Modeling, Training, and Mentoring Teacher Candidates to Use SMART Board Technology

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Abstract

This paper reports on research by two higher education instructors who provided SMART board training to teacher candidates to help them become competent in the use of interactive technology and to integrate instructional technology into their student teaching experience. The instructors modeled effective use of SMART boards during course instruction, offered training on appropriate use of technology for the K-8 classroom, and provided ongoing mentoring of teacher candidates' emerging use of technology during student teaching field experience in a Professional Development School (PDS). Interviews with teacher candidates were conducted to investigate the impact of training on attitudes towards teaching with SMART board technology, and the barriers they encountered in using the technology for instruction. Interview results provided themes that might inform the design of teacher candidate preparation programs. Suggestions are given for teacher training program policies to venerate technology training and practice to encourage and support teacher candidates, and by extension, cooperating teachers in the schools, to effectively integrate technology in their teaching.

Keywords: SMART Boards, interactive technology, technology training, active learning, teacher training.

Introduction

Technology has the potential to provide new methods for teaching and learning in our K-12 schools (Rakes et al, 2006, Siemens and Matheos, 2010; Knezek, Christensen, Bell, 1998).

Studies have shown that school administrators believe that technology is a critical component of the educational experience for students (Brush & Bannon, 1998). Instructional technology is associated with increased academic achievement, and may increase student motivation for school work, by providing students with opportunities to interpret and construct meaning and to present data in meaningful ways to their instructors and peers (Bell, 2002; National Council for Accreditation {NCATE}, 2008). Technology can provide students with greater access to a vast array of information and resources, empowering them to become free agent learners able to create meaningful personalized learning experiences outside the traditional classroom.

Nevertheless, many practicing teachers in our public K-12 schools struggle to keep current with the implementation of emerging and rapidly advancing tools of instructional technology, which can be largely attributed to inadequate professional development and training (U.S. Department of Education, 2005;

Raynolds & Morgan, 2001; Yildrim, 2000; Teclehaimanot, Mentzer, and Hickman, 2011).

A national survey designed to examine the availability and use of educational technology among teachers in K-12 schools looked specifically at teachers' use of computers and the internet in the classroom; availability and use of computer devices and software; student use of educational technology; and teachers' preparation to use educational technology for instruction and technologyrelated professional development activities (NCES, 2010). While 97% of the teachers surveyed had access to computers in their classroom, those teachers reported that they most often used technology for administrative purposes, and only 40% percent indicated that they or their students often used technology for instruction (NCES, 2010). From the same study, although 57% of all teachers reported that they sometimes or often use interactive whiteboard for instructional purposes, only 23% of all teachers have SMART boards mounted in their classrooms, while another 28% reported they had access to a SMART board in the building. Despite increasing access to technology in our schools, many practicing teachers are not comfortable integrating technology into the daily teaching and learning process, making it difficult to assess the impact of instructional technology on student achievement (Barton, 2001; Cuban, 2001; Keengwe, 2007; Yau, 1999). A lack of confidence in integrating technology and a lack of understanding of its benefits to student learning may exist among teachers (Teclehaimanot, et al., 2011).

A large body of literature supports the idea that technology training and mentoring is the major factor that could help teachers develop positive attitudes toward technology and increase the likelihood that they use technology to enhance and support classroom instruction (Berson, 1996; U.S. Department of Education, 2005; Reynolds & Morgan, 2001; Yildirim & Kiraz, 1999; Yildirim, 2000, U.S. Department of Education, 2005; NCES, 2010). School administrators are engaged in efforts to develop effective policies that would enable students to gain greater access to learning resources beyond the school walls. They seek to secure sufficient funding to purchase technology and to provide on-going professional development for teachers. The recent NCES research reported that during the 12 months prior to completing the survey, 53% of the teachers had received between 1-8 hours of professional development for educational technology, 18% received 9-16 hours and 9% received 17-32 hours. Only 7% received 33 or more hours of training in the use of educational technology. Of those combined 87% of teachers who had received training in instructional technology, 81% reported that the training "met my goals and needs" (NCES, p. 4, 2010). Nevertheless only 61% of those same teachers reported that the professional development activities they participated or engaged in, prepared them to make effective use of educational technology for classroom instruction (NCES, 2010). In the absence of relevant training opportunities, teachers are faced with the challenge of independently figuring out how to integrate technology into the curriculum. The NCES survey reported that 78% of teachers felt that their own independent learning was most influential in preparing them to make use of the educational technology available to them.

Teacher preparation programs remain key to the modeling, training, and subsequent implementation of the effective use of technology in K-12 schools (Becker, 2001; Zhao, 2007). The NCATE accreditation standards emphasize the use of educational technology within teacher preparation programs to help teacher candidates' master skills to meet the needs of diverse learners (NCATE 2008). Nevertheless, in the recent NCES teacher survey only 25% reported that their undergraduate teacher education programs had a moderate or major impact on their ability to effectively integrate technology in their instruction. The reality is that there is often limited faculty modeling of appropriate use of technology in teacher education courses (National Center for Education Statistics, 2000; Teclehaimanot et al, 2011).

If teacher candidates are to learn to integrate technology effectively into the classroom, they must first see it modeled effectively by college instructors. Education faculty must therefore integrate a wide range of technology tools in their courses to help teacher candidates to develop an under-

standing of how technology might be used and differentiated to facilitate learning for all students. If teacher candidates are to learn to integrate technology effectively into the classroom they must be given specific training in current instructional technology use, and the multiple applications for instruction. If teacher candidates are to learn to integrate technology effectively into the classroom instruction, they must be provided with ongoing mentoring support for their emerging skills in the use of technology in the field. This model can potentially serve to encourage and support the use of instructional technology by the teachers in our schools.

SMART Board and Active Learning

SMART boards are Interactive Whiteboards (IWB) produced by SMART Technologies, Inc.The two main interactive whiteboard brands, SMART board and ActivBoard by Promethean, compete for market domination. It is estimated that SMART board provides about fifty percent of the interactive whiteboards in the market (Weiser, 2001). Both products have enjoyed immense success and teachers consider the IWB to be a useful instructional tool (Kuroneko, 2008). The SMART board system is composed of three parts, a computer with Notebook software, a projector, and interactive whiteboard. Computer images are displayed on a touch sensitive whiteboard where they are easily manipulated, providing opportunities for student engagement. SMART boards come with collaborative learning software known as Smart Notebook, but are also compatible with other software such as, Microsoft Power Point, Microsoft Word or Macintosh Keynotes (SMART Technology, 2006). In addition, the user can utilize the Internet and integrate numerous software programs (Bell, 2002), and can control the software from the computer and from the whiteboard. (See Figure 1)

Figure 1: Teacher Candidates Presenting SMART Board Interactive Learning Activities

The interactive whiteboards are used in a variety of learning environments and support an active, hands-on approach to learning (SMART Technology, 2006). The benefits of active learning are widely discussed in the literature. Current educational theories are grounded in the notion of social learners and consider student engagement a key component of knowledge construction. This research defines active learning as a process by which learners are actively engaged in the teaching and learning process through reading, discussion, analysis, and evaluation, rather than passively absorbing instruction. This research is consistent with the constructivist paradigm and socio-constructivist approach to learning (Vygotsky, 1978). The interactivity of the SMART boards appears to be significant for effective classroom teaching (Kennewell et al., 2008).

Guthrie and Carlin (2004) state that the twenty first century students are primarily active learners and the traditional lecture method has increasingly become out of touch with how students engage

in their world. A number of researchers demonstrate that SMART board interactive whiteboards promote student engagement and supports interaction and conversation in the classroom (Gerard and Widener, 1999; Solvie, 2001; Lee and Boyle, 2003). Students may be more focused in learning as notes can be added, highlighted, saved for future use, and printed out for later review. Cox et al. (2003) concluded that interactive SMART whiteboards allow teachers to gain a deeper understanding of their students' needs, and students are better able to learn through collaboration with each other.

Literature Review

Interactive whiteboards have gained popularity in the educational system from K-12 schools to the collegiate level (Bell, 2002; Oigara, 2010). Cognitive research has shown that learning is most effective when four fundamental characteristics are present: (1) active engagement, (2) participation in groups, (3) frequent interaction and feedback, and (4) connection to real-world contexts (Roschelle, Pea, Hoadley, Gordin, & Means, 2000). Research in educational technology has shown that combining SMART boards with computer use increases the interactive atmosphere in the classroom (Carbonara 2005; Oigara & Keengwe, 2011). The interactive quality of SMART board lends itself to a degree of student participation not offered by other presentation methods.

SMART boards are considered to be beneficial for students with learning disabilities. According to Ngao (2006) the importance of reaching students intellectually and stimulating them visually is especially valuable for students with special needs. The SMART board has the capability to make the keyboard larger on the touch-screen so students can more easily see and manage their work independently. Colorful visuals and the ability to move objects around on the whiteboard serves to keep students' attention much longer than a lesson without a SMART board (Ngao, 2006). The SMART board also helps to support visual learners as students can see, touch and move abstract concepts on the board, increasing their understanding. Documenting a case study of deaf, bilingual children and their experiences with an interactive SMART board, Carter (2002) found that making presentations on the interactive SMART board aided the development of self-esteem and pride. Research shows that students are more excited to learn with SMART board activities (Sani, 2007; SMART Technology, 2006). Sani (2007) indicated that students who are shy tend to become more engaged in learning when working with SMART boards. Carter (2002) stated "having a projector and whiteboard in class provides many positives, but the interactivity of a SMART board enhanced teaching and learning even further" (p. 4).

While emerging research supports the notion that interactive whiteboards affect learning in several ways, there is still limited data regarding its value, effectiveness, and impact on instruction and student learning. While a number of studies have examined the use of SMART board in K-12 schools (Richardson, 2002; Dye, 2003; Earle, 2004), few studies have been conducted on the training of teacher candidates to become effective users of interactive technology. Higher learning institutions are equipping their classrooms with modern technology like SMART boards not only to improve their image but also to give the students a better learning experience (Smart Classroom, 2012).

In their most recent standards, The National Council for Accreditation of Teacher Education (NCATE) calls for improvements in the integration of technology into teacher education programs, emphasizing the importance for teachers to be trained to use technology as an essential teaching tool to enhance student learning (NCATE, 2008). This calls for new approaches that would require teacher candidates to use tools of technology in their college courses and preparatory field experiences so that they would be more inclined, confident and more capable to incorporate instructional technology into their teaching practice. The National Research Council (1996) and Davis (2002) claim that future teachers will best learn to integrate tools of technology effectively into the curriculum if they see it modeled by their education instructors.

Research supports the notion that educational technology instruction should be integrated within the teacher education methods courses in order to provide teacher candidates with the confidence, skills and first-hand experiences of applying technology to their specific content areas (Davis and Falba, 2002; Groves & Zemel, 2000; Oigara and Keengwe, 2011; Teclehaimanot et al, 2011; Cheetham, 2003). Teclehaimanot et al, (2011) indicated that the best way to train new teachers to effectively use interactive electronic whiteboards is to develop a technology-infused teacher education program where teacher candidates will learn the pedagogical and practical use of technology. Likewise, Lemke and Coughlin (1999) suggest that teacher candidates need to have more experience with tools of technology and receive more guidance to become effective users. Although some teacher educators have taken positive steps towards developing and delivering technology based courses, still more needs to be done to provide meaningful ways to engage teacher candidates in using tools of technology effectively in the K-12 classroom (Teclehaimanot et al, 2011).

Research also indicates that mentoring programs are necessary after the initial technology integration training, not only to foster collaboration but also to provide support for the daily challenges that hinder the effective use of technology in the classroom (May, 2000; O'Dwyer, Russel & Bebell, 2004). May (2000) evaluated a program which provided technology training coupled with supplemental mentoring support by a colleague. Teachers trained and mentored in this model achieved three time greater gain on teacher profiler scores versus traditionally trained teachers. In addition, teachers in the study indicated that the mentoring by a colleague promoted their confidence in using technology, increased their ability to work through technical issues, and demonstrated a desire to continue to integrate technology into instruction.

Initial training and mentoring models can serve to inform school administrators and policy-makers about ways to provide more effective instructional and technology training and support for practicing teachers to reap the most benefit from investments made on the purchase of instructional technology and for professional development for teachers related to technology integration.

Purpose of the Study

This research investigated teacher candidates' competency, comfort with SMART board technology and use of instructional technology during student teaching internship. The research was inspired by a successful grant for educational technology from SMARTer Kids Foundation which supported the purchase of SMART interactive technology tools for a college demonstration education technology classroom and for a partnership K-8 Professional Development School (PDS) where teacher candidates were placed for advanced fieldwork. Prior to this grant opportunity, the school had limited availability to SMART board technology, owning two permanently mounted SMART boards, one housed in the music room and the other in the middle school science room. The grant allowed the purchase of four portable SMART boards to add to those previously owned by the school, thus providing additional SMART board tools for teacher candidates to have access to during their field experience. The increased availability and access to the this interactive technology, both on campus and in the school setting, provided the means for the teacher candidates to practice and become more comfortable with SMART board interactive technology.

This research gathered information on SMART board use from undergraduate early childhood/childhood teacher candidates enrolled in a methods course where they were taught the pedagogical and practical use of instructional technology and a subset of that group who completed a student teaching internship in a Professional Development School (PDS). The goal of this research was to determine appropriate training and support necessary for teacher candidates to become more effective users of interactive SMART board technologies and to identify the barriers to the effective utilization of this technology in a school during a student teaching experi-

ence, where access to technology, and professional training of teachers in the use of technology has historically been limited.

Specific questions addressed in this study included:

1. To what extent do teacher candidates believe modeling, training and increased expectation of the use of technology determine the extent of their use of SMART board in the classroom?
2. What factors influenced/hindered teacher candidate experimentation with and use of SMART interactive technology during student teaching?
3. Do teacher candidates hold the opinion that SMART interactive technology is an effective tool for teaching, learning and assessment?

Setting

An urban K-8 school and the college entered into a Professional Development School (PDS) relationship in 2007. The PDS mission statement articulates "*a shared commitment to the preparation of socially responsible students, teacher candidates, and educators within a vibrant community of learners and leaders. Partners share responsibility and appropriate resources for academic excellence though inquiry-based practices and relevant professional development.*" A PDS is often considered a learning laboratory for teacher candidates to practice their craft under the guidance of experienced, mentor teachers. In this environment, there becomes a continuum, whereby teacher candidates, experienced teachers, and college/university faculty are professionally developed via their work in a PDS (NAPDS, 2008).

As previously mentioned, the K-8 school had a total of six SMART boards, one in the music room, one in the middle school science room, and four portable SMART boards acquired through the grant. A survey administered to the K-8 teachers prior to this study revealed that many teachers did not use SMART technology in the classroom because they lacked sufficient skills, equipment, and time. Several teachers in the school requested professional development training that focused on interactive SMART board technology. The researchers organized four professional development workshops for the teachers to advance their SMART board technology skills. While studies have documented the benefits of placing teacher candidates with experienced mentors who effectively model technology integration and encourage its use during student teaching internship, the mentor teachers in this situation were just learning of the ways they could incorporate technology in their teaching and were receptive to teacher candidates using technology in the lessons they taught.

Methods and Procedures

Data Collection

Data was collected from multiple sources, including teacher candidate surveys, reflective journals, teaching observations, field notes, interviews, document analysis (SMART board technology based project, lesson plans and unit plans) and informal feedback from cooperating teachers over a period of three semesters.

The first phase the research involved teacher candidates introduced to SMART board integration as part of a methods course where the instructor modeled effective use and supported teacher candidates in learning about its potential in context a K-8 classroom environment. The methods instructor had experience with interactive technology and was confident in creating interactive lesson activities using Notebook software. The instructor modeled the integration of SMART

board use by preparing lessons with the notebook software. Throughout the course the instructor created opportunities for the teacher candidates to use SMART board in a variety of ways. For example, in one social studies lesson the class created timelines and used the SMART board both to demonstrate the software and to present the finished timelines. The teacher candidates explored more fully how to integrate SMART board technology into their planning and teaching during the course, and were required to complete a SMART board technology project where they created interactive lesson activities to demonstrate emerging competence.

The teacher candidates completed a technology competence survey at the beginning and at end of the methods course in order to measure any changes in students' knowledge, developing skills, and comfort level with technology. The survey used four proficiency level categories (*no- experience, basic, advanced, and expert*) to measure technology skills of the teacher candidates. The percentages of students at each of the level are reported in the result section.

The second phase of the research involved a subset of seven of the twenty teacher candidates who had received SMART board training through the above mentioned methods course. The research focused on an assessment of their comfort level with using technology, perceptions of how support or lack of support affected technology integration, and attitudes toward using SMART technology in the classroom. The seven teacher candidates were placed into a PDS school for their fifty hour pre-student teaching field experience, followed by a full time seven week student teaching internship in the same classroom. Over the course of two semesters, teacher candidates were required to incorporate SMART board interactive activities in their instruction. Each teacher candidate was required to teach a minimum of two lessons using SMART board technology during the fifty hour pre-student teaching experience and four lessons during the seven week student teaching experience. The course instructor was available to teacher candidates during the two-semester period to provide additional assistance and support as they developed SMART board lesson activities. Three of the seven students sought out additional mentoring support during their field experience. The mentoring sessions were responsive to the needs of the teacher candidate to effectively utilize SMART board technology in the classrooms to which they were assigned.

The field experience supervisor made focused observations of lessons taught by teacher candidates involving SMART board technology, took observation notes and conducted post lesson debriefing interviews with all seven teacher candidates. These post lesson interviews focused on teacher candidates' reflections on their experience with the SMART board technology as an instructional tool. Reflective journals recorded during field experiences and written lesson and unit plans were collected and reviewed as an additional data point for evidence of technology integration into teaching.

Group interviews with teacher candidates were conducted following the fifty hour pre-student teaching field experience. The purpose of the interviews was to understand how teacher candidates perceived technology training and how it affected their teaching. Teacher candidates were asked to what extent they used SMART board for instruction, the challenges and successes they experienced, and the kind of support and mentoring they felt they might need as they moved into the student teaching placement. Teacher candidates were surveyed again in May 2011 at the end of their student teaching and asked to respond to the following questions:

1. To what extent do you believe the modeling, training, and support received influenced the extent of your SMART board use in the classroom?
2. What factors influenced/hindered your experimentation with and use of SMART interactive technology during student teaching?

3. In your opinion, is SMART interactive technology an effective tool for teaching, learning, and assessment? Why or why not?

Data Analysis

To investigate the research questions, a descriptive action research case study was administered. For the purpose of this study, action research is defined as a systematic, self –reflective inquiry aimed at constructing knowledge about one's practice with the major goals of improving and developing a better understanding of that practice (Carr & Kemmis, 1986). The methods employed supported an interpretivists qualitative paradigm, which believe that social realities are constructed by the participants in those social settings (Glesne, 1999). Glesne further stated that qualitative researchers must gain access to the multiple perspectives of participants and interact and talk with participants about their perceptions. Maxwell (1996) suggested that qualitative researchers seek to understand how participants make meaning of the events, situations, and actions with which they are involved and of the account they give of their lives and experiences.

Constant comparative method (Glazer & Strauss, 1967) was used to analyze the data. Using this method, the researcher first examined and compared themes and categories generated from different data sources. Then some categories were combined with others that had similar properties. This method included coding of the participants' responses to survey questions, students course work projects, and reflections and field placement journal entries. Group interviews were recorded and transcribed. During the coding process, the categories and concepts that appeared repeatedly led to the construction of key themes (Strauss & Corbin, 1990) based on the methods course instructor's attempts at mentoring teacher candidates' implementation of instructional technology into classroom. The emerging themes were then tested via triangulation with other relevant data set (in the form of field notes from class observations, student responses in journal entries, personal interviews and unit plan) (Miles & Huberman, 1994). This process involved reading the notes numerous times, coding them by topics and themes, comparing and contrasting the notes classified under any given code, and finally looking for patterns and themes that integrated separate codes. To verify the emerging themes, peer debriefing was employed by consulting cooperating teachers from the field experience and the school principal regarding use of interactive SMART board technology by the teacher candidates. Through this process, the researchers were able to critically examine emerging patterns that seemed apparent and provided alternative explanation for the data.

Results

Survey Findings

Quantitative data was analyzed using both quantification and codification. The survey questions were coded or assigned numerical representations. The surveys included questions about the comfort level of the teacher candidates for various technology uses. Tables are presented that summarizes the findings regarding teacher candidates' perceptions about their level of expertise as technology users and training experience. Table 1 below shows percentages for teacher candidates' proficiency skills on different technology tools before and after they had completed the methods course. In general, teacher candidates had limited experience with using the SMART board interactive technology tools prior to taking the course.

Developing the personal technology skills of the teacher candidates was a necessary component of the teaching methods course to facilitate the integration of interactive technology into their student teaching experience. The findings of this research survey matched other research findings

that stress the importance of technology integration training and support while learning to create a teaching environment that foster rich technology integration (see Teclehaimanot et al, 2011).

Table 1: Evaluating Teacher Candidates Technology Proficient Skills (N=20)

Technology Skill Pre-Survey	*NO Experience*	*Basic*	*Advanced*	*Expert*
SMART Board	95.0%			5.0%
SMART Response	90.0%	10.0%		
Primary Sources	45.0%	40.0%	15.0%	
Internet		10.0%	20%	70.0%
GPS & GIS	80.0%	20.0%		

Table 1 above shows the pre-survey self assessed ratings of technology proficiency skills of the twenty teacher candidates enrolled in the methods course. From the pre-survey questionnaire almost all 95.0% indicated that they had no experience or developed skills to use SMART board technology. Only one participant indicated to be an expert in SMART board technology use. 90.0% reported that they had no prior experience with SMART response (clickers) in the classroom and only 10.0% reported that they had basic knowledge or partial masterly of how clickers worked.

Only 15% of the teacher candidates indicated advanced proficiency in utilizing primary sources to enhance student learning. Most teacher candidates stated that they had either no experience or had basic or partial knowledge of using primary sources 45.0% and 40.0% respectively. The majority of teacher candidates reported to have good developed skills to utilize Internet resources to enhance student learning (70.0% expert) and (20% advanced level). The majority of teacher candidates (80.0%) indicated that they had no experience in utilizing GPS/GIS tools in the classroom. Only 20.0% claimed to have basic skills and knowledge of this technology tool.

In Table 2 below the post-survey ratings of their technology proficiency skills increased significantly. Most teacher candidates indicated that they had attained advanced skills (90.0%) in integrating SMART board technology into teaching. 10% of them contended their level of expertise as basic after the courses, but no one considered himself or herself an “expert."

Table 2: Evaluating Teacher Candidates Technology Proficient Skills (N=20)

Technology Skill Post-Survey	*NO Experience*	*Basic*	*Advanced*	*Expert*
SMART Board		10.0%	90.0%	0.0%
SMART Response		40.0%	60.0%	0.0%
Primary Sources		20.0%	65.0%	15.0%
Internet			85.0%	15.0%
GPS & GIS		40.0%	55.0%	5.0%

When asked about their expertise in using SMART response system (clickers) for instruction, 60.0% considered themselves to be at an advanced level and 40.0% stated that they had attained a basic level proficiency. Surprisingly, in the post survey only a few teacher candidates (15.0%) considered themselves as being expert in utilizing Internet resources in the classroom (see Table 2 post-survey). In this technology skill of utilizing internet resources in the classroom, the majority (85.0%) of teacher candidates rated themselves being at an advanced level of proficiency. This was a great shift from what they had indicated as their level of proficiency in the pre-survey.

The data suggest that teacher candidates, in a self-evaluation, felt they had developed many of the technology skills needed to foster the integration of technology into their teaching by the end of the methods coursework. The combined percentage of 60.0% of teacher candidates felt that they had improved their GPS /GIS skills with 55.0% indicating advanced and 5.0% expert.

Table 3: Teacher Candidates Perceptions about SMART Board Technology Training (N=20).

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I think it is easy to use SMART board technology in the classroom.		70.0%	30.0%		
Learning about different tools of SMART Notebook software was beneficial	20.0%	60.0%	10.0%		
Learning about SMART board in the course was worthwhile.	40.0%	60.0%			
Knowing how to work with SMART board technology will benefit my teaching.	40.0%	60.0%			
I feel confident; I can start using SMART board technology in my classroom teaching.	30.0%	40.0%	30.0%		
It was important for me to learn about SMART board technology in my methods class.	20.0%	70.0%	10.0%		
The course provided opportunities to learn about utilizing SMART board technology in the classroom.	55.0%	45.0%			
SMART board technology training should be required in all teacher education programs.	60.0%	40.0%			

All of the teacher candidates felt that they improved SMART board technology skills after the course, and indicated that they would start using the skills they had learned. 70.0% of the teacher candidates said that SMART board technology was easy to use and it made the subject matter more interesting compared to traditional lecture-based classes (see Table 3 for details). All teacher candidates agreed that knowing to utilize SMART board technology would benefit their teaching, with 40.0% indicating strong agreement and 60.0% indicating agreement with the statement. The majority of the teacher candidates (40.0% agree and 30.0% strongly agree) stated that they felt confident with SMART board technology and would immediately start using it in

the classroom. Almost all teacher candidates felt that it was a worthwhile experience learning to use SMART board technologies in the methods course with 20.0% strongly agrees and 70.0% agree with the statement. 10.0% of teacher candidates remained neutral on this question. The candidates indicated they strongly agreed or agreed that the course provided them with opportunities to experiment using SMART board technology in a classroom environment 55.0% and 45.0% respectively. The teacher candidates reported that learning about different tools of SMART Notebook software was beneficial to their technology skills (60.0%) and (20.0%) agree, and strongly agree respectively. All teacher candidates thought that the SMART board technology should be a requirement in all teacher-training programs to increase the future teachers' confidence in how to utilize interactive technology.

When asked if they had any concerns or recommendations for the course, some teacher candidates felt that limited time in class to complete the activities was an issue of concern. They stated that there was a lot of work outside the regular time to complete the assigned tasks. Four teacher candidates recommended more class time to be allotted to create SMART board activities.

Teacher candidates performed very well on the required SMART board technology assignment, indicating that they were competent in the use of technology and creating interactive lesson activities. During student teaching experience a number of candidates self-reported in their reflective journals to have utilized SMART board technology in their teaching at least once. This data indicated that teacher candidates were able to use interactive tools and were interested in integrating technology into their teaching practice.

Summary of Qualitative Findings and Interpretations

The second phase of the research involved seven teacher candidates placed in a PDS school for fieldwork and explored their comfort level of using technology, perceptions of how support or lack of support affected technology integration, and attitudes toward using SMART technology in the classroom. Data from teacher candidates' fieldwork, reflective journals, and survey responses were analyzed and coded to capture key themes of responses. Quotations from the qualitative data were selected to illustrate the themes. From this study, themes emerged that can be used to inform the design of teacher preparation programs regarding technology integration during course work and field experiences.

1. Theme: Modeling and training to support technology skills

An initial survey administered to teacher candidates enrolled in the methods course at the beginning of the semester revealed that most teacher candidates had limited exposure to SMART board technology integration in teaching and learning process. A second survey that was administered at the end of the semester revealed that there was a positive shift in teacher candidates' attitudes toward instructional technology as they reported a greater understanding of how instructional technology could be used as an instructional tool, an increased comfort level and perceived skill level with using interactive technology.

The teacher candidates felt that the training allowed them to improve their technology skills and provided ideas for integrating within their content area, and that they were able to successfully integrate SMART technology resources into their lessons and course projects.

The quotes below provide evidence that teacher candidates became more willing and comfortable to integrate interactive technology into their teaching.

> *"The recent purchase of SMART boards by the college as well as our local schools has made the use of this technology easier for us."*

"I really appreciate that we have class time to work on our technology projects. This is very helpful since we have access to all the tools we need. Thank you."

"I just wanted to say thank you so much for being patient with me. I was frustrated at the first to work with Notebook software but I feel lot more confident now in using the software."

"Since the beginning of the semester, I have gained an immense amount of information pertaining to SMART board and their use in the classroom. Gaining an in-depth knowledge about SMART board has allowed me to expand my understanding of the tool and thus an appreciation for its use in the classroom. I am glad that I now have the knowledge and confidence to go to the classroom and maneuver the use of this new technology."

"The SMART board project helped me to learn how to use the SMART board effectively and made me feel more confident in my abilities to use it. This course opened my eyes to the various possibilities and options that a SMART board can offer. I am glad that I now have acquired technology skills that not many teachers have, which will make me stand out from the sea of inspiring teachers."

"I was introduced to SMART Response Systems (clickers) where students get their own remote control devise in the classroom to answer question anonymously without having to raise their hands. Teachers are able to check for students comprehension based on the answers given and students gets instant feedback. I have always heard about 'clickers" but had never used them until I took this course."

2. Theme: Perceived SMART board technology barriers in implementation

To answer the second question regarding factors that influenced or hindered experimentation with, and use of SMART interactive technology during student teaching, the seven teacher candidates responded in detail. There were many factors that influenced or limited their use of instructional technology during their field experiences. Insufficient exposure to SMART Board technology and the lack of its emphasis in most education courses were cited as barriers. Some reported that the most important factor influencing the effective use of SMART technology depended on observing experienced cooperating teachers who modeled technology enriched instruction. Most participants however did not identify their cooperating teachers as the main source of support for technology integration and this raises questions about opportunities for teacher candidates to work with expert technology role models and appropriate technology mentoring by teachers in partnership schools. Other factors that teacher candidates listed as hindering their use of technology during their field placement included limited access to SMART boards, lack of on-site technical support, time constraints, and a broad curriculum to cover. The findings support earlier studies documented in the literature (see Mumtaz, 2000). Teacher candidates reported to have had issues with portable SMART boards during their lessons, hindering its use. Many complained of problems with securing access to the SMART board in time for class and the constant need to orient the board each time before its use and during instruction. Below are a sampling of quotes from teacher candidates regarding barriers and concerns related to technology use during student teaching.

"I don't feel comfortable incorporating SMART technology in my instruction because my cooperating teacher doesn't use it and has an established routine and I don't want to disrupt her routine. That was probably the biggest obstacle during my field experience

"I feel like if SMART board is used in the classroom, more consistently, maybe like on a daily basis, or every other day, it would become more effective, because students would be used to the technology, and know how to use it, because it was difficult for them to do certain things on the board, like drag the letters I had for them, and it just wasn't working very well for them."

"I think the problem with a portable SMART board is not being able to block out the shadow, and the fact that I had to keep the projector cart in the middle of where I was teaching, so if little Billy hit the cart, the whole calibration went off. Or if he moved the wire, I had to trouble shoot for what happened. And it takes away the time of your lesson, and it takes away the flow of your lesson."

3. Theme: Future Direction of Technology in Teacher Education.

In regard to teacher candidates' perceptions about SMART board use, the findings revealed a positive attitude towards integration. Teacher candidates indicated that the features of the SMART board can offer significant benefits to learners and supports active engagement in the classroom.

Teacher candidates expressed the desire to have experienced technology mentors, both at college and in the K-8 school to help familiarize them with the technology and its teaching application. Although the teacher candidates described receiving good modeling and support during this method course, faculty in teacher training programs may struggle to keep current with emerging tools of instructional technology and may not be modeling technology integration in education coursework. Effective technology integration into methods coursework may provide contextualized, collaborative learning environments that support technology in a specific content area. Teacher candidates in this study felt that additional professional development and mentoring programs would allow them the opportunity to expand their technology integration skills beyond the current level.

While studies have documented the benefits of placing teacher candidates with mentors who effectively model technology integration and encourage its use during student teaching internship (Brown, 2003), it can require a strong and ongoing commitment to prepare teachers and higher education faculty through professional development to be effective in the use of the rapidly changing tools of instructional technology.

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"My cooperating teacher said a lot of things...a lot of her concerns with the SMART board are related to the novelty of it, because the children hadn't used it before – so when I brought it in, all the kids were like…'oohhh, I want to touch it, I want to touch it'…SMART board is what is going on!" It made them more engaged in the lesson, but just because they wanted to touch the SMART board.

"Learning how to integrate SMART board into my everyday teaching and creating interactive lesson activities was extremely helpful. The SMART board get students to be active in there learning; it gets them out of their seats to participate in engaging activities thus exciting them about learning. Learning to use the SMART board opened up a myriad of different avenues in which to teach the materials that students need to learn."

"I used Smart board in my lessons. The kids were very, very excited about it, they absolutely LOVED the clickers. The clickers were the hit of the show. They loved that."

"The Smart board responses (clickers) for the kindergarten/first grade classroom went very well. I mean they needed a little bit of help for where they needed to punch in, but they were excited, and very attentive to what they needed to do so they could get their responses in on that board."

Discussion

This study examined how interactive technology is being used in teaching and how teacher educators can train, mentor and support teacher candidates in the use of interactive SMART board technology, both on campus and during student teaching field experiences. The SMART technology grant provided financial support for the college to purchase SMART products housed within the department of education (e.g. SMART table, SMART boards, SMART Responses System, and SMART Sympoduim) for teacher candidates to be educated about and be provided with specific training for how to generate interactive lessons on the college campus.

Teacher candidates responded enthusiastically to course activities that helped them to learn to use interactive technology to enhance teaching and learning in different curriculum content. Specific technology integration training positively affected teacher candidates' attitudes toward SMART board technology, their understanding of its instructional potential and confidence in experimenting with the technology for instructional purposes.

Technology training alone did not lead to teacher candidates' high levels of technology use in the classroom. The access to instructional technology in the school environment and the availability of ongoing support and mentoring related to technology use was necessary to help teacher candidates implement what they had learned from the initial technology training. Technology mentoring can provide relevant and practical support for teacher candidates with their differing technology skills to improve the ways they integrate technology in their teaching.

To be certain, the experience in one class and subsequent field experiences in no way offers a guarantee that teacher candidates will successfully utilize the tools of technology in their own classroom. It however, allows and encourages teacher candidates to develop the vision and belief that will guide their practice (Albion and Ertmer, 2000). Through this investigation the researchers were able to reflect upon the training, mentoring and field placement support that leads to effective integration of interactive technology by teacher candidates in the program.

Limitations

This study had limitations that should be taken into consideration when generalizing the results. The sample size was small and the participants were volunteers in a convenience sampling (volunteers were enrolled in courses taught by the researchers) that could cause response bias. These limitations need to be considered in the assessment of the study's validity. Nevertheless, qualitative analysis revealed some important findings that might be considered in future research.

Conclusion

This research provides a framework for teacher preparation programs to consider programmatic changes to address the growing need for preparing teachers to become effective users of emerging educational technology. The results of this study suggest that to best prepare teacher candidates to be effective users of instructional technology they should be trained to understand the benefits of technology and be provided with specific assignments designed to help them acquire the knowledge, confidence and skills during their coursework. For teacher candidates to make instructional

technology part of their practice, with emerging confidence and knowledge of its applications, they must also have easy access to the technology, be in a supportive environment, and have opportunity to reflect on its role in their own practice.

Modeling of effective classroom technology practices by both teacher education faculty and cooperating teachers (school-based mentors) is critical to successful mastery of instructional technology integration by teacher candidates. The results suggest that teacher candidates found the technology mentoring process that provides one-on-one sustained support after the initial technology training to be extremely beneficial in preparing them for integration of instructional technology.

The reality is that many practicing teachers in our schools where teacher candidates are placed for field experiences still lack the training, confidence and resources to model effective use of technology in the classrooms. Schools of Education must continue to collaborate with and provide support to partnership schools through the preparation of teacher candidates and in professional training of faculty to ensure that teacher candidates are placed with mentor teachers proficient in the use of technology for instruction with the ultimate and mutual goal of improving student learning in our K-12 schools. In addition, this process is best supported in a Professional Development School partnership which provides an environment where teacher candidates and practicing teachers can construct collective knowledge about their practice and have access to shared resources and support.

Recommendations for Future Study

There are recommendations that might need to be considered in future study. First, a larger sample should be assessed. A larger group of teacher candidates would better represent candidates' perceptions towards SMART board technology and identify barriers toward effective utilization and implementation. Second, there is need for a qualitative research to follow participants once they have completed the teacher education program to learn whether they continue to pursue the use of the SMART board and other forms of instructional technology in the classroom, and what conditions foster or hinder their ability to effectively use technology in practice. This would extend the existing results beyond the training and mentoring sessions. Third, investigating more about the issue of using a portable SMART Board versus a permanently wall mounted SMART Board would be worthwhile. Participants complained of many issues related to use of portable SMART Boards during this study. Finally, ongoing training and support for the teachers in the Professional Development School will provide teacher candidates with mentors who are experienced with instructional technology. A follow-up interview with cooperating teachers after they actually have practiced and feel competent using interactive SMART board in classroom would generate different results, and improve the school based mentoring experience for teacher candidates during a student teaching experience. The researchers will continue to investigate further the use of interactive SMART Board technology in teaching.

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