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Improving Teacher's self confidence in Learning Technology Skills and Math Education through Professional Development

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ABSTRACT

Using technology tools in math instruction can help stimulate problem-solving skills and understanding of math concepts. However, teachers need to be confident in their abilities to use technology tools. This study investigated whether or not a four-week in-service professional development institute that addressed the use of technology in math education helped improved the teachers' attitude and confidence in applying technology. Findings indicated that as the teachers explored and used the available technology tools relevant to math instruction during the institute, the more proactive and motivated they became to continue their professional development in using technology for classroom instruction. They realized that they were able to use technology and desired to continue their education in this area.

Keywords: *Educational Technology Integration, Exploratory Study, Instructional Technology, Math Education, Professional Development, Teacher Preparation, Technology Training*

INTRODUCTION

Technology is a tool that could be used in the mathematics classroom to enhance learning (NCTM, 2000). There are many forms of technology that can assist in teaching mathematics, supplement instruction, and remediate mathematical skills that require reinforcement. Tools such as spreadsheets, databases, educational software programs, drill-and-skills programs, scientific calculators, interactive whiteboards, and other applications are appropriate methods

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to teach mathematical concepts. The problem lies in that some teachers do not know how to use the technology tools or feel that they possess the ability to integrate technology effectively. Hence, teachers need to obtain the knowledge and skills that would help improve their self-confidence in using the technology at hand (ISTE, 2008). Mitchem, Wells, and Wells (2003) state that, "Research on schools and teaching has suggested for decades that student success and achievement are intricately associated with students' interactions with effective teachers" (p. 1). If this is true, then mathematic s teachers are the key agents to bringing out reform toward technology integration (Garofalo, Drier, Harper, & Timmerman, 2000). But, the way to effectively prepare teachers to become change agents is another issue. Professional development is a primary factor toward helping teachers become self-adept in learning the knowledge and skills required of them when teaching math content. This study investigates whether professional development could promote math education teachers' self-confidence in using and applying the technology tools learned back to the classroom. In-service teachers participating in a Math Summer Institute are the participants in this particular study, and the researchers explore whether completing a four-week intensive professional development institute has improved the participants' knowledge, skill sets, attitude, and self-confidence in applying what they have learned.

Literature Review

The effective preparation of teachers to teach mathematics in K-12 education is recognized as a vital factor toward students' academic success. In conjunction with the curriculum, teachers are the key in assisting students to learn required information necessary to succeed in the mathematics curriculum (Schmidt et al., 2001). Several professional organizations note the importance of teacher preparation and professional development as a means toward improving the aptitudes of math education teachers, especially in regards to technology integration. The National Council of Teachers of Mathematics (2000) considers technology as being essential "in teaching and learning mathematics; it influences the way mathematics that is taught and enhances students' learning" (p. 2) as one of their six principles of school mathematics. Furthermore, the Association of Mathematics Teacher Educators (2006) goals includes one to promote the recognition of the ever-increasing impact of technology on mathematics teacher education and has made a position statement on the importance of preparing math teachers to meet the current standards of integrating technology. If one reviews the Association of Mathematics Teacher Educators newsletter called *Connections* (2008), the content solely concentrates around technology and why these tools should be utilized in the math classroom. If organizations such as these recognize the importance of technology, then teacher preparation and professional development need to include a demonstration that goes beyond just the "how to use technology," but how to integrate.

Reasons behind using technology in the mathematics curriculum are numerous. Heid (1997) cites that technology when used in conjunction to teaching math could (a) make learning more student-centered, (b) give students the experience of being mathematicians themselves, (c) provide an avenue for reflection, and (d) make available constant access to the instruction, meaning that the instruction is no longer restricted when the teacher teaches. Contextual learning in constructive environments is critical when applying technology in math education. Students need to apply learning in novel and authentic situations so that they can practice skills, knowledge, and decision-making, while experiencing the implications or repercussions of certain decisions (Dyer, Reed, &Berry, 2006). Constructive or contextual learning environments actively engages the students as they (a) relate learning to one's life experience, (b) experience and learn by doing or through exploration and discovery, (c) applying the concepts to actual scenarios, (d) cooperate with others in terms of sharing, responding, and communicating with others, and (e) transfer the knowledge to a new context or novel situation that has not been covered in the classroom (Crawford, 2001). In short, technology in math education provides students with an opportunity to explore, reflect, and discover the consequences of learning math concepts.

The issue toward successful implementation of technology in math education is professional development. A large body of literature cites that the major obstacle toward teachers using technology in the classroom is the lack of proper teaching training (VanFossen, 1999; Veen, 1993; Whetstone & Carr-Chellman, 2001; Wild, 1996). Teachers today are often behind in meeting current challenges of the rapid expansion of technology in education. Many technology tools are available to teachers, but the application of these tools to teach content areas can be foreboding, especially when training is not present. Other studies on the effectiveness of teaching technology in pre-service and in-service courses reveal some positive results such as the participants improving their likelihood to use technology in the classroom and altering their perspectives toward technology as an obstacle (Lee &Hollebrands, 2008). Although some studies indicated that certain technology tools are more likely to be used than others, an introduction to technology in math education is important (Franz, Pope, & Fredrick, 2005). Thus, professional development is critical when expecting teachers to use technology in the math classroom. With more practice, teachers' self-assurance increases.

Problem Overview

Educators in math education should integrate technology tools as a means to assist students to learn mathematical concepts and principles. Technology can become an interactive supplement to the standard form of math instruction through paper-and-pencil methods to stimulate higher order problem-solving skills in novel situations. In addition, technology is a tool that could be applied in classrooms to assist students with diverse needs and learning styles to approach math and problem-solving scenarios more effectively (Kurz, Middleton, & Yanik, 2005). Students are not a homogeneous group of individuals in which everyone learns at the same pace and in the same method. Hence, math instruction should be individualized to cater diverse learning styles. One classroom teacher cannot design and develop personalized math curricula for thirty-three distinct students. But, the teacher could use different instructional tools and strategies that could accommodate individual learning characteristics (Cohen, 2001). With the availability of technology in schools, homes, libraries, and other public spaces, using technology as instructional tools to teach mathematical concepts and problem-solving skills seems to be the logical approach. However, the teacher is the central cornerstone toward successful implementation and integration of technology. The teacher is the one who selects and evaluates which technology tool to use at specific times. Without access and knowledge concerning technology hardware and software, successful integration of technology will not occur. In addition, not only do classroom math teachers need constant instruction and assistance in using various hardware and software application tools, personal self-aptitude and esteem are also essential criteria toward effective integration. The teacher has to know what he/she is doing in the classroom, along with embracing a positive outlook toward using technology as a means to instruct math. Thus, attitude and confidence are key criteria when trying to integrate technology into the mathematics curriculum.

For teachers who are currently in the classroom, in-service professional development conducted during the summer is a way in which they can obtain instruction concerning available technology tools. In addition, these in-service institutes can provide teachers with practice in using and adapting technology into their curriculum. The goal of these in-service institutes is to foster a positive reinforcement on part of the teacher's ability to take the knowledge back to the classroom. The researchers in this study were involved in such an in-service

Summer Math Institute to help teachers in the surrounding area to learn, explore, utilize, and practice different technology tools that could be applied to math instruction. The researchers wanted the participating teachers to understand that alternative instructional tools were available that could be successfully utilized in the math curriculum. Improving the participating teachers' self-confidence was a primary objective of the in-service math institute.

This study tried to assess whether participating in a four-week Summer Math Institute concerning the integration of technology into the math curriculum helped improve teachers' skills, knowledge, ability, and willingness to apply what they learned. To examine this research problem, four research questions were investigated:

1. Does participating in an in-service training session concerning technology integration into math instruction help teachers learn how to apply and use their knowledge and skills in the classroom (RQ1)?
2. Does participating in an in-service training session concerning technology integration into math instruction help develop teachers' interest in using technology and self-confidence to apply what has been learned (RQ2)?
3. Do teachers who complete a technology-oriented in-service training session focus more on learning to use the technology during the professional development, as opposed to applying the technology in teaching (RQ3)?
4. Do teachers who complete a technology in-service training session have a more positive attitude and outlook toward technology after completing the professional development (RQ4)?

Methodology

Participants

Participants for the research study involved public school mathematics teachers in grades 5 – 8 from South Mississippi. A total of 75 teachers (24 in 2005, 24 in 2006, and 27 in 2008) participated in the Summer Math Institute. Between five to nine high-needs schools were represented each year (5 of 9 in 2005, 9 of 12 in 2006, and 5 of 12 in 2008). In this case, high-needs schools were those that served not less than 20 percent of the children from families with incomes below the poverty line. The vast majority (80%) of the teachers had more than 3 years of teaching experience; 12% had over 25 years. The Institute provided four-weeks of professional development on the integration of technology into math instruction including: strategies involving the scientific graphing calculator, Microsoft PowerPoint, Microsoft Excel, MS Paint, MathType Equation Editor, and the Internet. Instruction occurred in a computer lab equipped with an interactive whiteboard and enough computers for each teacher to work individually. Each teacher was provided a USB flash drive and TI graphing calculator to use during the institute and for classroom instruction.

Instrumentation

Methods of data collection for this study involved teachers completing a pre- and post-survey and completing a weekly reflection instrument. An instrument for the in-service institute derived from The Concerns-Based Adoption Model was developed by the researchers (Hall & Loucks, 1979). The model describes a hypothesized sequence of seven stages that individuals experience as they adopt a new practice. Professional development strategies may then be tailored for the predominant stage of a group. The Stages of Concern instrument, consisting of 35 items, was developed for assessing concerns of teachers as they adopt new practices (Hall, George, & Rutherford, 1979). Teachers respond using a scale of 0 – 7 with 0, indicating that the concern is irrelevant and 7 indicating that the concern is very true. Bailey and Palsha tested this version with a shorter, 15-item instrument (1992). Using multiple statistical tests, these researchers demonstrated enhanced psychometric properties with the shortened version and made the argument for a five-stage model. The correlation between total concerns on both the long and short versions of the questionnaire was .92. Along with a brief description of each level of concern, the Cronbach's Coefficient Alpha for each factor is provided below.

- Awareness. The individual has little concern or involvement with the innovation, but wants to learn more about it. Cronbach's α long version .74; short version .74.
- Personal. Individuals are concerned with how the innovation will affect them, with a specific focus on required changes in roles and tasks. Cronbach's α long version .76; short version .83.
- Management. Individuals are concerned with time management, organization, and prioritizing responsibilities. Cronbach's α long version .55; short version .60.
- Impact. Individuals focus on the innovation's effects. Cronbach's α long version .73; short version .81.
- Collaboration. Individuals are concerned about working with others to implement the innovation. Cronbach's α long version .78; short version .79.

The survey developed specifically for this institute consisted of 24 items based on a four-point Likert scale: 4=Strongly Agree, 3=Agree, 2=Disagree, and 1=Strongly Disagree (see Appendix). Modifications included changing the statements from generic to more specific terms. For example, the statement "I am concerned about not having enough time to organize each day using this innovation," was changed to "I am concerned about not having enough time to organize each day when it comes to combining math and technology." There were sixteen items (1-16) of this nature. In addition, 8 statements (items 17 – 24) required teachers to indicate their perceived level of proficiencies in specific technologies (e.g., Microsoft PowerPoint, Microsoft Excel, graphing calculators, MathType Equation Editor, the Internet). Following the initial orientation session, the survey was administered during the first day of the 2005, 2006, and 2008 institutes. The questionnaire was administered again four weeks later at the end of the last regularly scheduled working day.

The second method of data collection consisted of prompted responses. The instrument consisted of five prompts on a one-page reflection paper. Each prompt was positioned within a large circle with room provided for teachers to record their responses. Prompts included: (a) I expected, (b) I got, (c) A thing of value, (d) I wish, and (e) Next I will or Next I need. In this regard, Krathwohl's affective domain taxonomy (1964) helped frame the effectiveness of a professional development institute by taking into account prior expectations. If participants' expectations are incongruent with the goals of a professional development program as indicated by responses in the "I expected" circle, then teachers may be dissatisfied with the experience despite the quality of the program. The prompts served as a means of formative assessment and enabled instructors to make modifications if needed. The prompts also facilitated the process of metacognition. Metacognition is the process of monitoring one's own learning progress and making changes to improve learning strategies (Winn & Snyder, 1998). Ways to facilitate metacognitive approaches to instruction, including the use of prompted responses, have been described in *How People Learn* (NRC, 2000). On the Friday of each week of the Institute, time was set aside at the end of the day for completing the prompted response instrument. Following the Institute, the researchers listed each teacher's responses to each prompt in an Excel document.

Findings

The presentation of findings is organized into one of the four categories developed for this study: (1) technology integration, (2) hardware, (3), software, and (4) confidence. These categories emerged as the researchers reviewed and analyzed the prompted reflections. Initially, the researchers began with six categories, but later immersed two categories into one of the four. The following discussion addresses the results from the survey, supported with responses given by the participants in the prompted reflections.

Survey Instrument

The survey consisted of 24 items (see Appendix). The researchers anticipated that scores for some items would *decrease* from pre to post, because it was hypothesized that teachers would demonstrate greater concerns about using technology in teaching mathematics at the beginning of the institute than at the end of the institute. Thus, numbers 1, 2, 5, 6, 8, 9, 15, and 16 were coded as negative items. All the negative worded statements were recoded (reversal of responses) during analysis of the survey. The researchers anticipated that scores for other items would *increase* from pre- to post-test, because it was hypothesized that teachers would demonstrate less confidence about using various technology tools at the beginning of the institute and greater confidence at the end. Positive items included numbers 3, 4, 7, 10 - 14, and 17 - 24. Overall, the survey included 16 positive and eight negative statements. The eight negative items are italicized in the Appendix. Two of the positive items overlapped among categories. Item number 7 combined integration, hardware, and software; number 17 combined integration and confidence. All the hardware and software questions were positively worded. While analyzing the overall confidence, the researchers considered all 24 items, including those designated as confidence. As shown in Table 1, six positive items (4, 7, 10, 13, 14, and 17) and four negative items (1, 5, 9, and 16) were categorized as *integration*; four positive items for *hardware* (3, 7, 21, and 23), six for *software* (7, 18, 19, 20, 22, and 24); three positive (11, 12, and 17) and four negative (2, 6, 8, and 15) for *confidence*.

Descriptive statistics (means and standard deviations) were used to describe the central tendency and dispersion on all measures. Table 2 provides the minimum and maximum scores for each category. The participant's responses over technology integration, hardware, software and confidence at the beginning and end of the program were compared by using two-tailed paired sample t-test. The 0.05 level of significance was set for the rejection of all null hypotheses.

Technology Integration

The first category to be discussed is technology integration. Participants were asked to rate their capabilities and knowledge for incorporating technology into math instruction. Results from this particular area helped answer the research questions RQ2 and RQ4. The analysis revealed that teachers' concerns decreased over the course of the institute each year. The analysis revealed significant changes in participants' attitudes toward the integration of technology in math instruction in 2005 and 2008, positive changes though not significant in 2006 (see Table 3). These results indicated teachers' confidence levels in using technology in their math instruction increased as well as their knowledge about the use of technology. They had more confidence in both their capabilities and knowledge needed for integrating technology into math instruction.

Table 1. Classification of survey items for data analysis according to category and coding

	Integration	Hardware	Software	Confidence
Positive	4,**7**,10,13,14,**17**	3,**7**,21,23	**7**,18,19,20,22,24	11,12,**17**
Negative	1,5,9,16			2,6,8,15

Table 2. Minimum and maximum scores in each category

	Total number of items	Scale	Minimum Score	Maximum Score
Positive integration	6	1-4	6	24
Negative integration	4	1-4	4	16
Hardware	4	1-4	4	16
Software	6	1-4	6	24
Total positive Confidence	16	1-4	16	64
Total Negative Confidence	8	1-4	8	32

Table 3. Attitude toward integration of technology in mathematics instruction

Year	Pre-Survey		Post-Survey		Change of Score		t	p[1]
	N	(Mean±SD)	N	(Mean±SD)	N	(Mean±SD)		
2005	18	27.50±2.12	17	30.35±3.52	15	2.20±3.53	2.41	0.0300
2006	16	28.69±2.85	17	30.71±2.93	10	0.40±3.03	0.42	0.6857
2008	22	30.23±2.14	24	32.04±3.91	20	2.30±4.08	2.52	0.0208

Note: [1] by paired *t* survey.

Participants' improved attitude toward technology integration also emerged in the prompted reflections. The following statements demonstrate how the institutes altered teachers' attitudes toward the use of technology in teaching mathematics.

As a result of this workshop, I expect to become a more efficient user of technology and use calculators and computers in my classroom.

A thing of value from this experience is the benefit of being able to learn to use a variety of strategies for various technologies in mathematics instruction for the classroom.

Next I need to go observe a computer discovery class (7th grade) in my school to learn more about how technology can be used.

Next I will take back to my classroom all the information that I have learned in this workshop. I want to carry all my skills back to the classroom to help instruct my students.

Hardware

In the hardware items, teachers were asked to rate their proficiency in the use of a graphic calculator (T1-83 or T1-84) and other technology materials. Results from this particular area helped answer the research questions RQ1 and RQ3. Paired t-tests revealed significant and positive changes in self-confidence in the knowledge and use of hardware across the three years (see Table 4). These findings show that participating in the summer mathematics institutes had a positive impact toward the attitudes of using hardware in math instruction. Researchers could also see that the participants obtained greater confidence in using hardware and became more aware of institutional support for hardware. This confidence not only made these teachers believe they were better able to use hardware, but also helped them become

Table 4. Attitude toward hardware use in mathematics instruction

Year	Pre-Survey		Post-Survey		Change of Score		t	p[1]
	N	(Mean±SD)	N	(Mean±SD)	N	(Mean±SD)		
2005	18	9.50±1.58	21	12.52±1.50	16	3.00±2.22	5.40	<0.0001
2006	21	10.62±1.88	20	12.65±1.93	17	2.12±2.50	3.50	0.0030
2008	24	9.67±1.95	26	12.69±2.43	23	3.00±2.65	5.44	<0.0001

Note: [1] by paired *t* test.

future leaders in their schools to advocate technology access and availability.

Participants' attitude toward the utilization of technology hardware to teach math concepts also changed for the better in the prompted reflections. The following statements demonstrate how the institutes improved teachers' attitudes toward the use of related technology hardware in teaching mathematics.

I got a lot of information on the calculator skills this week and how to graph the information in tables. I am feeling reasonably safe and competent with calculator use.

Wish I can learn more ways of implementing all this into my classroom. I would like to use this and see how the Smart Board and the Smart View software (in conjunction with the graphing calculator) can be used in the classroom.

I wish our district would use the graphing calculator presentation as part of our staff development. This technology can really help us teach math skills.

I expect to continue learning about Excel and the graphing calculator. So far, I have learned many things such as creating graphs and random number generators in the calculator that I had no knowledge of prior to this workshop.

I wish we were reviewed more on using the SmartBoard. We do not know all of its features and what it can do in the classroom

I wish I had a SmartBoard in my classroom. But, now I know how to ask for it (from my principal) because of what it could do for the classroom.

Software

The third category is the application of various software programs in education. Results from this particular area helped answer the research questions RQ1 and RQ3. Teachers' attitudes toward related software programs used in mathematics instruction are revealed in Table 5. Teachers were asked to rate their knowledge of software programs that included Excel, PowerPoint, Equation editor, and the Internet. Researchers found significant and positive differences between the pre- and post-surveys in all three years. From these results, researchers believe that teachers became more prepared for using the software programs available, and this increased confidence will have a positive impact on the usage of software programs in their teaching process.

Teachers also changed in their perspective toward using different software application programs to teach math concepts in the prompted reflections. The following statements demonstrate how the institute helped teachers positively perceive the use of software in teaching mathematics.

I want to continue learning various functions in Excel and use special features of PowerPoint so that I can use these programs when creating lesson plans.

Table 5. Attitude toward software use in mathematics instruction

Year	Pre-Survey		Post-Survey		Change of Score		t	p[1]
	N	(Mean±SD)	N	(Mean±SD)	N	(Mean±SD)		
2005	20	13.25±3.34	21	19.57±3.33	18	6.50±3.43	8.03	<0.0001
2006	20	15.50±3.03	21	19.81±3.93	17	3.88±5.81	2.76	0.0141
2008	23	15.65±4.15	26	20.54±4.66	22	4.73±4.97	4.46	0.0002

Note: [1] by paired *t* test.

A thing of value is learning how to make spreadsheets, creating charts and graphs, and using clipart. I also enjoyed creating PowerPoint for teaching math lessons and using animations.

A thing that I valued the most was using spreadsheets to create gradebooks. Learning how to create a gradebook from scratch and putting formulas into cells to get operations performed was useful. I know how to make the spreadsheet more for "my taste."

Confidence

The fourth category involves an increase in confidence, attitude, and a desire to continue using technology to teach math concepts in math classrooms. . Results from this particular area helped answer the research questions RQ1, RQ2, and RQ4. The results revealed significant improvement in their concerns regarding the use of technology across all years (see Table 6). According to these results, the researchers believed that the participants acquired greater confidence regarding technology integration and their knowledge of hardware and software compared to before attending the institutes. The significant changes between the scores of pre- and post-survey also indicate that the teachers were more prepared to utilize the technology available in schools. The institutes not only gave teachers knowledge of hardware and software, but also helped them gain confidence to integrate technology into their curriculum. This confidence would help teachers utilize the available technology in schools and in math classrooms. In turn, the improved confidence would help teachers explore more concepts and applications in this area.

The responses in the prompted reflections also indicate an increase in self-confidence and willingness to learn more about technology integration. The following statements demonstrate how the in-service training led by the Institute's instructors assisted in improving teachers' confidence and continuing their desire to use technology. Most of these comments with reference to confidence emerged in the *Next I will* or *Next I need* prompt.

I will continue to learn all that I can in order to be an asset to my students and my school. I also want to pass this information to my fellow co-workers.

I will continue to practice experimenting and using what I have learned. I want to take these skills into my own classroom.

I will continue to work harder in understanding the various formulas in Excel and work on my own!

I am getting a SmartBoard this coming year. So, I need to go in and play with it. I also need to begin creating PowerPoint's for certain math skills taught this coming school year while this is still fresh on my mind. I would also love to set up a master Excel sheet with formulas already set in it for students to use.

Table 6. Overall confidence in incorporating technology in mathematics instruction

Year	Pre-Survey		Post-Survey		Change of Score		t	p[1]
	N	(Mean±SD)	N	(Mean±SD)	N	(Mean±SD)		
2005	11	56.27±3.00	17	70.76±6.72	10	15.10±5.17	9.23	<0.0001
2006	14	62.79±6.14	16	72.56±6.07	9	7.33±7.58	2.90	0.0199
2008	21	59.62±6.93	23	71.30±9.23	19	12.05±8.86	5.93	<0.0001

Note: [1] by paired *t* test.

I will try and take time to find places/topics in the curriculum standards to insert Excel and PowerPoint. I also need to continue building my confidence in what I am doing.

I want to take all this information back to my classroom to make it a more exciting and productive environment for learning.

I got 50000000 much more from all this. My brain was exercised greatly with the math concepts to go along with the technology skills.

An interesting finding from the prompted reflections was the issue of time, in addition to technology access. The teachers wanted to keep learning and using these technology tools in the classrooms. But, time and access were a reoccurring concern as exemplified in these statements, "I wish I had more time with colleagues to develop in-depth math lessons for my class and have more computers in my class to implement the lessons," and "I wish I had more time and access to integrate all of this into my daily schedule."

CONCLUSION AND DISCUSSION

The research questions asked for this particular study have been answered. First, offering an in-service professional development institute concerning technology integration into math instruction can help teachers learn how their knowledge and skills could be used in the classroom. Teachers not only learned about the technology hardware and software per se, but also the practical skills that they could use in instruction. By modeling appropriate uses of technology in the institute, teachers could envision how instruction can be carried out. Second, participating in an in-service professional development institute concerning technology integration into math instruction helped develop teachers' self-confidence to apply what they learn. Many teachers who had never used a computer before voiced their aspirations to continue learning and using technology beyond the institute. Some expressed interest in becoming leaders in their schools to help others learn to use the technology tools. Third, the teachers who completed this technology-oriented institute not only focused on learning to use the technology, but also on the application of technology in teaching. The questionnaire and prompted reflections indicate that although teachers valued the how-to-use-technology instruction they received, the teachers also began thinking about how they could use the technology in their math lessons and how to make it part of their school culture. This information reveals that the institute was successful in taking teachers from the initial "awareness" level all the way to the final "collaboration" level in Bailey and Palsha's five-stage model of concern (1992). Finally, the teachers who completed this institute developed a more positive attitude and outlook toward technology. Most were excited to continue their exploration of the possibilities that technology tools could provide in the classroom and how to obtain them.

This study does have its limitations. First, the sample population is not representative of teachers in South Mississippi. They were selectively chosen to participate in the Institute through an application process. Second, the administration of the prompted reflection instrument was not always consistent. In some years, the weekly reflections were administered on Thursday rather than Friday and the content schedule fluctuated that affected how the participants responded to the prompts (e.g., for one year the topic of grants was predominant, but not in another). Although this factor did not affect the data findings, not all the participants completed both the pre- and post-surveys. Nonetheless, the findings from this study address the effectiveness of conducting an intensive, four-week professional development institute focused on the integration of technology in teaching mathematics and how this could enhance teachers' attitude, confidence, and skills acquisition.

Teachers' perceptions, attitudes, and concerns should be addressed during any professional development workshop or institute. Simply administering a questionnaire before and after an event bypasses the rationale for a concerns-based survey, and, other than providing institutional assessment, serves as a fruitless exercise. Feedback from the weekly reflections enabled instructors to address teachers' struggles with certain technologies or mathematical concepts immediately. Instructors provided personal attention and instruction was modified accordingly. As revealed by this study and others (Atkins & Vasu, 2000; Rakes & Casey, 2002), future studies should continue to be performed in the tradition of Hall and Loucks (1978) in order to examine the effectiveness of professional development in improving teachers' confidence and attitude. However, a survey is only useful if the professional development staff uses the initial analysis to design the professional development experiences. That said, however, a survey alone is not sufficient to determine all areas of concerns that teachers may have. Prompted reflections, administered daily during a workshop or weekly during an institute, provide a simple and effective way to obtain additional feedback and take immediate steps to address teachers' concerns. However, an even more thorough qualitative approach could be performed that includes interviews, observations, and document analyses. This type of examination would bring a further in-depth perspective of how professional development sessions can change the environmental culture and people's perspectives.

Professional development helps teachers become the key agents they need to be. If anyone expects change to occur in the classroom, teachers need to be well-informed, skilled, ready, and possess the correct tools for change to take place. Without this help and support, change in the mathematics classroom will not occur. The Summer Math Institute provided teachers with the professional development needed to integrate technology into the math classroom. However, this professional development model is just not limited to mathematics. Schools, colleges, and universities can adopt similar types of extended professional development to help facilitate the acquisition of not only content material (e.g., math, science, language arts), but technology skills and pedagogical applications as well. In addition, professional development requires to be delivered over a longer period of time in order to be effective in changing the confidence level of teachers. A one-time, daylong workshop is not sufficient enough to initiate change in terms of attitude and confidence. Participants in such shorter professional development sessions may acquire specific technology skills or content knowledge, but the application of such skills and knowledge may not be fully recognized. A long-term professional development model is required to help stimulate continuing interest among the participants and increase confidence. A final observation that emerged from this study is that time and access to technology must be provided to mathematics teachers. This access to technology needs to be ensured in order for change to occur in instruction. Comments made by the participants in this study emphasized the need for extra time to assimilate all the information and skills learned into their actual teaching. Furthermore, the participants were concerned that the technology used in the professional development workshop may not be available back at their schools. They believed that in order to fully integrate what had been learned from the Summer Math Institute, extra time to practice using the technology tools was required. This is an area in which educational institutions need to consider if change is to occur. In short, effective professional development is one way to stimulate interest that would extend beyond the constraints of the workshop itself and lead toward greater self-confidence in one's ability.

REFERENCES

Association of Mathematics Teacher Educators. (2008)... *Connections*, *18*(1), 1–16.

Atkins, N. E., & Vasu, E. S. (2000). Measuring knowledge of technology usage and stages of concern about computing: A study of middle school teachers. *Journal of Technology and Teacher Education*, *8*(4), 279–302.

Bailey, D. B., & Palsha, S. A. (1992). Qualities of the Stages of Concern Questionnaire and implications for educational innovations. *The Journal of Educational Research*, *85*(4), 226–232.

Cohen, V. L. (2001). The name assigned to the document by the author. This field may also contain sub-titles, series names, and report numbers.Learning styles and technology in a ninth-grade high school population. *The entity from which ERIC acquires the content, including journal, organization, and conference names, or by means of online submission from the author.Journal of Research on Technology in Education, 33*(4). Retrieved March 5, 2009 from http://206.58.233.20/jrte/33/4/abstracts/cohen.html

Crawford, M. (2001). *Teaching contextually research, rationale, and techniques for improving student motivation and achievement in mathematics and science.* Retrieved March 5, 2009 from http://www.cord.org/uploadedfiles/Teaching%20Contextually%20(Crawford).pdf

Dyer, R. D., Reed, P. A., & Berry, R. Q. (2006). Investigating the relationship between high school technology education and test scores for algebra I and geometry. *Journal of Technology Education*, *17*(2), 7–17.

Franz, D., Pope, M., & Fredrick, R. (2005). Teaching preservice teachers to use mathematic-specific technology. In C. Crawford et al. (Eds.), *Proceedings of Society for Information Technology and Teacher Education International Conference 2005* (pp. 3462-3466). Chesapeake, VA: AACE.

Garofalo, J., Drier, H., Harper, S., & Timmerman, M. A. (2000). Promoting appropriate uses of technology in mathematics teacher preparation. *Contemporary Issues in Technology and Teacher Education, 1*(1). Retrieved March 9, 2009 from http://www.cit-ejournal.org/vol1/iss1/currentissues/mathematics/article1.htm

Hall, G., George, A., & Rutherford, W. (1979). *R & D Report No. 3032*. Austin, TX: University of Texas, Research and Development Center for Teacher Education.

Hall, G. E., & Loucks, S. (1978). Teacher concerns as a basis for facilitating and personalizing staff development. *Teachers College Record*, *80*, 36–53.

Heid, K. M. (1997). The technological revolution and the reform of school mathematics. *American Journal of Education*, *106*(1), 5–61. doi:10.1086/444175

International Society for Technology in Education. (2008). *National Educational Technology Standards (NETS•T) and Performance Indicators for Teachers*. Retrieved March 5, 2009 from http://www.iste.org/AM/Template.cfm?Section=NETS

Krathwohl, D. R., Bloom, B. S., & Masia, B. B. (1964). *Taxonomy of educational objectives: Handbook II: Affective domain*. New York: David McKay Co.

Kurz, T. L., Middleton, J. A., & Yanik, H. B. (2005). A taxonomy of software for mathematics instruction. *Contemporary Issues in Technology & Teacher Education*, *5*(2), 123–137.

Lee, H., & Hollebrands, K. (2008). Preparing to teach mathematics with technology: An integrated approach to developing technological pedagogical content knowledge. *Contemporary Issues in Technology & Teacher Education*, *8*(4), 326–341.

Mitchem, K., Wells, D. H., & Wells, J. G. (2003). Effective integration of instructional technologies (IT): Evaluating professional development and instructional change. *Journal of Technology and Teacher Education*, *11*(3), 399–416.

National Council of Teachers of Mathematics. (2000). *Executive summary: Principles and Standards for School Mathematics*. Retrieved March 5, 2009 from http://www.nctm.org/uploadedFiles/Math_Standards/12752_exec_pssm.pdf

National Research Council. (2000). *How people learn: brain, mind, experience, and school*. Washington, DC: National Academy Press.

Rakes, G. C., & Casey, H. B. (2002). An analysis of teacher concerns toward instructional technology. *The International Journal of Educational Technology, 3*(1). Retrieved March 8, 2009 from http://www.ed.uiuc.edu/IJET/v3n1/rakes/index.html

Schmidt, W. H., McKnight, C. C., Houang, R. T., Wang, H. C., Wiley, D. E., Cogan, L. S., & Wolfe, R. G. (2001). *Why schools matter: a cross-national comparison of curriculum and learning*. Indianapolis, IN: Jossey Bass Publishing.

VanFossen, P. (1999, November 19-21). *Teachers would have to be crazy not to use the Internet!": Secondary social studies teachers in Indiana*. Paper presented at the Annual Meeting of the National Council for the Social Studies, Orlando, FL.

Veen, W. (1993). The role of beliefs in the use of information technology: implications for teacher education, or teaching the right thing at the right time. *Journal of Information Technology for Teacher Education*, *2*(2), 1390–153.

Whetstone, L., & Carr-Chellman, A. (2001). Preparing preservice teachers to use technology: Survey result. *TechTrends*, *45*(4), 11–17. doi:10.1007/BF02784820

Wild, M. (1996). Technology refusal: rationalizing the failure of student and beginning teachers to use computers. *British Journal of Educational Technology*, *27*(2), 134–143. doi:10.1111/j.1467-8535.1996.tb00720.x

Winn, W., & Snyder, D. (1996). Cognitive perspectives in pyschology . In Jonassen, D. H. (Ed.), *Handbook of research for educational communications and technology* (pp. 112–142). New York: Simon & Schuster Macmillan.

APPENDIX

Survey for $(SM)^2$ I Summer Math Institute Participants

The purpose of this questionnaire is to determine your current concerns regarding the integration of mathematics and technology into your classes. The items were developed from typical responses of teachers who ranged from no knowledge at all about the ideas to many years experience in using them. **Therefore, a good part of the items on this questionnaire may appear of little relevance to you at this time.** For completely irrelevant items, please circle **"NA"** on the scale. Other items will represent those concerns that you ***do*** have, in varying degrees of intensity, and should be marked higher on the scale. Please respond to the items in terms of your present concerns about your involvement, or how do you feel about your involvement with **integrating mathematics and technology into your classes.** We do not hold to any one definition of this innovation, so please think of it in terms of your own perceptions of what it involves in your teaching situation.

1 = completely disagree 2 = somewhat disagree 3 = somewhat agree 4 = completely agree NA = Irrelevant

1 2 3 4 NA 1. I am concerned about my ability to integrate mathematics with technology.
1 2 3 4 NA 2. I am concerned about not having enough time to organize each day when it comes to combining math and technology.
1 2 3 4 NA 3. I am concerned about availability of technology materials at my school.
1 2 3 4 NA 4. I would like to help other faculty in their attempts to blend technology into their subject areas.
1 2 3 4 NA 5. *I have a very limited knowledge about integrating mathematics and technology*.
1 2 3 4 NA 6. *I am concerned about the students' abilities in technologies exceeding my own*.
1 2 3 4 NA 7. I would like to how what resources are available if we decide to inte grate mathematics and technology.
1 2 3 4 NA 8. I am concerned about my inability to manage all that integrating math with technology requires.
1 2 3 4 NA 9. I would like to know how my teaching or administration is supposed to change when integrating these subjects.
1 2 3 4 NA 10. I would like to revise the instructional approach for integrating technology into the mathematics classroom.
1 2 3 4 NA 11. I would like to have more information on time and energy commitments required for integrating these subjects.
1 2 3 4 NA 12. I would like to know what other faculty are doing in this area.
1 2 3 4 NA 13. I would like to determine how to supplement, enhance, or replace the mathematics teaching that I use to integrate technology.
1 2 3 4 NA 14. I would like to use feedback from students to change my integration of the two subjects.
1 2 3 4 NA 15. I would like to know how my role in the classroom will change when I am using this approach.

1 2 3 4 NA 16. Coordination of tasks, grading, and equipment is taking too much of my time with regards to integrating math and technology.
1 2 3 4 NA 17. I would like to know how using this approach is better than what I have been doing in my classroom.
1 2 3 4 NA 18. I am proficient in the use of Powerpoint in my classroom.
1 2 3 4 NA 19. I am proficient in the use of Microsoft Excel in my classroom
1 2 3 4 NA 20. I am proficient in the use of integrating Microsoft Excel into Word documents.
1 2 3 4 NA 21. I am proficient in the use of graphing calculators (ex: TI-83) in my classroom
1 2 3 4 NA 22. I am proficient in using MathType Equation Editor to create documents.
1 2 3 4 NA 23. I am proficient in using the graphing calculator to perform spread sheet applications.
1 2 3 4 NA 24. I consider my knowledge of the Internet to be very proficient.

Note: Items in italics were coded as negative statements for the purpose of item analyses (e.g, the researchers anticipated that scores for these items would go down from pre- to post-test).

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