, an overhead projector and a balance scale. "We had computers but there is so much standardized testing going on," he sighed, "it was pretty much the whole year and there was only one computer lab. We got into it maybe twice". This is not uncommon in a district that recently switched from one computer platform to another, and there were many growing pains for students, teachers, and technology integrators alike.

During the era of NCLB, many educators complained of both the quality and quantity of district directives with regard to what must be taught, what the classroom should look like, and so on. Scott has received no such directives, aside from a pacing guide from which he is not supposed to deviate. What really is troubling, however, is his classroom setup in what is a relatively new lab. “I really thought that teachers should have had a bigger input in how the classroom was designed. I walked in and thought, ‘Wow!’ It does not seem like they really asked any teachers how this classroom should be designed. The board space is all the way to the front, so it pushes the kids all the way back and I am thinking, “why the board space was not this way? (as Scott points to the ‘long side’ of his classroom where all of his cabinets are located)” If it was here, the kids could see and it would have more impact on their learning. Obviously they thought they knew how the classroom should look. I do not know where they get it from. The district does not ask for input; my principal does, and she keeps me in the loop about a lot of things.

Scott envisions his ideal classroom as very student-centered, as he shared that “there is a lot of student work evident, and the students pass information back and forth, having a good open discussion with lots of feedback. There would be a lot of high technology in the classroom including computers for students to explore science”. In that same vein, Scott noted the usefulness of interactive white boards in his classroom, “I really love them, I can do everything on them, and demonstrations are excellent. It also helps with hands-on activities in the classroom and students actively exploring science and learning about their world.” This is something that simply could not take place with a textbook alone. Scott was preparing his students for the rigors of high school science and beyond. “The one big idea I want them to leave with is that they can achieve and they can succeed if they put their minds to it. Whatever they want to do in life, they can reach those goals if they work hard and do their best”. Scott shared a story about a recent technology-based project in which his students did exactly that.

This is a SURR building: a school under registration review. Basically that means we are designated as a low achieving school in ELA and math. So now the kids follow a ‘model B’ format for their classes where they have two hours of ELA, two hours of math, and science and social studies pretty much take a back seat to that. Art and music are basically out of the car’s back seat. In this project using digital video cameras, it gave the kids a chance to be creative, it was an opportunity to do something that was out of the construct of the strict ELA or math program they are held to. This was an excellent opportunity and they really liked it. In the post-project assessment, Scott had a chance to read and reflect about the job he did as the teacher; and more importantly about the learning that took place for his students. The great thing about this was that the students were working together, and in Scott’s words, “that is a great thing because a lot of times the students this age have problems doing that. These kids memorized their lines and did their research, and we’re talking about students who sometimes have difficulty retaining definitions for their vocabulary, but they did an excellent job”.

There is an obvious disconnect from Scott’s classroom to the district level administration. “I would tell them they would have to definitely come in and talk to the kids and observe the kids and that is pretty much how you’re going to find out about how they are learning and how they are not learning”, he sighed. “You are going to have to come to the trenches and actually observe them and talk to them for themselves”. We see Scott talking to his students daily, and on a personal level. His students respect him for it; they respect him for the fact that they are not numbers on his resume. Unfortunately, Scott sees his district in a different light as he shared that, “on paper is one thing, how they are scoring, you know, item analysis, all that good stuff. That is good but I do not think they will have a clear picture until they actually come to the classroom and meet the kids who are performing. The administrators need to be reflecting on that data. They need to come to the classroom and see the kids for themselves and observe how they are learning, how they are not learning and talk to them”.

Summary

Scott was an enthusiastic science teacher in the classroom for seemingly all the right reasons. He was an asset to the grant, an encouragement and had strong connection with children, and thought to be a leader in his school as he was asked to become and Assistant Principal. One would imagine that strong connections to students and to visions for better science that Scott would be making a big impact on the implementation of technology in science teaching at one of the poorest performing schools in the region. Yet, Scott found that the emphasis on testing at his school under NCLB policies compelled the current administration to book teachers back to back in the limited computer lab space. Teachers used the limited available technology to testing and reviewing for the State exam. Teachers who did not understand technology as an opportunity to transform teaching operated as Mehan (1989) and others (Cuban, 2001; Oppenheimer, 2003) have been described as accommodating new technologies into old cultural practices. Scott was unable to get support from the district for his Apple computers. The Windows mentality of pushing a single image, locking out other platforms from the network, and purging each machine from all media artifacts kept Scott’s students from creating the media assets he needed to compel his peers to follow his lead. The cuts went so deep as to minimize contact of teachers to tech mentors to over 400 to 1. The only access Scott’s peers could get to technology experts was used for emergencies, not transformation of teaching. Hence, Scott eventually left the classroom and became an administrator where he could advocate for his kids in other ways.

Case 2: Robyn the familiar stranger

Robyn is a veteran teacher, despite teaching in this urban district for 2 years, whose preferred content area is social studies. Robyn is a native of this neighborhood and school as she grew up in this community and went to school at the place where she is now employed. “It is so different now,” Robyn laments. “We used to have activities for kids all the time. Now it is just tutoring, after-school social programs, skills, and testing. There is no place for kids to just enjoy themselves at school anymore. The school is locked up before and after and during school it is just all business: teaching and testing”. She readily admitted that she went back to college at age 36 primarily to make herself employable. “I knew that science was in greater demand, and I wanted to have a job since I went back to school late in life,” she tells me cheerfully. “I did not know exactly what I was going to pursue, but I am glad I selected science, and I enjoy it”.

She arrived at Westlake school at the last possible moment; the first day of classes she was informed of her assignment. It is a typical practice in this large urban district. Teachers are treated rather unprofessionally as they show up to the district on the first day and shipped off anonymously to one of the most difficult teaching assignments in one of the poorest performing schools. There was no time to develop a rapport with her students from previous years as there was nothing upon which to build. She was not given the opportunity to create cross-curricular relationships with her fellow junior high teachers as they were meeting for the first time. It was as though she was given a puzzle to solve without any instructions as to the rules of that puzzle. Further, this feeling of being removed and separate from her colleagues within her building permeates to certain aspects of the grant as well.

Robyn is vexed by her lack of ability to connect to students showing up to her old school. “When I went to school here, there were a million things to do!”, She continued, “we had a talent show, we had band and cheerleading, athletics, a basketball team, all those kinds of things. There is definitely a big difference now”. While she wants to quickly reconnect to the culture of the school through activities and the social and cultural lives of school, the school seems to isolate the parents as much as the teachers from the daily grind. But the administration insists they are going to initiate a program in this school in the coming months, but Robyn is not convinced of that. “Going to start? When? The middle of December or perhaps winter vacation?” Frustrated, she continued, “It seems that we ‘catch-up’ to things. I do not know if that is a reality in all parts of the world, and I do not want to be negative either, but it seems to be a bit of an issue here”. Robyn entered the grant at a late date and works hard to make up for the 8 days of missed training over the summer. She has received the same equipment as the other 14, but feels separate and alone relative to her colleagues. She was not welcomed at the summer training due to a district policy regarding professional development for non-probationary teachers. The need to elevate the study of science in this district has never been greater. During the past 3 years, due to budget issues among other things, and despite consistently low science achievement scores, the formal program of professional development was limited to sessions offered during district conference days. As a result, teachers have been left with few coordinated efforts to strength their pedagogy.

Isolation is representative of teachers in the district. It is a feeling shared by teachers resulting from years of deskilling teachers (Cusick, 1973). Phrases like “socio-economic status” and “diverse children” are fancy phrases given to cover up the directives to teachers to stay on the prescribed curriculum guide using didactic measures so that scores can be targeted and tracked. A victim of last minute shuffling in the district, Robyn is a typical story of the new guy on the block. The district known for closing schools and reassigning teachers because of failure rates of urban minorities targeted by millions of dollars of aide monies. It is not uncommon for teachers to find out only the night before the academic year begins where they have been placed. There is a high turnover rate at the junior high level in the schools that have been given a failure tag by the State Department of Education. Despite the obstacles and isolation she faces, optimism exudes from her descriptions of teaching in her class. “I have the ideal classroom,” she explains as she looks around her room with bare walls and empty cupboards. She admits to needing “only a few more glass beakers.” She is pleased to have sinks available for her chemistry labs along with plenty of storage space for student journals, books, and other items. Her only wish, she explains is “to have cozy chairs like they have in some science departments, with laptops for the students”. Robyn hopes to improve the image of her school and the district in the local media. “It seems like I sort of stick up for us even if I think we are wrong,” she says sadly when discussing the challenge of how she is represented in the city newspaper. “I feel like the criticism is so biased, I do not even want to look at it”. Robyn has noted her students generally come from a lower socio-economic status than she did when she attended the same school many years ago. “The group of friends I hung out with had more of a range of financial background”. She recognizes that this results in a different student which in turn results in different challenges; some better, some worse. “I do not think I have a totally preconceived idea that these are all poor kids and I felt sorry for them,” she sighed, “but I do think there are cultural differences and I am still examining my perceptions on a regular basis”. Robyn struggles to maintain order and the attention of her students. She readily admits that her biggest challenge is classroom management. “Probably my biggest challenge is keeping the atmosphere the way I want it to be, that is, positive and healthy,” she says. “I think sometimes the behavior management is a challenge too because of the cultural differences between us; I am the little old white lady,” she sighs. “I have got to be careful because I do not want the perception to come across that it is racist even thinking that to myself or expressing that to my colleagues”. Robyn’s classroom has become a dumping ground for English Language Learners (ELLs) as she has over 5 different languages present in the immigrant population that is attending her class. She has only one ELL support staff at the school who speaks Spanish who is quite unable to help with the Asian refugee population. Robyn is welcoming and positive but ill-equipped to assist in teaching science to children of other language orientations. Robyn wants her students to understand that they can answer the ever-present question of ‘why do I need to know this’ themselves. “I believe science is in everything, and I try to have that as a basis of my thought process any time I am planning a lesson. I wish I was doing more (outdoor) stuff so they could really see that science is in their neighborhood”. She described her role in the ideal science classroom as being the coach instead of the sage on the stage. “The one thing I would like my students to take from this class,” she says, “is the wonder of the natural world around them, but probably even more so that they are valuable, that they are important. What comes with that,” Robyn adds, “Is specifically the responsibility to themselves to take care of that world around them”.

Summary

Robyn is a teacher ready for change, ready to learn, and open to new ideas. Her problem is that she has been dutifully placed as a new teacher in a context where she has the least support or leadership to make change. There is no school emphasis on connecting teaching to community understanding. There is no professional development to support teachers’ growth in understanding the changing culture of the school. Robyn has repeatedly asked for assistance and the district continues to send people to her classroom that tell her to simply follow the curriculum guide and hand out the prescribed worksheets.

Technology cannot be expected to transform environments where teachers are struggling to understand the students who are arriving to their classrooms. Ironically, Robyn should be one of the most connected to the local culture, yet she feels herself a stranger as things have changed so much. With urban districts competing for achievement driven funds, literacy in the strictest and driest sense of reading skills and decoding is the language spoken. The only rewards and penalties associated with teacher performance at Robyn’s school are connected to specific reading scores and standardized outcomes. Technology in this context is subjugated to presenting knowledge, testing received knowledge, and monitoring individual student progress through standardized testing. It is not just the professional development, the technology support that Robyn is requesting or what she believes her students need. Yet isolation from her colleagues and control exerted by the administration continue to keep technology from changing the learning culture which Robyn believes is vital to reaching her children.

DISCUSSION

The results of our research revealed much about the views toward technology and teaching of two very different teachers in an urban middle school science classroom. Teachers were different in: 1) the degree of administrative interference into the curriculum, 2) the teacher-student interactions that took place both in and out of the formal classroom setting, 3) their respective histories at the schools, and 4) the manner in which technology was integrated in the classrooms. Through this lens, the students at Westlake were placed into a more teacher-centered and controlled environment as evidenced through the worksheets that were required of them daily. At Hope, however, the curriculum was less formal and therefore more conversational. The students were more engaged in a conscientious effort to make science more easily understood and accessible to these students. Still, overwhelming demands at the school forced this good teacher to leave the classroom where he was being effective.

The science curriculum, while subject to a district-provided pacing guide at both schools, was less as irrelevant to the lives of the children at Westlake school as it was limited in its scope. The ‘worksheet’ approach, which promotes both rote memorization and testing skills, still dominates some areas of science teaching, especially at the high school level and beyond (Tobin, 1987; Lyons, 2006; Scott et al., 2006). This is opposite in approach to what was happening at Hope, where students’ experiences were a valued and necessary part of the curriculum and discussions about science. The simple fact that the teacher’s options were not stymied or constrained at Hope allowed for a more positive experience for the students, and allowed the students to value their teacher outside classroom setting. Developing rapport with students has led to a more open and comfortable learning environment.

Scott was the beneficiary of both his genuine concern for the students as well as his longevity in the school. He was in a unique position as educator and as acting administrator to function as a mediator for his students. He listened to them when there was a problem, acting as an advocate for them both in and out of the classroom. He developed this rapport and these relationships with parents as well. Robyn, while being a caring and concerned teacher, has not been able to navigate the pathways of her school or her classroom nearly as effectively in such a short time at her building. Robyn spent her high school years in this building and understood that it has changed dramatically. These changes in the educational context of which her students learn, combined with her last-minute appointment to this school, have created an exceptional challenge which she is presently trying to overcome.

The technology involved in this grant was implemented in different ways and at different times at both schools. Those students at Westlake were often invited to participate as a part of a reward structure. These students were frequently offered technology as part of a behavioral management plan in the classroom. Those students who excelled within the given assignment were offered further opportunities for investigation using various different software applications to create artifacts. At Hope, computers were frequently used as a learning instrument be it through the creation of Powerpoint presentations, photobooks, or movies. The students in this science classroom were frequently afforded the opportunity to engage in learning electronically.

IMPLICATIONS

Simply providing the technology to the teachers does not help them understand new management, pedagogical, and professional development issues which arise. Further, these new high tech classroom tools do not mean that the researcher can easily discern the reasons why one teacher is going to grow differently than another teacher. The end goals for the students desired by these two teachers appeared to be the same when discussing them at professional development gatherings. It was a stark contrast to see different way technology was enacted in science classrooms. The supports that need to be provided will also differ and one our many challenges is determining what support needs to be provided to these teachers. Teachers even with identical equipment funded and supported within the same grant and professional development need different modes of support. In the case of Robyn, an additional piece was needed, that is, an understanding of cultural connections to students, which was necessary before she was able to focus on the best practices using technology in her classroom. A potential role to consider for future professional development might include the facilitator of an environment in which teachers are able to use these tools effectively: something which transcends the technology component.

Creating a learning community for teachers to discuss their successes and failures, and to collaborate on upcoming events is a necessary component for continued impact or success. Robyn was able to talk openly about her practice in a room filled with veteran science educators, not as a result of simply putting technology into her classroom, but by allowing her to feel a part of this community. If technology is going to continue its broad implementation into American classrooms, teacher learning communities are a necessary component. District leaders as well need to understand the emphasis placed on helping the teachers understand their students, the learning context, and the classroom discipline before engaging them with technology in fruitful ways.

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