DIFFERENCES IN TECHNOLOGY USE BASED ON LEVELS OF IMMERSION IN A TEACHER TECHNOLOGY TRAINING PROGRAM

By

LEE E. ALLEN * DEBORAH L. LOWTHER** J. DANIEL STRAHL, M.S***

ABSTRACT

While it is well-documented that appropriate training of teachers in the use of technological tools is an important variable in predicting the success of technology integration (Faseyitan & Hirschbuhl, 1994), a variable that is less often considered is that of the time spent or different levels of immersion in a technology integration training program (Stuhlmann & Taylor, 1999). This factor must be considered to be separate and distinct from the variable of overall experience as a teacher in the classroom, and/or teacher age.

This paper is based on a selected portion of the results of a five-year evaluative study of the teachers implementing a technology integration program in a rural school district located in the Southwestern United States. The fifth year design included analysis of observation data by year(s) of teacher participation in the program, as Novice, having1 to 2 years of experience; Experienced with 4 to 5 years . The purpose for the focus on this aspect of the evaluation was to determine what differences, if any, existed between novice (to the program training) and experienced (in the program training) teachers in how and to what degree technology is integrated into classroom instruction. The findings reflect differences of varying degrees in certain areas of instructional strategies and technology integration that should be considered for further investigation.

Keywords: Technology integration, teacher preparation programs, levels of program immersion.

INTRODUCTION

Few would argue that the advent of new technologies has had a substantial impact on the nation's society, culture, and workplaces. However despite the prevalence of computer placement in the United States' K-12 classrooms, the measured impact of technology on U.S. education has been relatively minimal (Norris, et al, 2003; Cuban, Kirkpatrick, & Peck, 2001; Dede, 1998; Becker, 1994), and relegated primarily towards running self-contained packaged software programs, or for Internet searches (Barron, et al, 2003). Specifically, U.S. schools have approximately one computer for every four students (Fox, 2005), yet increased access has not raised overall student achievement (US DOE, 2004).

The results appear to indicate that technology use does not increase student learning; however, much of the research in the area of classroom technology integration has focused solely on student outcomes, especially via mandated test results (Lowther, et al, 2004; Newman, 2002; Becker & Riel, 1999). When studies have focused instead on teacher preparation and overall effectiveness, additional factors emerge (Baylor & Ritchie, 2002; Zhao, et al, 2001; Lin, 2001).

It has been documented that appropriate training of teachers in the use of technological tools is an important variable in predicting the success of technology integration (Faseyitan & Hirschbuhl, 1994), as are several other factors such as age, individual readiness, motivation, time commitment, and initial technological competency (Lee, 2001; Newton, 2003; Rossiter & Watters, 2000). One of the challenges in using technology effectively in instructional environments is the dependency on the technological proficiency of both the instructor and students (Leh, 2005). Ample documentation exists of failed educational initiatives with technological components (Dexter & Riedel, 2003), with causes ranging from inadequate technical training to unclear or misinterpreted pedagogical goals (Willis, 1997). The degree of the teacher's technical proficiency tends to be a key factor in the eventual outcome of the integration of technology in the classroom (Trinkle, 2005)

Other dominant issues for faculty are the pedagogical

benefits derived by the integration of technology in the classroom (Surry & Land, 2000). Failure to consider pedagogical issues with technology in teaching can cause a deviation in the actual learning objectives (Kerr, 1996). In order to take full advantage of what the use of technology offers to the teaching and learning process, faculty should align the technology use with the goals of teaching (de Castell, Bryson, & Jason, 2002). Developing such a relationship requires careful consideration of the following factors: alignment between course goals and course activities, between course activities and course evaluation, between course evaluation and course goals, and, importantly, between engaged teaching and engaged learning (Sun, 2004).

Time commitment is often cited as a crucial factor for teachers when faced with the prospect of developing the skills to appropriately integrate technology in lessons and lesson planning (Lawson & Comber, 1999). Teachers typically indicate that they are pressed for time in preparation, teaching, grading, completing paperwork, etc. thus leaving little time to dedicate to using technology (Williams, 2000). However, it is also noted that the initial requirement for additional time can become an investment for time saved in the future, when the technology-enhanced courses actually begin to save time for teaching (Dexter, Anderson & Becker, 1999).

The technological competency required for faculty refers to the basic skills that would enable the faculty to perform the tasks for effectively using technology in the classroom (Morrison & Lowther, 2005). An appropriate evaluation of faculty technical skills is extremely important to determine readiness and in identifying the skills required to accomplish specific tasks; this assessment can assist in developing appropriate technology training curriculum for faculty (Showers & Joyce, 1996). This training are of crucial importance because such requirements are often the primary obstacle in a faculty's decision to integrate technology in a course or program (Goldberg, 2000). Furthermore, studies have indicated that teacher education programs (TEP) often fail to adequately prepare new teachers to teach using technology, which is largely due to TEP faculty use of traditional, non-technology supported instructional practices in required courses (Strudler, McKinney & Jones, 1999).

A variable that is less often considered is that of the time spent in or different levels of immersion in a technology integration training program (Stuhlmann & Taylor, 1999). In this context, this factor must be considered to be separate and distinct from the variable of overall experience as a teacher in the classroom, and/or teacher age. Because teacher turnover rates are approaching an all-time high with corresponding costs in the $7.3 billion range nationally (NCTAF, 2007), there is an appropriate responsive level of concern for school districts considering implementing long-range teacher development projects, and especially for those in the constantly changing area of technology.

Background

This paper is based on a selected portion of the results of a five-year evaluative study of the teachers implementing a technology integration program in a rural school district located in the Southwestern United States. The overall purpose of the evaluation was twofold: (a) to provide formative evaluation data to the participant schools to serve as a basis for improvement planning and as documentation of their accomplishments to demonstrate progress; and (b) to provide cumulative evidence of the implementation progress and outcomes of the participant schools as well as identification of exemplary programs.

The context for the evaluation consisted of eight schools receiving specialized training developed by a regional consortium and integration training provided by the school district's instructional technology department. While the consortium training dealt directly with developing skills in using technology in the classroom, the integration training expanded on this and emphasizes using technology to support student-centered teaching methods and strategies that promote higher-level learning outcomes.

The final evaluation data were collected from eight schools over the academic years 2001- 2005, and were compared to the 2001-2002 (first year) baseline

conditions to gauge program implementation progress. For the purpose of this study, "novice" as compared to "experienced" teachers, is determined by the years of exposure, and immersion in the consortium technology program. However, the data used for the purposes of discussion in this paper was derived from the final year of the study (2005-2006) and distinguished the subjects as:

- "Novice" teachers: those who received the consortium training 1-2 years before the final evaluation and summary of the program's effectiveness; and
- "Experienced" teachers: those who received the consortium training 4-5 years prior to the final evaluation and summary of the program's effectiveness.

Purpose of the Study

The consortium technology training program's overall evaluation was structured around five primary research questions that focused on classroom practices, degree and type of technology use, academically focused time, student engagement, student achievement, and school climate. The teacher ability , use of attitudes toward technology are also of interest. However, again, for the purpose of analyzing the portion of the data for this study, the research question investigated the following things:

What differences exist between novice (to the program training) and experienced (in the program training) teachers in how and to what degree technology is integrated into classroom instruction?

Methodology

The evaluation was conducted during the spring semester of the 2005-2006 academic year. The overall evaluation design for Year 5 reflected those of the Year 1 baseline study to enable comparative analyses between the years. The Year 5 design also included analysis of observation data by year(s) of teacher participation in the program: Novice 1 to 2 years of experience; Experienced 4 to 5 years of experience. Both quantitative and qualitative data were collected at each of the eight schools by trained observers (e.g., retired teachers, district staff). The observers spent the majority of their time visiting classrooms. A description of the instruments used and data collection procedures is provided below.

Instrumentation and Procedures

Three instruments in the form of classroom observation measures were used to collect the evaluation data for the current analysis. These instruments have been fully developed and validated. They are as follows:

Classroom Observation Measures

Trained observers conducted classroom visits to collect frequency data regarding observed instructional practices. The visits were targeted or scheduled in advance with teachers randomly selected from those who participated in the technology training program. Selected teachers were instructed to deliver a lesson that integrates the use of technology. The data collection instruments were the School Observation Measure© (SOM), the Survey of Computer Use© (SCU), and the Rubric for Student-Centered Activities© (RSCA). The SOM was used to collect data regarding overall classroom activities, the SCU was used to collect data regarding student use of computers, and the RSCA was used to capture more detailed information about student-centered activities observed during the targeted visits. The use of classroom observation instruments are described below.

SOM: The SOM was developed to determine the extent to which different common and alternative teaching practices are used throughout an entire school or during a targeted lesson (Ross, Smith, & Alberg, 1999). During this evaluation, it was used to record observations of classroom instruction during prearranged one-hour sessions in which randomly selected teachers demonstrated a prepared lesson for which they were asked to use technology. The observers recorded classroom events and activities descriptively, not judgmentally. Notes forms were completed every 15 minutes of the lesson to record the use or non-use of 24 target strategies and the degree to which a high level of academically focused class time and a high level of student attention/interest was observed. At the conclusion of the one-hour lesson, which typically lasted

for 45 to 60 minutes, the observer used a SOM Data Summary Form to summarize the frequency with which each of the strategies was observed. The frequency was recorded via a 5-point rubric that ranges from (0) Not Observed to (4) Extensively.

To ensure the reliability of data, observers received a manual that provided definitions of terms, examples and explanations of the target strategies, and a description of procedures for completing the instrument. The target strategies include traditional practices (*e.g.*, direct instruction and independent seatwork) and alternative, predominately student-centered methods associated with educational reforms (*e.g.*, cooperative learning, project-based learning, inquiry, discussion, using technology as a learning tool). The strategies were identified through surveys and discussions involving policy makers, researchers, administrators, and teachers as those most useful in providing indicators of schools' instructional philosophies and implementations of commonly used reform designs (Ross, Smith, Alberg, & Lowther, 2001).

After receiving the manual and instruction in a group session, each observer participated in sufficient classroom-based practice, exercises to ensure that his/her data are comparable with those of experienced observers. In a reliability study (Lewis, Ross, & Alberg, 1999), pairs of trained observers selected the identical overall response on the five-category rubric on 67% of the items and were within one category on 95% of the items. Further results establishing the reliability and validity of the *SOM* instrument are provided in the Lewis *et al.* (1999) report.

SCU: A companion instrument to SOM is the Survey of Computer Use (SCU) (Lowther & Ross, 2001). The SCU was completed as part of the SOM observation sessions during which SCU data were also recorded in 15-minute intervals and then summarized on an overall data form.

The SCU was designed to capture exclusively observable *student* access to, ability with, and use of computers rather than teacher use of technology. Therefore, in its first section, four primary types of data are recorded: (a) computer capacity and currency, (b) configuration, (c) student computer ability and (d) student activities while using computers. Computer capacity and currency is defined as the age and type of computers available for student use and whether or not Internet access is available. Configuration refers to the number of students working at each computer (*e.g.*, alone, in pairs, in small groups). Student computer ability is assessed by recording the number of students who are computer literate (*i.e.*, easily used software features/menus, saved or printed documents) and the number of students who easily use the keyboard to enter text or numerical information.

The next section of the SCU records the types of student computer activities, and the subject areas of those activities. The computer activities are divided into four groups based on broad categories of software used: production tools, Internet/research tools, educational software, and testing software. Within each category, more specific types of software are identified. In the Production Tools category, the software types include: word processing, databases, spreadsheets, draw/paint/graphics, presentation, authoring, concept mapping, and planning. In the Internet/research tools category, the software include: Internet browser, CD reference materials, and communications (*e.g.*, email, listservs, chat rooms). In the Educational Software category, the software types include: drill/practice/tutorial, problem-solving and process tools. The Testing Software types include individualized/tracked and generic. With this type of recording system, several activities can be noted during the observation of one student working on a computer. For example, if a student gathered data from the Internet, created a graph from the data, then imported the graph into a PowerPoint presentation, the observer would record that, three types of software tools were been observed: Internet browser, spreadsheet, and presentation. The frequency with which the computer activities and software were observed in use was summarized and recorded using a five-point rubric that ranges from (0) Not Observed to (4) Extensively observed. The subject area of each computer

activity was categorized as: language arts, mathematics, science, social studies, other, or none.

The final section of the SCU is an "Overall Rubric" designed to assess the degree to which the activity reflects "meaningful use" of computers *as a tool* to enhance learning. The definition of meaningfulness is derived from the International Society for Technology in Education's National Educational Technology Standards for Students (NETS-S) (ISTE, 2002). The rubric has four levels: 1) Low-level use of computers, 2) Somewhat meaningful, 3) Meaningful, and 4) Very meaningful.

Reliability data for the SCU (Sterbinsky & Burke, 2004), show that observer ratings were within one category for 97% of the whole-school observations and for 91% of the targeted observations.

RSCA: The Rubric for Student-Centered Activities (Lowther &Ross, 2001) was developed for the Center for Research in Educational Policy (CREP) as an extension to SOM and SCU. The RSCA was used by observers to more closely evaluate the strength of application for seven selected areas considered fundamental to the goals of increasing student-centered learning activities (cooperative learning, project-based learning, higher-level questioning, experiential/hands-on learning, student independent inquiry/research, student discussion, and students as producers of knowledge using technology). These strategies reflect emphasis on higher-order learning and attainment of deep understanding of content and whether or not technology was utilized as a component of the strategy. Such outcomes are intended to be consistent with those likely to be engendered by well-designed, real-world linked exercises, projects, or problems utilizing technology as a learning tool. Each item includes a two-part rating scale. The first is a four-point scale, with "1" indicating a very low level of application, and "5" representing a high level of application. The second is a Yes/No option to the question: "Was technology used?" with space provided to write a brief description of the technology use. The RSCA was completed during the SOM/SCU observation periods.

Data Analysis

As indicated in the description of SOM, the observation procedure primarily focused on 24 instructional strategies using a five-point rubric (0 = not observed, 1 = rarely, 2 = occasionally, 3 = frequently, and 4 = extensively). In an initial analysis, the researchers computed the percentage of times a strategy was not observed (rubric category = 0) vs. observed (categories 1-4 combined). Chi-square analyses were conducted to compare Novice vs. Experienced results. To examine the full, five-category breakdown of the SOM, t-tests for independent samples were performed on each item to determine whether significant differences existed between the classroom practices of Novice and Experienced teachers. In addition, Effect Sizes (*ES*) using Cohen's *d* formula (Cohen, 1988) were computed to determine the educational importance of differences (an *ES* having an absolute value greater than .25 is considered to be educationally important).

Results

A summary of the results grouped by the 3 observation instruments namely School Observation Measure (SOM), Survey of Computer Use (SCU), and Rubric for Student-Centered Instruction is discussed here. The data for 58 classroom observations were collected with SOMs, SCUs, and RSCAs during prearranged sessions in which teachers were asked to implement a lesson using technology. Results from each measure are described in the following section. The data presented were compared on the basis of teacher experience with the technology training program: novice (n = 28) vs. Experienced (n = 30).

School Observation Measure (SOM)

The greatest difference when examining the data by experience level, was that the novice teachers used higher-level questioning strategies more often than the experienced teachers: 75% observed in the novice teachers as compare to nearly 57% not observed in the experienced teachers (Table 1). However there were other differences worth noting; in particular the use of experiential, hands-on learning strategies by the novice teachers exceeded that of the experienced teachers by

Instructional Strategies	Not Observed		Observed	
	Novice	Experienced	Novice	Experienced
Direct instruction	10.7	26.7	89.3	73.3
Teacher as coach/facilitator *	10.7	30.0	89.2	70.0
Use of higher level questioning ***	21.4	60.0	78.6	39.9
Technology as a learning tool **	25.0	46.7	75.1	53.3
Higher level instructional feedback ***	25.0	56.7	75.0	43.3
Computer for instructional delivery	25.0	30.0	74.9	70.0
Experiential, hands on learning **	42.9	70.0	57.1	30.0
Ability groups	50.0	70.0	49.9	29.9
Student discussion	57.1	60.0	42.9	39.9
Cooperative/ Collaborative learning	60.7	66.7	39.4	33.4
Integration of subject areas	64.3	66.7	35.7	33.3
Independent seatwork	67.9	43.3	32.1	56.6
Work centers	67.9	73.3	28.6	26.6
Project -based learning	71.4	70.0	28.6	30.1
Individual tutoring	75.0	76.7	25.1	23.4
Independent inquiry/research	75.0	66.7	25.1	33.3
Team teaching	78.6	83.3	21.4	16.7
Systematic, individual instruction	78.6	86.7	21.4	13.2
Multi-age grouping	82.1	73.3	17.8	26.7
Parent/community involvement	89.3	96.7	10.7	3.3
Performance assessment	89.3	76.7	10.7	23.3
Student self - assessment	92.9	90.0	7.2	9.9
Sustained writing/composition	96.4	93.3	3.6	6.6
Sustained reading	96.4	96.7	3.6	3.3

*p<.05,, **p<.01, ***p<.001

Note. Sorted from highest to lowest proportion of Novice Teacher Observed

Table 1.School Observation Measure (SOM) Proportion of not observed (0) vs. observed (1-4) Strategies

over 27%. Experiential, hands-on learning was not observed in seventy percent of the experienced teachers' classrooms. Other areas where the novice teachers exceeded use of specific learning strategies were in the use of technology tools (over 75% observed in novice teachers versus almost 47% not observed in experienced teachers), and the teacher in the role of coach/facilitator: over 89% observed in novice teachers

Computer configuration	Novice Teachers	Experienced Teachers
Classrooms most frequently had the following number of computers or digital tools		
None	0.0	3.3
One	10.7	20.0
2-4	35.7	20.0
5-10	32.1	33.3
11 or more	21.4	23.3
Classroom computers were most frequently		
Up-to-date*	96.4	86.7
Aging, but adequate	3.6	10.0
Outdated/ limited capacity	0.0	0.0
No computers were observed	0.0	3.3
Classroom computers were most frequently		
Connected to the Internet*	100.0	83.3
Not connected to the Internet	0.0	13.3
No computers were observed	0.0	3.3
Student computer use		
Classroom computers or digital tools were most frequently used by:		
Few (less than 10%) students	10.7	23.3
Some (about 10-50%) students	21.4	13.3
Most (about 51-90%) students	10.7	10.0
Nearly all (91-100%) students **	46.4	33.3
Students need not use computers	10.7	20.0
Students most frequently worked with computers or digital tools:		
Alone	57.1	53.3
In pairs	17.9	10.0
In small groups	7.1	3.3
Students did not use computers	17.9	33.3
Student computer literacy skills were most frequently:		
Poor	3.6	0.0
Moderate	25.0	30.0
Very good**	50.0	36.7
Not observed	21.4	33.3
Student computer literacy skills were most frequently:		
Poor	3.6	3.3
Moderate	7.1	23.3
Very good***	46.4	16.7
Not observed	42.9	56.7

Novice Teacher N = 28; Experienced Teacher N = 30

*P<0.05,**p<0.01, ***p<0.001

Table 2. Survey of Computer Use (SCU) Data Summary: Computer Configuration

compared to 30% not observed in the experienced teachers.

In all other areas that were measured by the SOM, few differences were observed.

Survey of Computer Use (SCU)

There were some differences between novice and experienced teachers in a few areas measured by the SCU (Tables 2-6). Table 2 shows that there were some differences in availability and use of computer hardware

Computers/Digital Tools Used by Students	Experience Level	Not Observed	Observed
Desktop Computers	Novice	46.4	53.6
	Experienced	50.0	50
Laptop Computers	Novice	60.7	39.2
	Experienced	56.7	43.3
Personal Data Assistants (PDA)	Novice	96.4	3.6
	Experienced	100.0	0
Graphing Calculator	Novice	100.0	0
	Experienced	100.0	0
Information Processor (*e.g.*, Alphaboard)	Novice	100.0	0
	Experienced	100.0	0
Digital Accessories (*e.g.*, camera, scanner, probes)	Novice	85.7	14.3
	Experienced	93.3	6.6

Table 3. Survey of Computer Use (SCU) Data Summary: Computer/Digital Tools Used by Students

and Internet access, and that novice teachers had a greater percentage of up-to-date computers and 100% access to the Internet in their classrooms. Also noteworthy, more students (91-100%) in the novice teachers' classrooms demonstrated more frequent use of computers or other digital tools (46.4% of the time), as well as demonstrated computer literacy skills at a Very Good level of 50% of the time. Students in the novice teachers' classrooms also demonstrated better keyboard using skills at a higher level (46.4% compared to 16.7% in the experienced teachers' classrooms).

While other areas measured by the SCU (Tables 3 - 5) did not indicate significant differences as Observed versus Not Observed, the year five data showed that teachers, novice to the program integrated the students' use of computers into their instruction in Meaningful ways (25% of teachers novice to the program compared to just over 13% of teachers experienced in the program), and at in Very Meaningful ways (nearly 18% of novice teachers to just over 3% of experienced teachers) at a difference in ratio (Table 6).

Rubric for Student-Centered Activities (RSCA)

The RSCA results revealed, again, an increased usage of technology to support higher-level questioning by the teachers who were novice to the program (nearly 43%) when compared to the teachers who had 4-5 years of

Student computer Activities by software used	Experience level	Not observed	Observed
production Tools			
Word processing	Novice	89.3	10.7
	Experienced	83.3	16.6
Database	Novice	100	0
	Experienced	100	0
Spread sheet	Novice	100	0
	Experienced	100	0
Draw/panit/Graphics	Novice	92.9	7.2
	Experienced	86.7	13.3
Presentation(e.g., MS power point)**	Novice	92.9	7.1
	Experienced	90	9.9
Authoring (e.g., Hyper Studio)	Novice	100	0
	Experienced	100	0
Concept Mapping (e.g., Inspiration)	Novice	100	0
	Experienced	96.7	3.3
Planning (e.g., MS project)	Novice	100	0
	Experienced	100	0
Internet/Research Tools			
Internet Browser (e.g., Netscape)**	Novice	75	25
	Experienced	73.3	26.7
CD Reference (encyclopedias, etc.)	Novice	100	0
	Experienced	100	0
Communications	Novice	100	0
	Experienced	100	0
Educational Software			
Drill/ practice/ Tutorial	Novice	64.3	35.7
	Experienced	73.3	26.6
Problem solving (e.g, Slim city)	Novice	100	7.2
	Experienced	100	13.2
Process Tools(Geometer's sketchpad, etc.)	Novice	100	0
	Experienced	100	3.3
Testing Software			
Individualized/Traked (e.g., Accelerated Reader)	Novice	100	0
	Experienced	96.7	3.3
Generic	Novice	100	0
	Experienced	96.7	3.3

Table 4. Survey of Computer Use (SCU) Data Summary: Student Computer Activities by Software Used

experience in the program (33.3%) (Table 7). Also noteworthy is the higher quality with which teachers implemented cooperative and project-based learning after five years as compared to the first year of program participation. These results suggest that the program was successfully preparing teachers to implement above average student-centered activities. In other areas, there were no significant differences between the novice and experienced teachers, or, as in the use of Cooperative Learning, experienced teachers used this strategy at a higher rate (40%) compared to the novice teachers (25%).

Analysis and Evaluation

The analysis of the data is derived directly in association with the research question: What differences exist

Subject Areas of computer Activities	Experience Level	None	Other	Language	Mathematics	Science	Social Studies	Total Observed
Production Tools	Novice Experienced	50 60	10.7 6.7	25 13.3	10.7 23.3	10.7 6.7	10.7 6.7	67.8 53.3
Internet/ Research Tools	Novice Experienced	75 60	10.7 3.3	7.1 13.3	3.6 16.7	3.6 6.7	7.1 6.7	32.1 46.7
Educational Software	Novice Experienced	60.7 66.7	3.6 3.3	25 20	17.9 20	7.1 6.7	10.7 3.3	64.3 53.3
Testing Software	Novice Experienced	96.4 86.7	0 3.3	0 3.3	3.6 0	0 3.3	0 3.3	3.6 13.2

*Note: Item percentages may not total 100% because of missing input from some respondents

Table 5. Survey of Computer Use (SCU) Data Summary: Subject Areas of Computer Activities

Overall meaningful use of computers	Experience Level	Not observed	Rarely	Occasionally	Frequently	Extensively	Total Observed
Low level use of computers	Novice Experienced	75.0 83.3	10.7 10.0	0.0 0.0	7.1 3.3	7.1 3.3	24.9 16.6
Somewhat meaningful use of computers	Novice Experienced	75.0 80.0	7.1 0.0	3.6 6.7	7.1 10.0	7.1 10.0	24.9 20
Meaningful use of computers*	Novice Experienced	50.0 56.7	3.6 3.3	3.6 6.7	17.9 16.7	17.9 16.7	50.1 40
Very meaningful use of computers	Novice Experienced	64.3 73.3	7.1 20.0	3.6 3.3	7.1 20.0	7.1 20.0	35.7 26.6

*p<.05, **p<.01

Table 6. Survey of Computer Use (SCU) Data Summary: Overall Meaningfulness of Computer Activities

Items	Experience Level	% observed	Rubric Rating **- percentage observed				Percentage that used Technology
			1	2	3	4	
Co-operative Learning	Novice Experienced	39.3 56.6	7.1 3.3	0.0 23.3	14.3 20.0	17.9 10.0	25.0 40.0
Project-based Learning	Novice Experienced	28.7 40.1	3.6 6.7	3.6 6.7	17.9 20.0	3.6 6.7	28.6 33.3
High- level Questioning Strategies*	Novice Experienced	82.2 60.0	7.1 13.3	17.9 16.7	28.6 20.0	28.6 10.0	42.9 33.3
Experiential, hands-on Learning	Novice Experienced	53.6 33.0	0.0 0.0	10.7 10.0	14.3 10.0	28.6 13.3	25.0 30.0
Independent Inquiry/ Research	Novice Experienced	32.1 33.3	3.6 6.7	7.1 13.3	7.1 3.3	14.3 10.0	21.4 30.0
Student Discussion	Novice Experienced	42.9 39.9	7.1 13.3	14.3 13.3	17.9 10.0	3.6 3.3	17.9 23.3
Students as producers of knowledge	Novice Experienced	32.2 60.0	3.6 20.0	0.0 3.3	14.3 26.7	14.3 10.0	*** ***

Novice Teachers (2005-2006) N = 28 Experienced Teachers (2005-2006) N = 30 *p<.05

**Rating scale: 1 = limited application; 2 = somewhat limited application; 3 = somewhat strong application; 4 = strong application.
*** Students as Producers of Knowledge" is not included because use of technology was not a required component.

Table 7. Rubric for Student Centered Activities (RSCA) Item Ratings by Percentage Observed

between novice (to the program training) and experienced (in the program training) teachers in how- and to what degree technology is integrated into classroom instruction?

When examining the results by level of experience in the consortium technology training program, one notable difference was revealed during the classroom observations: the novice teachers in the program (1-2 years) more frequently used higher-level questioning

strategies than the teachers with 4-5 years of experience in the program.

Other differences worth noting were in the use of experiential, hands-on learning strategies by the novice teachers, exceeding that of the experienced teachers, where this instructional strategy was not observed in a majority of the experienced teachers' classrooms. Novice teachers also used technology tools at an increased rate than that of teachers experienced in the program and in the teacher in the role of coach/facilitator.

Some differences between novice and experienced teachers also were shown in the availability and use of computer hardware and Internet access, and with novice teachers' students more frequently using computers or other digital tools, increased computer literacy skills, and higher levels of keyboarding skills.

In another area measured, the data showed that teachers novice to the program integrated the students' use of computers into their instruction in meaningful and in very meaningful ways at a higher ratio.

Conclusions

The findings that, in some areas measured, the teachers with less exposure, or immersion, in the technology training program outperformed the teachers with longer, prior experience in the program poses interesting problems, and raises questions in regards to what additional variables contributed to the outcomes that were either totally unrelated to the program training or were peripheral factors that affected the results as measured by the instruments used. One speculative cause could be that the performance by the teachers who were novice to the program reflects refinement of the professional development that the novice teachers received; however, this variable was not measured, and it cannot be readily assumed that the training program changed significantly during the five year implementation.

Other variables, such as the age or experience of the teachers identified as novice in this study and introduced later into the program, were not considered when demographic data were gathered. The possibility that the novice teachers received increased mentoring by experienced teachers either outside or within their school environment is also a variable worthy of consideration, but again was not measured within the confines of this study.

Suggestions for Further Research

Because the five year program as a whole was deemed a success in the district where it was implemented, the results of this focused meta-study cannot be used to call into question the overall effectiveness of the technology training program itself. However, the questions raised by analysis of the better performance of the "newcomers" relative to the "old-timers" to the program in some areas should be investigated. A more thorough demographic portrait and comparison between the two identified groups would be a very good start in understanding why the relative level of immersion in the technology training program was not a deciding factor in many important areas that were specifically targeted by the training program. Also, any changes made in the training program should be thoroughly investigated and identified to determine if critical factors were contributed due to such changes.

References

[1]. **Barron, A. E., Kemker, K., Harmes, C., & Kalaydjian, K. (2003).** Large-scale research study on technology in K-12 schools: Technology integration as it relates to the National Technology Standards. *Journal of Research on Technology in Education,* 35(4), 489-507.

[2]. **Baylor, A. and D. Ritchie (2002).** "What factors facilitate teacher skill, teacher morale, and perceived student learning in technology-using classrooms?" *Computers & Education* 39(4): 395-414.

[3]. **Becker, H. J. (1994).** How exemplary computer-using teachers differ from other teachers: Implications for realizing the potential of computers in schools. *Journal of Research on Computing in Education, 26*, 291-321.

[4]. **Becker, H. J., & Riel, M. M. (1999).** *Teacher professionalism, schoolwork culture and the emergence of constructivist-compatible pedagogies* [PDF file]. Center for Research on Information Technology and Organizations. Available online at

http://www.crito.uci.edu/tlc.

[5]. **Cuban, L., Kirkpatrick, H., & Peck, C. (2001).** High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal, 38*, 813-834.

[6]. **de Castell, S., Bryson, M., & Jason, J. (2002).** Object lessons: Towards an educational theory of technology. *First Monday*, 7(1). Retrieved Oct. 24, 2006 from http://firstmonday.org/issues/issue7_1/castell/index.html.

[7]. **Dede, C. (Ed.) (1998).** *Learning with technology: The 1998 ASCD Yearbook*. Alexandria, VA: Association for Supervision and Curriculum Development.

[8]. **Dexter, S. & Riedel, E. (2003).** Why improving pre-service teacher educational technology preparation must go beyond the college's walls. *Journal of Teacher Education*, 54(4), p.p. 334-346.

[9]. **Dexter, S., Anderson, R. E., & Becker, H. J. (1999).** Teachers' views of computers as catalysts for Changes in their teaching practice. *Journal of Research on Computing in Education, 31*(3), 221-239.

[10]. **Faseyitan, J.J. & Hirschbuhl, S.O. (1994).** Faculty uses of computers: Fears, facts and perceptions. *T H E Journal* 21(9), 64-65.

[11]. **Fox, E. (May, 2005).** Tracking U.S. Trends. *Education Week's Technology Counts 2005.* Marion, OH: Editorial Projects in Education.

[12]. **Goldberg, M.L. (2000).** Educational technology and distance education at UW Bothell:Initial findings, observations, and recommendations. Retrieved Oct. 30, 2006fromhttp://faculty.uwb.edu/mgoldberg/edtech/report.html.

[13]. International Society for Technology in Education (ISTE) (2003). National Educational Technology Standards for Students (NETS*S): Technology Foundation Standards for all Students. Available online at http://cnets.iste.org/students/s_stands.html

[14]. **Kerr, S. T. (1996).** Toward a sociology of educational technology. In Jonassen, D.H. (Ed.), *Handbook of research for educational communications and technology*, (pp. 143-169). New York: Simon & Schuster.

[15]. **Lawson, T. & Comber, C. (1999).** Superhighways Technology: personnel factors leading to successful integration of information and communications technology in schools and colleges. *Technology, Pedagogy and Education*, 8(1), 41-53.

[16]. **Lee, K.T. (2001)** Information technology integration in teacher education: Supporting the paradigm shift in Hong Kong. *Asia-Pacific Journal of Teacher Education & Development*, 4(1), 157-78.

[17]. **Leh, A. (2005)** Lessons learned from service learning and reverse mentoring in faculty development: A case study in technology training. *Journal of Technology and Teacher Education*, 13(1), 57-63.

[18]. **Lewis, E. M., Ross, S. M., & Alberg, M. (July, 1999).** *School Observation Measure: Reliability analysis*. Memphis, TN: Center for Research in Educational Policy, University of Memphis.

[19]. **Lin, X. (2001).** "Reflective adaptation of a technology artifact: A case study of classroom change." *Cognition and instruction* 19(4): 395-440.

[20]. **Lowther, D. L., & Ross, S. M. (2001).** *Survey of Computer Use (SCU).* Memphis, TN: Center for Research in Educational Policy, University of Memphis.

[21]. **Lowther, D. L. & Ross, S. M. (2001).** *Rubric for Student-Centered Learning (RSCA).* Memphis, TN: Center for Research in Educational Policy, University of Memphis.

[22]. **Lowther, D. L., Ross, S. M., Walter, J. W., McDonald, A. J., & Wang, L. W. (2002).** *Tennessee Technology Literacy Challenge Fund: Evaluation Report.* Memphis, TN: Center for Research in Educational Policy, University of Memphis,

[23]. **Morrison, G.R. & Lowther, D. L., (2005).** *Integrating Computer Technology into the Classroom* (3rd Ed.). Englewood Cliffs, NJ: Merrill/Prentice Hall.

[24]. **Newman, H. (2002, February 26).** Computers used more to learn than teach. *Detroit Free Press*. Available online at http://www.freepress.com/news/education/newman26_20020226.htm

[25]. **Newton, R. (2003).** Staff attitudes to the

development and delivery of e-learning. *New Library World*, 104(10), 412-425.

[26]. Norris, C., Sullivan, T. , Poirot, J., Soloway, E. (2003) No Access, No Use, No Impact: Snapshot Surveys of Educational Technology in K-12. *Journal of Research on Technology in Education*, 36(1), 15-28.

[27]. Ross, S. M., Smith, L. J., & Alberg, M. (1999). *The School Observation Measure (SOM©)*. Memphis, TN: Center for Research in Educational Policy, University of Memphis.

[28]. Ross, S. M., Smith, L., Alberg, M., & Lowther, D. (2004) Using Classroom Observations as a Research and Formative Evaluation Tool in Educational Reform: The School Observation Measure. In S. Hilberg and H. Waxman (Eds.) *New Directions for Observational Research in Culturally and Linguistically Diverse Classrooms* (pp. 144-173). Santa Cruz, CA: Center for Research on Education, Diversity & Excellence.

[29]. Rossiter, D. & Watters, J.J. (2000). *Technological literacy: foundations for the 21st century*. Brisbane: Queensland University of Technology.

[30]. Showers, B., & Joyce, B. (1996). The evolution of peer coaching. *Educational Leadership*, 54 (6), 12-16.

[31]. Sterbinsky, A., & Ross, S. M., (2003). *Summary of CSRTQ Reliability Studies*. Technical Report. Memphis, TN: Center for Research in Educational Policy, University of Memphis.

[32]. Strudler, N. B., Mckinney, M. O. & Jones, W.P. (1999) *First-year teachers' use of technology: Preparation*, expectations and realities. *Journal of Technology and Teacher Education* (1999) 7(2), 115-129.

[33]. Stuhlmann, J. M., & Taylor, H. G. (1999). Preparing technically competent student teachers: A three-year study of interventions and experiences. Journal of Technology and Teacher Education, 7(4), 333-350.

[34]. Sun, J.R. (2004). Turning a regular (face-to-face) course into a more engaging blended (hybrid) course. Paper presented at the Ohio Commons for Digital Education 2004 - The Convergence of Libraries, Learning and Technology Conference March 8-9, 2004.

[35]. Surry, D.W. & Land, S.M. (2000). Strategies for motivating higher education faculty to use technology. *Innovations in Education and Teaching International*, 37(2), 145 - 153.

[36]. Trinkle, D.A. (2005). The 361° Model for transforming teaching and learning with technology. Educause Quarterly, 28(4), 18-25.

[37]. U.S. Department of Education (DOE), (November, 2004) *U.S. Department of Education FY 2004 Performance and Accountability Report*, Washington D.C. Available online athttp://www.ed.gov/about/reports/annual/2004report/index.html

[38]. Williams, C. (2000). *Internet access in U.S. public schools and classrooms: 1994-1999*. (NCES 2000-086). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

[39]. Willis, E. M. (1997). Technology: Integrated into, not added onto, the curriculum experiences in pre-service teacher education. *Computers in the Schools*, 13(1-2), 141-53.

[40]. Zhao, Y., Byers, J., Mishra, P., Topper, A., Chen, H., Enfield, M., et al. (2001, Winter). What do they know? A comprehensive portrait of exemplary technology-using teachers. *Journal of Computing in Teacher Education,* pp. 2537.

ABOUT THE AUTHORS

** Assistant Professor, College of Education, University of Memphis, Memphis.*

*** Associate Professor, College of Education, University of Memphis, Memphis.*

**** Project Coordinator , Center for Research in Educational Policy, University of Memphis, Memphis.*

Dr. Lee Allen is an Assistant Professor of Instructional Design and Technology, and has served as the Special Assistant to the Chair of the Instruction and Curriculum Leadership Department for Online Learning and Technology Integration. Dr. Allen has also served as a school district assistant superintendent for technology in Dallas, TX, and as a technology administrator in Santa Fe, NM.

Dr. Deborah Lowther is an Associate Professor of Instructional Design and Technology and Director of Graduate Studies for the Instruction and Curriculum Leadership department at the University of Memphis' College of Education. Dr. Lowther is also the Senior Faculty Researcher at the Center for Research in Educational Policy (CREP) at the University of Memphis.

Dan Strahl is Project Coordinator at the Center for Research in Educational Policy (CREP) at the University of Memphis. He is responsible for numerous research and evaluation projects, primarily with focus in the area of technology integration in schools.