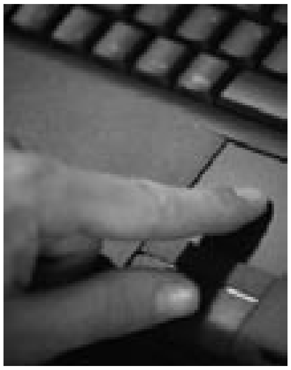

Seeking Alternatives to Inservice Technology Workshops from Teachers' Perspectives

William Sugar and Kenneth Wilson

Abstract

This study details our efforts in examining alternatives to inservice technology workshops according to the perspectives of teachers from two school districts located in the southeastern region of the United States. Our initial survey (68% return ratio) and final survey (65% return ratio) asked teachers to respond to the following four areas related to inservice technology workshops, including: technology advice that they currently seek, possible approaches to learn a new technology, ways to improve existing technology inservice workshops, and obstacles that prevent them from integrating technology. In this paper, we present relevant initial survey and final survey results. These results can affect the development of future inservice technology workshops and strategies to facilitate effective technology integration.

Public school teachers are expected to continually learn and incorporate new technologies into their respective classrooms. To respond to this current need, school districts offer a variety of inservice technology workshops. The goal of these workshops is to provide instruction on an assortment of new instructional technologies to teachers. To substantially improve schools, the continual professional development of teachers is a crucial component (e.g., Darling-Hammond & McLaughlin, 1999). There also is an indisputable need for more effective technology integration professional development. Bradshaw (2002) observed that there is "broad recognition that teachers must have new knowledge and develop new skills and attitudes before they can teach others about technology or integrate technology into their classroom instruction in meaningful ways" (p. 132). However, the traditional inservice workshop model does not appear to be a viable solution to help teachers learn about and integrate new technologies. The intent of this study was to seek possible alternatives to these conventional inservice technology workshops according to teachers' point of view.

Truisms about Inservice Technology Workshops and Teachers' Technology Skills

Apparent truisms about the current status of inservice technology workshops and teachers' technology skills are prevalent in a review of recent literature and relevant statistics from the National Center for Education Statistics (NCES). Since 1999, 99% of all public school teachers reported having computers available in their schools and 84% of those teachers had access in their actual classrooms (U.S. Department of Education, 2000). As of 2002, 92% of the public schools now have Internet access in the classroom, computer labs and media centers (U.S. Department of Education, 2003). However, only a third of these teachers reported being "well prepared" or "very well prepared" to use computers for classroom instruction (U.S. Department of Education, 2000). Russell, Finger, and Russell (2000) noted that teachers are less confident with activities requiring advanced uses of computers. To help prepare and educate themselves about using technology, more than 90% of the respondents cited "independent learning", more than 80% of the respondents listed professional development (88%) and colleagues (87%) respectively (U.S. Department of Education, 2000). In 2002, almost all of the teachers (99%) participated in technology professional development sessions during the previous 12 months. More than 80% (87%) of public schools with Internet access offered professional development on how to integrate the use of the Internet into the curriculum (U.S. Department of Education, 2003).

Critiques of Traditional Professional Development Workshops

In the past, several researchers have criticized professional development workshops. These programs often were ineffective and school systems neglected to provide adequate professional development (Cole, Simkins, & Penuel, 2002; Sparks & Hirsh, 2002; U.S. Department of Education, 2001). Typical technology workshops were designed to teach specific skills and "few center on emerging knowledge of cognition and learning and their relationship to technology-assisted learning environments" (Glenn, 1997, p. 124). Instead of having skill-based technology professional development workshops, the purpose of these workshops needs to enable teachers to critically reflect on the workshop content and develop implementation strategies to implement in their respective classrooms. Pianfetti (2001) observed, "Teachers must see links between professional activity, their existing curriculum, and the fact that student achievement will increase as a result of the teacher's professional development" (p. 258). Mouza (2002) also commented, "Traditional sit-and-get-training sessions without follow-up support have not been effective in preparing teachers to integrate classroom technologies. Rather, thoughtful and ongoing professional development programs are needed" (p. 273).

Alternatives to Traditional Professional Development Workshops

An extensive list of proposed alternatives to traditional inservice technology workshops is found in Table 1. Most of these recommendations promoted a hands-on, active learning approach (e.g., Sandholtz, 2001), as well as a collaborative professional development approach. Teachers can collaborate with each other on a particular curricular project (e.g., King, 2002), collaborate on developing the actual professional development program (Sandholtz, 2001), or tutor each other in a "Train the Trainer" model (e.g., Cooley, 2001). Specific professional development initiatives also proposed that teachers collaborate with experts (Stein, Smith, & Silver, 1999), obtain administrators' support (Sandholtz, 2001), as well as participate in a university-school partnership (e.g., Jayroe, Ball, & Novinski, 2001).

Another innovative professional development technique is an individualized, contextualized approach to learning about new technologies. Cole, Simkins, & Penuel (2002) applied a holistic design, where they implemented several approaches within a unified professional development program. A common theme amongst these alternative approaches was the emphasis on directly connecting the workshop content with the teacher's particular classroom environment, as well as providing individualized instruction (Gray, 2001). Stein, Smith, & Silver (1999) advised:

> Professional developers will need not only to have access to a variety of strategies, but also to have the ability to gauge which strategy will be most effective with a given set of teachers, in a given setting, at a particular point in the developmental trajectory of the teachers. (p. 263)

The social constructivist theoretical perspective is prevalent in several of these proposed professional development alternatives. Teachers need to develop their decision-making and reflective skills in these workshops (e.g., Holland, 2001). In fact, Koszalka, Grabowski, and McCarthy (2003) developed:

> A reflection tool to help teachers move through the stages of innovation by prompting them to think about possibilities, realities, issues, standards, and multidimensional perspectives of teaching and learning to create an action plan for transforming their classroom into a Web-enhanced learning environment. (p. 347)

Also, associated with this social constructivist theory are learning communities. In these communities, teachers collaborate and learn together, as opposed to learning in isolation in a typical professional development workshop. For example, Dexter, Seashore, and Anderson (2002) developed a technology learning community and noted, "the professional community deepened and refined the shared vision related to the purposes of instructional technology and the technology support" (p. 489).

Another inservice workshop alternative is a technology mentoring or situated professional development program (see Chuang, Thompson, & Schmidt, 2003 for an overview on various faculty mentoring programs). In this type of program, a technology coach, mentor, counselor, or a technology learning coordinator (Cole, Simkins, & Penul, 2002) is assigned to a group of teachers to provide technology support and guidance. A NCES report noted: "70% of the teachers who were mentored at least once a week reported that it improved their teaching" (U.S. Department of Education, 1999, p. v). Several professional development programs have applied this mentoring approach within an online setting. These virtual environments provided an electronic apprenticeship for these teachers. That is, teachers conferred and collaborated with peers and experts concerning technology integration-related activities.

Goal of Study

The goal of our study was to determine possible alternatives to inservice technology workshops according to teachers' perspectives. We sought to examine teachers' perceived alternatives (if any) to traditional inservice technology workshops and how these possible alternatives correspond to proposed theories on improving inservice technology training. With these data, we speculated and offered guidance on how to improve future professional development activities according to teachers' experience and confidence towards using technology.

Methods

To accomplish the goal of this study, we conducted a multi-stage research design composed of preliminary interviews, an initial survey, and a follow-up survey. The three stages are summarized below.

Preliminary Interviews

In order to develop a questionnaire that reflected the experiences and needs of teachers, six middle school teachers and two administrators (principal and a technology lab coordinator) were interviewed on their perceptions about current technology staff development workshops. During these interviews, respondents commented on topics related to their own staff development, inservice technology workshops and their technology expertise. Using an adaptation of the constant comparison technique (Glaser & Strauss, 1967; Lincoln & Guba, 1985), we categorized these individuals' responses and developed the initial set of topics that that needed to be included in our questionnaire. We compared each interview response with each other and developed the following topic areas:

- Best approaches on how to learn a new technology (*Approaches*)
- Improvements to existing technology inservice workshops (*Improvements*)
- Technology advice that teachers currently seek (*Advice*)
- Obstacles that prevent teachers from integrating technology (*Obstacles*)

Table 1. Current Professional Development Best Practices

Best practice	Citation
Individualized and contextualized	Ball & Cohen (1999); Gray (2001); Sparks & Hirsh (2002); Stein, Smith & Silver (1999)
Collaborative teams	Beavers (2001); Cooley (2001); Glenn (1997); Gray (2001); Guskey (1995); Hawley & Valli (1999); King (2002); Marx, Blumenfeld, Krajcik, & Soloway (1998); Sandholtz (2001)
School partnerships	Cole, Simkins, & Penuel (2002); DeWert & Cory (1996); Fullan (1995); Jayroe, Ball, & Novinski (2001); LePage, Boudreau, Maier, Robinson, & Cox, (2001)
Social constructivist influences	Carney (1998); Cifuentes (1997); Holland (2001); Koszalka, Grabowski & McCarthy (2003); Kuiper & Wilkinson (1998); Sandholtz (2001); Thompson (2001)
Learning communities	Dexter, Seashore, & Anderson (2002); King (2002); Knight (2002); MaKinster, Barab, & Keating (2001); Reynolds, Treay, Chao, & Barab (2001); Stein, Smith & Silver (1999)
Mentoring	Bowman, Newman, & Masterson (2001); Cole, Simkins, & Penuel (2002); Dexter, Anderson, & Ronnkvist (2002); Sandholtz (2001); Sprague, Kopfman, & Dorsey, 1998; Swan, Holmes, Vargas, Jennings, Meier, & Rubenfeld, 2002
Online initiatives	Barker (2002); Barkley & Bianco (2002); Bronack, Kilbane, Herbert, & McNergney (1999); Bonk, Ehman, Hixon, & Yamagata-Lynch (2002); Koszalka, Grabowski & McCarthy (2003); Leask & Younie (2001); Levin, Waddoups, Levin, & Buell (2001); MacKenzie & Staley (2000); Marx, Blumenfeld, Krajcik, & Soloway (1998); MaKinster, Barab, & Keating (2001); Pianfetti (2001); Reynolds, Treay, Chao, & Barab (2001); Saarenkunnas, Jarvela, Hakkinen, Kuure, Taalas, & Kunelius (2000); Schrum (1996); Topper, Gillingham, Ellefson, & Worthington (1997)

Initial Survey

A set of questions was developed to assess the entire domain of each topic. The questions were drawn both from the preliminary interviews and from existing literature. Teachers were asked to check each item with which they agreed. They could select as many or as few as they liked. The items are found in Table 2 under the headings: *Approaches*, *Improvements*, *Advice*, and *Obstacles*.

The initial survey was conducted in two school districts located in the southeastern region of the United States. These districts were selected because of their availability and willingness to participate. Although a random sample of school districts would provide stronger evidence that the results could be widely generalized, selecting more limited populations is an important and useful research strategy. These two districts, upon examination, seemed to be fairly typical of many southeastern school districts, and also offered traditional, inservice technology workshops. Out of 734 teachers in the two districts, 497 completed the survey, for a return rate of 68%.

Final Survey

In Table 2, you will find the initial survey responses. To more accurately identify practical alternatives to inservice technology workshops, the final survey incorporated the questions from the initial survey that were identified by more than 25% of the initial survey respondents. (See Table 2.) In consultation with a technology coordinator at one of the school districts, we decided to include *Lack of training* in the *Obstacles* category. We also included *Lack of confidence* in the *Obstacles* subscale, even though only 23.8% of the respondents identified this item as an obstacle. Although this factor did not meet our original "25% or more" threshold, we considered teachers' confidence level to be a critical factor in adopting new technologies. The final survey was organized into the following four categories and subscales:

- Best approaches on how to learn a new technology (*Approaches*)
- Improvements to existing technology inservice workshops (*Improvements*)
- Technology advice that teachers currently seek (*Advice*)
- Obstacles that prevent teachers from integrating technology (*Obstacles*)

Each of the items was presented in the form of statements with Likert-type responses. For the *Approaches*, *Improvements*, and *Advice* subscales, each item ranged from *Very Beneficial* (5) to *Very Disadvantageous* (1). For the *Obstacles* subscale, each item ranged from *Very Significant* (5) to *Very Insignificant* (1).

In addition to these four categories, two single items were included to assess the teacher's experience in using technology and teacher's confidence in using technology. The technology experience question asked respondents to rate their experience on a five-point Likert scale from *Expert* to *Novice*. Teachers were also asked to indicate how confident they were using technology in your classroom on a five-point Likert scale from *Very confident* to *Very unconfident*.

All teachers in two school districts located in the southeastern region of the United States (different from the two districts involved in the initial survey) were asked to complete the final survey. These districts were also selected because of their availability and willingness to participate, and also seemed to be fairly typical of many southeastern school districts. Again, these two school districts offered traditional, inservice technology workshops. Out of 1,344 teachers in the districts, 875 completed the survey, for a return rate of 65%.

Data Analyses

We focused part of our data analysis of the final survey results by comparing teachers' self-perceived confidence in using technology and technology

Table 2. Percentage of Subscale Items Identified by Initial Survey Participants

Subscale item	Percentage of survey responses
Approaches	
Hands-on activities	93.7%
Inservice training	66.3%
Talk with teachers	46.4%
"Trial and error"	46.1%
"How to" type instructions	34.1%
Talk with experts	29.2%
Talk with a technology "coach"	26.0%
Continuing education classes	23.6%
Manuals	20.0%
Online activities	17.1%
University classes	9.5%
Improvements	
Have variety of workshops to select from	64.8%
More practice time with technology	46.8%
Expose teachers to "new" technology	45.1%
More specific technology that is related to my discipline	43.9%
Address actual technology needs that are found at actual school	38.2%
More convenient time to take workshops	37.9%
Enough computers for teachers to work on	37.2%
Share ideas and successful tips on using technology	36.7%
Need to demonstrate more how one can use technology in classroom	36.2%
One-to-one training	28.4%
More advanced information discussed at workshops	17.7%
Need more current hardware in workshops	10.4%
Advice	
"Whenever something goes 'wrong', it fixes the problem."	51.1%
Develop creative lessons	48.7%
Provide step-by-step instructions on performing technical tasks	47.1%
Someone who helps me with my specific technology needs	41.2%
Time saving tips on using applications	40.4%
Information on software packages	38.4%
Resources and tools for technology integration	34.6%
Provide advanced multimedia training	33.4%
Observe other schools and see what they are doing with technology	31.6%
Creating web pages	30.4%
Teaching in a one computer classroom	22.4%
Internet tasks	21.0%
Advanced technologies (e.g., virtual reality)	18.3%
Basic technologies (e.g., databases, spreadsheets)	17.7%
"I am not exactly sure what I need to know."	11.0%
Obstacles	
Lack of preparation time	59.2%
Lack of equipment	41.3%
Lack of technology support	29.8%
Lack of funding	27.3%
Lack of technology knowledge	25%
Lack of confidence	23.8%
Lack of training	20.7%
Lack of planning	20.6%
Large class sizes	18.8%
Lack of basic computer skills	10.7%
Lack of access to computer lab	10.7%
Do not have personal interest	5.8%
Technology does not fit into curriculum	4.9%

experience with the four subscale items, including: *Approaches*, *Improvements*, *Advice*, and *Obstacles*. We conducted one-way analysis of variance and bivariate correlation analysis with the four subscale items and teachers' technology experience, as well as with technology confidence. In addition to these data analysis methods, we also conducted factor analysis with the four subscale items to determine if the various items in the subscale form a homogeneous domain. Table 3 lists the results of these factor analyses and the Varimax factor loadings greater than or equal to .50. Using these quantitative analysis methods, we describe pertinent initial and final survey results in the following Results section.

Results

In Figure 1, we list the frequencies of respondents' technology experience and levels of confidence based on the follow-up survey. The majority of respondents were either competent technology users (41.7%) or had average technology experience (43.3%). Slightly more than nine percent of the respondents (9.3%) were either novices or had limited technology experience ("Know how to use one or two technologies"). Almost four percent of the respondents (3.9%) rated themselves as technology experts. A majority of the respondents claimed that they were either confident or very confident in using technology in their respective classrooms (47.2%) or rated their confidence as average (44.8%). Approximately eight percent (8.1%) of the respondents were either unconfident or very unconfident in using technology.

Approaches to Learning New Technologies

Overwhelmingly, it appears that teachers prefer to have inservice workshops with a hands-on approach. More than ninety percent of the initial survey respondents (93.7%) and follow-up survey respondents (97.4%) reported that a hands-on approach was a favorable method in learning new technologies. More than two-thirds of initial survey respondents (66.3%) and more than ninety percent of the follow-up survey respondents (94.2%) remarked that an inservice workshop was a beneficial method of learning new technologies. However, inservice workshops

Table 3. Varimax Rotated Factor Loadings for Alternatives To Technology Workshops Survey Subscale Items

Subscale items	Loadings
Approaches	
Inservice training	.73
Talk with a technology "coach"	.72
Talk with experts	.66
Hands-on activities	.64
Talk with teachers	.54
Improvements	
Share ideas and successful tips on using technology	.77
More specific technology that is related to my discipline	.74
Address actual technology needs that are found at actual school	.72
Expose teachers to "new" technology	.71
Need to demonstrate more how one can use technology in classroom	.67
More practice time with technology	.65
Enough computers for teachers to work on	.58
One-to-one training	.57
Advice	
Resources and tools for technology integration	.79
Advanced multimedia training	.77
Time saving tips on using applications	.74
Develop creative lessons	.71
Information on software packages	.70
Provide step-by-step instructions on performing technical tasks	.66
Observe other schools and see what they are doing with technology	.65
Someone who helps me with my specific technology needs	.64
"Whenever something goes 'wrong', it fixes the problem."	.63
Creating web pages	.58
Obstacles – Personal	
Lack of knowledge	.96
Lack of confidence	.82
Lack of training	.73
Obstacles – External	
Lack of equipment	.74
Lack of funding	.70
Lack of support	.61

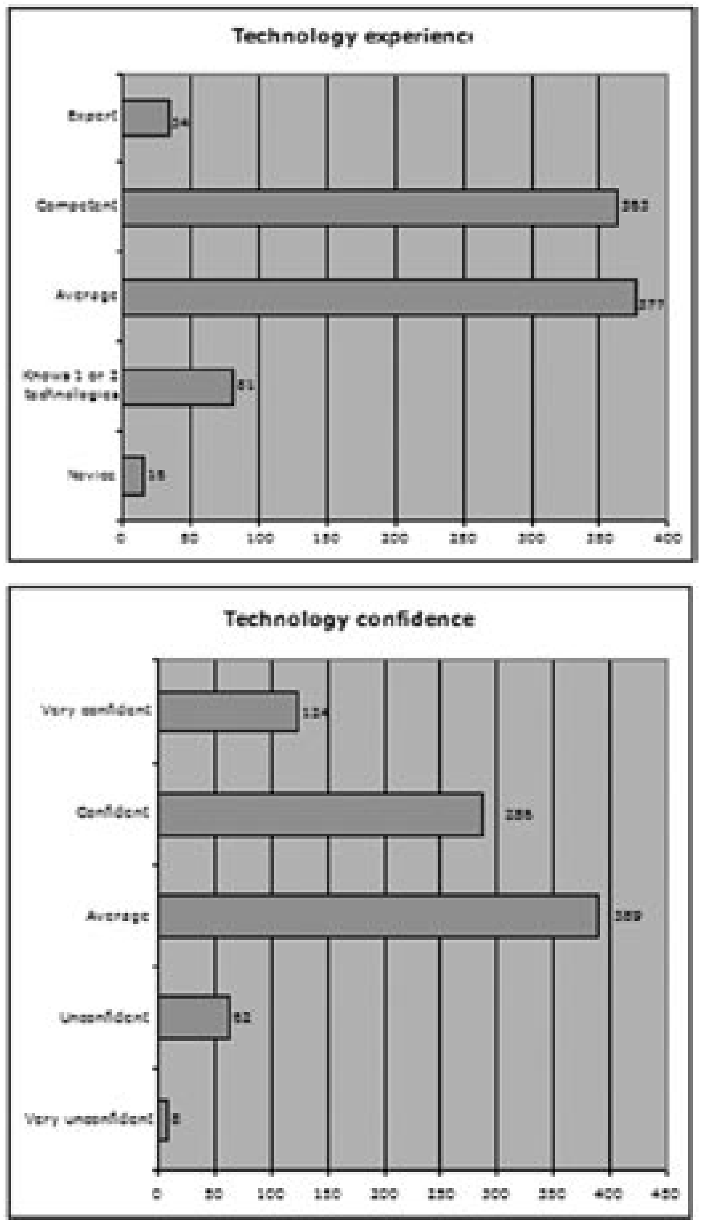

Figure 1. Frequencies of respondents' technology experience and levels of confidence

that employ a hands-on approach also should emphasize a collaborative method. As represented in Table 3, when inservice workshops were combined with a hands-on approach, talking with teachers, experts, and a technology coach, 46% of the common variance amongst respondents is accounted for. This factor had a Cronbach alpha reliability rating of .79. Within an inservice technology workshop setting, more than ninety percent of the respondents preferred to discuss, talk, and collaborate with other teachers (92%), experts (92%) and mentors (90%) while they learn about new technologies. However, teachers who have more technology experience tend to view talking with experts as a beneficial method more than teachers who have less experience (F=4.709 (4, 844) p<.001). There also was a significant correlation with technology experience and talking with experts (r=.144; p<.001) as well as with technology confidence (r=.202; p<.001).

In addition to this collaborative, hands-on approach, teachers who have more experience and confidence preferred a trial-and-error method in learning new technologies. Teachers who do not have confidence in their technology abilities and do not have extensive experience appear to be more cautious. Apparently, novice teachers (F=2.699 (4, 847) p<.03) and unconfident teachers (F=5.710 (4, 844) p<.000) do not view experimental activities that involve trial-and-error activities as being beneficial. Trial-and-error activities also had a significant correlation with technology experience (r=.106; p<.001), as well as with confidence (r=.146; p<.001).

Improvements to Existing Technology Inservice Workshops

The *Improvements* subscale accounted for 46% of the common total variance and had a Cronbach alpha reliability rating of .87. (See Table 3.) Three items appear to be more linked to teachers who have more technology experience. A significant number of teachers who have lots of technology experience believed that the improvements *Expose teachers to "new" technology* (F=8.031 (4, 862) p<.000) and *More specific technology that is related to my discipline* (F=4.323 (4, 858) p<.002) were beneficial, as opposed to their counterparts who were inexperienced with technology. The improvement *Address actual technology needs that are found at actual school* also had a slight significant difference between teachers who have more experience than teachers who have little or no technology experience (F=2.815 (4, 854) p<.024). Each of these three improvements had a significant correlation with technology experience, including: *Expose teachers to "new" technology* (r=.178; p<.001), *More specific technology that is related to my discipline* (r=.112; p<.001), and *Address actual technology needs that are found at actual school* (r=.08; p<.005). Similarly, each of these three improvements had a significant correlation with technology confidence, including: *Expose teachers to "new" technology* (r=.209; p<.001), *More specific technology that is related to my discipline* (r=.127; p<.001), and *Address actual technology needs that are found at actual school* (r=.116; p<.001). Interestingly, one Improvements item, *one-to-one training*, had a negative correlation with technology experience (r=-.086; p<.005).

Advice to Help Integrate Technology in the Classroom

The *Advice* subscale accounted for 53% of the common total variance and had a Cronbach alpha reliability rating of .89. (See Table 3.) More technology experienced teachers tend to be more favorable towards three Advice items that focused on actual technology resources. These Advice items included: *Creating Web pages* (F=6.439 (4, 859) p<.000); *Advanced multimedia training* (F=8.389 (4, 846) p<.000); and *Other schools' technology projects* (F=5.974 (4, 843) p<.000). Correspondingly, survey respondents who had more confidence in using technology also tend to be more favorable towards the same three Advice items: *Creating Web pages* (F=15.232 (4, 857) p<.000); *Advanced multimedia training* (F=17.382 (4, 843) p<.000); and *Other schools' technology projects* (F=12.471 (4, 840) p<.000). In each instance, teachers who had less experience and were less confident were unsure about the benefits of a particular resource. For example, almost 30% of the teachers (28.3%) who had limited or no technology experience were undecided about the benefits of examining other schools' technology projects, whereas only 16.5% of their competent or expert counterparts were undecided. More than 40% of the teachers (44.3%) who were either unconfident or very unconfident were undecided about the benefits of creating Web pages, whereas only 17.9% of their confident or very confident counterparts were undecided.

Obstacles to Integrating Technology in the Classroom

The *Obstacles* subscale produced a two-factor solution and had a Cronbach alpha of .78 (see Table 3). The first factor accounted for 40% of common total variance and included the following items: *Lack of knowledge*, *Lack of confidence*, and *Lack of training*. The second factor accounted for 20% of common total variance and included the following items: *Lack of equipment*, *Lack of funding*, and *Lack of support*. The grouping of *Lack of knowledge*, *Lack of confidence* and *Lack of training* relates to actual teachers and their personal experiences with technology. The grouping of *Lack of equipment*, *Lack of funding* and *Lack of support* relates to external support.

Three "personal" obstacles (*Lack of confidence*, *Lack of knowledge*, and *Lack of training*) tend to be more significant with teachers who have little or no technology experience and are unconfident. Overwhelmingly, teachers who rated themselves as inexperienced technology users found the obstacles *Lack of confidence* (F=55.137 (4, 825) p<.000), *Lack of knowledge* (F=62.683 (4, 818) p<.000), and *Lack of training* (F=37.463 (4, 815) p<.000) more significant than teachers who have more extensive technology experience. These obstacles also generated a negative correlation with technology expertise: *Lack of confidence* (r=-.452; p<.001), *Lack of knowledge* (r=-.477; p<.001), and *Lack of training* (r=-.389; p<.001). There definitively was a difference of opinions about these obstacles between inexperienced technology-using teachers and experienced teachers. For example, more than eighty percent of teachers (81.8%) with little technology experience believed lack of training was a significant obstacle, whereas approximately 35% of their more experienced counterparts (35.6%) believed lack of training was a significant obstacle.

Similarly, teachers who rated themselves as unconfident or very unconfident found the obstacles *Lack of confidence* (F=68.862 (4, 824) p<.000), *Lack of knowledge* (F=64.693 (4, 817) p<.000), and *Lack of training* (F=35.235 (4, 814) p<.000) more significant than teachers who rated themselves as confident or very confident. These obstacles also generated a negative correlation with technology confidence, including: *Lack of confidence* (r=-.486; p<.001), *Lack of knowledge* (r=-.484; p<.001), and *Lack of training* (r=-.378; p<.001). Again, there was a difference of opinions about these obstacles between unconfident teachers and confident teachers. For example, almost eighty percent of unconfident teachers (79%) believed lack of training was a significant obstacle, whereas only 36.3% of their confident counterparts believed lack of training was a significant obstacle.

One "external" obstacle, *Lack of funding*, was more likely to be a significant obstacle amongst teachers who have more technology experience (F=3.776 (4, 825) p<.005) and are more confident (F=4.915 (4, 823) p<.001). *Lack of funding* also had a positive correlation with technology experience (r=.129; p<.001). The main difference lies in teachers who were undecided about the significance of this obstacle. Almost 20% of teachers (19.1%) with little technology experience were undecided about the significance of lack of funding, whereas only 9.6% of teachers who have more technology experience were undecided. In addition, more than 20% of teachers (20.6%) who are unconfident were undecided about the significance of lack of funding, whereas only 9.5% of confident teachers were undecided.

Implications

In this section, we discuss the implications of these results on future inservice technology professional development for teachers. Specifically, we consider the effect of these results on developing future professional development activities, as well as compare these results with proposed alternatives to professional development activities.

Developing Future Professional Development Activities

One of the most striking findings is the number of teachers (47.2%) who rated themselves as very confident or confident in using technologies in their respective classrooms, as well as teachers (44.8%) who rated their technology confidence as average. This figure is impressive and represents a considerable difference with the earlier data collected by NCES, in which a third of the teachers surveyed feel prepared in using computers in their classrooms (U.S. Department of Education, 2000). We also note that the majority of the respondents (85%) either rated their technology skills as competent or average. We are cautiously optimistic about this increased technology experience and confidence. More investigations on teachers' individual technology skills and their perceived confidence in using technology will provide further insight into whether teachers indeed are more confident in using technology.

Another notable result is the definitive difference between experienced, confident teachers and novice, unconfident teachers with regards to inservice training. Teachers with little or no technology experience clearly viewed personal obstacles (i.e., training, knowledge, and confidence) as more significant than their experienced and confident counterparts. In contrast, more experienced and confident teachers perceived one external obstacle—lack of funding—as more significant. This contrast between personal and external obstacles to integrating technology is quite similar to Ertmer's (1999) first-order and second-order barriers. Though these second order barriers are related to one's beliefs about the use of technology, we can assume the novice's lack of knowledge, training, and confidence are precursors to forming one's beliefs about technology. Our novice respondents were more concerned about personal/second-order beliefs before being concerned with external/first-order beliefs.

Besides these personal obstacles, teachers who have little or no experience appear to be more cautious towards specific approaches in learning about new technologies. They significantly rated *talking with experts* and *trial and error* as less beneficial compared to their more experienced counterparts. A possible solution could be the role of a technology mentor. Because there was a negative correlation ($r=-.086$; $p<.05$) between expertise and one-to-one training, it appears that some teachers who have more technology expertise may not see the value of collaborating with a mentor. Quite possibly, teachers who have more technology experience do not need the assistance of a technology coach. Conversely, teachers who have little or no technology experience do need this support.

Once teachers become more confident and gain more experience with technology, they probably will have specific expectations on learning more about specific technology resources. From our results, teachers who are confident in their technology use and have technology expertise view more sophisticated technology resources (i.e., creating Web pages, advanced multimedia training, other schools' technology initiatives) as more beneficial. After receiving training in basic technology skills, teachers will expect more training in more advanced resources. Equally, teachers with little or no technology experience apparently do not perceive this advanced knowledge as beneficial.

Our focus now shifts to the "average" teacher—that is, the teacher who has average experience and average confidence. In several cases, the average-experience and average-confidence teachers rated themselves in between the inexperienced and unconfident teachers and the experienced and confident teachers. However, in some cases, the average teachers were more aligned with their inexperienced and unconfident counterparts. For instance, 25.8% of the novice teachers either were undecided or viewed the trial-and-error method as a disadvantageous approach. More than twenty percent of average experienced teachers (22.5%) also were undecided or viewed the trial-and-error method as disadvantageous. Only 14% of experienced teachers (competent or expert) were undecided or viewed the trial and error method as a disadvantageous approach. Similar frequencies occurred with the *Advice* item *Creating Web pages*. Almost 40% of teachers (39.2%) who had little or no technology experience were undecided about the effectiveness of creating Web pages. More than 30% of their average counterparts (31.1%) also were undecided, whereas 19.5% of experienced teachers were undecided about this *Advice* item.

On the contrary, some average teacher responses were more aligned with more experienced and confident teachers. For instance, 12.8% of the experienced teachers were undecided or viewed advanced multimedia as being unbeneficial, whereas 17.6% of the average teachers were undecided or viewed advanced multimedia as being unbeneficial. This figure increases with inexperienced teachers. More than thirty percent of the inexperienced teachers (31.5%) were undecided or viewed advanced multimedia as being unbeneficial. This distribution also occurred with the *Lack of funding* obstacle. More than 85% of the confident and very confident respondents viewed *Lack of funding* as a significant or very significant obstacle. Similarly, more than 80% of average confident respondents also viewed this obstacle as significant or very significant. However, 65% of unconfident or very unconfident respondents viewed *Lack of funding* as a significant or very significant obstacle.

Proposed Alternatives to Professional Development Activities

The individualized and contextualized approach in learning new technology overwhelmingly was approved by all teachers. Ninety-five percent of the final survey respondents viewed *someone who helps me with my specific technology needs in my classroom* as being a beneficial or very beneficial approach. However, compared to less experienced and confident teachers, more experienced and confident teachers preferred two *Improvements* items (i.e., *address actual technology needs* and *more specific technology that is related to my discipline*) that focused on this individualized approach. The preference for discipline-related technology may be connected to the novice's personal obstacles (knowledge, confidence, and training) and cautious behavior towards learning new technologies. Novice teachers need to learn more and feel comfortable towards new technologies before they learn how to apply these technologies in their own discipline.

The hands-on, collaborative approach also was a clear winner amongst the respondents. When combined with inservice workshops, hands-on and collaborative activities (i.e., talking with teachers, experts, and a technology coach) accounted for 46% of the common variance within the *Approaches* factor. This outcome has clear consequences. Teachers prefer an active and collaborative approach during inservice technology workshops and related activities. Professional developers should consider incorporating a learning community approach in educating teachers about new technologies. Teachers should have ample opportunities to talk, discuss and collaborate with each other and other individuals (e.g., mentor, experts, administrators, etc.).

One approach that was absent from the final survey was online instructional activities. Online activities only were preferred by 17% of the initial survey respondents as a viable approach in learning new technologies. Despite this low percentage, we do not believe that this is a permanent indictment against this instructional method. Most likely, initial survey respondents were not aware of possible online approaches listed in Table 1. Thus, they could not accurately evaluate the effectiveness of *all* online professional development activities; they could only evaluate the online activities offered by their respective school districts. We still advocate a hands-on, collaborative, individualized approach for online instructional initiatives. That is, online inservice technology workshops should not have a traditional tutorial design but should emphasize an interactive, contextualized, and collaborative design.

Conclusion

The results from our study give insight into how to educate teachers about integrating current technologies into the curriculum. These results and their implications also offer advice for those who are developing future professional development workshops. There are apparent professional development differences between the needs of novice, average and experienced teachers, as well as teachers who have varying levels of confidence in using technologies. Professional developers who develop technology inservice activities should heed these differences. To facilitate effective technology integration, these individuals and school administrators should promote and develop hands-on, collaborative, and individualized professional development activities for their respective teachers.

References

Ball, D. L., & Cohen, D. K. (1999). Developing practice, developing practitioners: Toward a practice-based theory of professional education. In L. Darling–Hammond & G. Sykes (Eds.), *Teaching as the learning profession: Handbook of policy and practice*. (pp. 3–32). San Francisco: Jossey-Bass Publishers.

Barker, P. (2002). On being an online tutor. *Innovations in Education and Teaching International, 39*(1), 3–13.

Barkley, S., & Bianco, T. (2002). Part digital training, part human touch: Rural district mixes its offering of staff development services. *Journal of Staff Development, 23*(1), 42–45.

Beavers, D. (2001). Professional development: Outside the workshop box. *Principal Leadership, 1*(9), 43–46.

Bonk, C., Ehman, L., Hixon, E., & Yamagata-Lynch, L. (2002). Pedagogical TICKIT: Web conferencing to promote communication and support during teacher professional development. *Journal of Technology and Teacher Education, 10*(2), 205–233.

Bowman, J., Jr., Newman, D. L., & Masterson, J. (2001). Adopting educational technology: implications for designing interventions. *Journal of Educational Computing Research, 25*(1), 81–94.

Bradshaw, L. (2002). Technology for teaching and learning: Strategies for staff development and follow-up support. *Journal of Technology and Teacher Education, 10*(1), 131–150.

Bronack, S. C., Kilbane, C. R., Herbert, J. M., & McNergney, R. F. (1999). Inservice and pre-service teachers' perceptions of a Web-based, case-based learning environment. *Journal of Information Technology for Teacher Education, 8*(3), 305–320.

Carney, J. M. (1998). Integrating technology into constructivist classrooms: an examination of one model for teacher development. *Journal of Computing in Teacher Education, 15*(1), 7–15.

Chuang, H., Thompson, A., & Schmidt, D. (2003). Faculty technology mentoring programs: Major trends in the literature. *Journal of Computing in Teacher Education, 19*(4), 101–106.

Cifuentes, L. (1997). From sages to guides: A professional development study. *Journal of Technology and Teacher Education, 5*(1), 67–77.

Cole, K., Simkins, M., & Penul, W. (2002). Learning to teach with technology: Strategies for inservice professional development. *Journal of Technology and Teacher Education, 10*(3), 431–455.

Cooley, V. E. (2001). Implementing technology using the teachers as trainers staff development model. *Journal of Technology and Teacher Education, 9*(2), 269–284.

Darling-Hammond, L., & McLaughlin, M. W. (1999). Investing in teaching as a learning profession: Policy problems and prospects. In L. Darling–Hammond & G. Sykes (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp. 376–411). San Francisco: Jossey-Bass Publishers.

DeWert, M. H., & Cory, S. L. (1996). Becoming partners: building a school/university collaboration focused on teaching and learning with technology. *Journal of Computing in Teacher Education, 12*(3), 8–12.

Dexter, S. L., Anderson, R. E., & Ronnkvist, A. M. (2002). Quality technology support: What is it? Who has it? and what difference does it make? *Journal of Educational Computing Research, 26*(3), 265–285.

Dexter, S., Seashore, K. R., & Anderson, R. E. (2002). Contributions of professional community to exemplary use of ICT. *Journal of Computer Assisted Learning, 18*(4), 489–497.

Ertmer, P. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4), 47–61.

Fullan, M. G. (1995). The limits and the potential of professional development. In T. R. Guskey & M. Huberman (Eds.), *Professional development in education: New paradigms and practices* (pp. 253–267). New York: Teachers College Press.

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research.* Chicago: Aldine Publishing Company.

Glenn, A. D. (1997). Technology and the continuing education of classroom teachers. *Peabody Journal of Education, 72*(1), 122–128.

Gray, K. C. (2001). Teachers' perceptions of innovation adoption. *Action in Teacher Education, 23*(2), 30–35.

Guskey, T. R. (1995). Professional development in education: In search of the optimal mix. In T. R. Guskey & M. Huberman (Eds.), *Professional development in education: New paradigms and practices* (pp. 114–131). New York: Teachers College Press.

Hawley, W. D., & Valli, L. (1999). The essentials of effective professional development: A new consensus. In L. Darling–Hammond and G. Sykes (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp. 127–150). San Francisco: Jossey-Bass Publishers.

Holland, P. E. (2001). Professional development in technology: Catalyst for school reform. *Journal of Technology and Teacher Education, 9*(2), 245–267.

Jayroe, T. B., Ball, K. C., & Novinski, M. R. (2001). Professional development partnerships integrating educational technology. *Journal of Computing in Teacher Education, 18*(1), 12–18.

King, K. P. (2002). Educational technology professional development as transformative learning opportunities. *Computers & Education, 39*(3), 283–297.

Knight, P. (2002). A systemic approach to professional development: Learning as practice. *Teaching and Teacher Education, 18*(3), 229–241.

Koszalka, T., Grabowski, B., & McCarthy, M. (2003). Reflection through the ID-PRISM: A teacher planning tool to transform classrooms into web-enhanced learning environments. *Journal of Technology and Teacher Education, 11*(3), 347–375.

Kuiper, J., & Wilkinson, W. (1998). Teachers' professional development through technology education. *South African Journal of Higher Education, 12*(1), 207–219.

Leask, M., & Younie, S. (2001). The European Schoolnet. An online European community for teachers? A valuable professional resource? *Teacher Development, 5*(2), 157–175.

LePage, P., Boudreau, S., Maier, S., Robinson, J., & Cox, H. (2001). Exploring the complexities of the relationship between K-

12 and college faculty in a nontraditional professional development program. *Teaching and Teacher Education, 17*(2), 195–211.

Levin, S. R., Waddoups, G. L., Levin, J., & Buell, J. (2001). Highly interactive and effective online learning environments for teacher professional development. *International Journal of Educational Technology, 2*(2). Retrieved May 9, 2005 from http://www.ao.uiuc.edu/ijet/v2n2/slevin/index.html.

Lincoln, Y., & Guba, E. (1985). *Naturalistic inquiry.* Beverly Hills, CA: Sage Publications.

MaKinster, J. G., Barab, S. A., & Keating, T. M. (2001). Design and implementation of an on-line professional development community: A project-based learning approach in a graduate seminar. *Electronic Journal of Science Education, 5*(3). Retrieved May 9, 2005 from http://unr.edu/homepage/crowther/ejse/makinsteretal.html.

MacKenzie, N., & Staley, A. (2001). Online professional development for academic staff: Putting the curriculum first. *Innovations in Education and Training International, 38*(1), 42–53.

Marx, R. W., Blumenfeld, P. C., Krajcik, J. S., & Soloway, E. (1998). New technologies for teacher professional development. *Teaching and Teacher Education, 14*(1), 33–52.

Mouza , C. (2002). Learning to teach with new technology: Implications for professional development. *Journal of Research on Technology in Education, 35*(2), 272–289.

Pianfetti, E. S. (2001). Teachers and technology: digital literacy through professional development. *Language Arts, 78*(3), 255–262.

Reynolds, E., Treahy, D., Chao, C.-c., & Barab, S. (2001). The Internet Learning Forum: Developing a community prototype for teachers of the 21st Century. *Computers in the Schools, 17*(3–4), 107–125.

Russell, G., Finger, G., & Russell, N. (2000). Information technology skills of Australian teachers: Implications for teacher education. *Journal of Information Technology for Teacher Education, 9*(2), 149–166.

Saarenkunnas, M., Jarvela, S., Hakkinen, P., Kuure, L., Taalas, P., & Kunelius, E. (2000). Ninter-networked interaction: Theory-based cases in teaching and learning. *Learning Environments Research, 3*(1), 35–50.

Sandholtz, J. H. (2001). Learning to teach with technology: A comparison of teacher development programs. *Journal of Technology and Teacher Education, 9*(3), 349–374.

Schrum, L. (1996). Rural telecommunication for educational professional development and instructional improvement: Two federally funded models. *Journal of Technology and Teacher Education, 4*(3–4), 247–262.

Sparks, D., & Hirsh, S. (2002). A national plan for improving professional development. Retrieved: January 19, 2004, from http://www.nsdc.org/library/authors/nsdcplan.cfm.

Sprague, D., Kopfman, K., & Dorsey, S. d. L. (1998). Faculty development in the integration of technology in teacher education courses. *Journal of Computing in Teacher Education, 14*(2), 24–28.

Stein, M. K., Smith, M. S., & Silver, E. A. (1999). The development of professional developers: Learning to assist teachers in new settings in new ways. *Harvard Educational Review, 69*(3), 237–269.

Swan, K., Holmes, A., Vargas, J., Jennings, S., Meier, E., & Rubenfeld, L. (2002). Situated professional development and technology integration: The capital area technology and inquiry in education (CATIE) mentoring program. *Journal of Technology and Teacher Education, 10*(2), 169–190.

Topper, A. G., Gillingham, M. G., Ellefson, N. C., & Worthington, V. L. (1997). Teacher professional development on the World Wide Web: The LETSNet Web site and teacher learning. *Journal of Computing in Teacher Education, 13*(4), 25–33.

Thompson, K. (2001). Constructivist curriculum design for professional development: A review of the literature. *Australian Journal of Adult Learning, 41*(1), 94–109.

U.S. Department of Education. (1999). *Teacher quality: A report on the preparation and qualifications of public school teachers.* Washington, DC: U.S. Government Printing Office.

U.S. Department of Education. (2000). *Teachers' tools for the 21st century: A report on teachers' use of technology.* Washington, DC: U.S. Government Printing Office.

U.S. Department of Education. (2001). *Teacher preparation and professional development: 2000.* Washington, DC: U.S. Government Printing Office.

U.S. Department of Education. (2003). *Internet access in U.S. public schools and classrooms: 1994–2002.* Washington, DC: U.S. Government Printing Office.

Dr. William Sugar is an assistant professor in the Library Science and Instructional Technology department at East Carolina University. He also is the program coordinator of the MS in Instructional Technology program. His current research interests are developing effective and alternative technology integration strategies for teachers, as well as examining the interrelationship between human computer interface design principles and instructional design principles.

William Sugar, PhD
Assistant Professor
Program Coordinator, MS in Instructional Technology
East Carolina University
Library Science and Instructional Technology
1805 Joyner Library
Greenville, NC 27858
Phone: 252.328.1546
Fax: 252.328.4368
sugarw@coe.ecu.edu

Kenneth Wilson is an associate professor and Director of the Sociological Research Laboratory at East Carolina University. His current research includes the social effects of digital technology, questionable research procedures and ethics, and responses to serious natural and medical events.

Kenneth Wilson, PhD
Associate Professor
Department of Sociology
East Carolina University
Greenville, NC 27858
Phone: 252.328.4897
Fax: 252.328.4837
wilsonk@mail.ecu.edu