Contextual and Psychological Predictors of Instructional Technology Use in Rural Classrooms

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Studies have shown that stand-alone technology courses, such as those taught in most teacher education programs, only develop basic computer literacy skills and do not prepare educators to use instructional technology in the classroom. A 14-item questionnaire assessed instructional technology use for classroom management and instructional development among a stratified random sample of K-12 teachers in four rural, Middle Tennessee schools. A total of 168 inservice teachers completed the study questionnaire. Results supported the hypothesis that teachers were using instructional technology primarily for classroom management tasks. Access to technology, State technology utilization grant recipients, and teachers' computer self-efficacy significantly predicted IT utilization. Results are discussed in the current social context of IT infusion through education and recommendations concerning K-12 IT use are offered.

> *I believe that the motion picture is destined to revolutionize our educational system and that in a few years it supplant largely, if not entirely, the use of textbooks.*
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> *I should say that on average we get about two percent efficiency out of schoolbooks as they are written today. The education of the future, as I see it, will be conducted through the medium of the motion picture… where it should be possible to obtain one hundred percent efficiency. (Wise, 1939, p.1)*
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> *-- Thomas Edison, 1922*

For the past several decades, in preparation for the 21st Century, our schools have rushed to put computers in the classroom. Millions of dollars have been spent as the ratio of students to computers decreased from 125:1 to less than 6:1 in the state of Tennessee alone (Education Week, 1999). Internet connections increased, as school after school gained access to the Information Superhighway. And now that those computers are in the classroom, how are they being used?

Those most struggling with this new technology seem to be today's inservice teachers – all 2.8 million educators from kindergarten through 12th grade – who were, most likely, not involved in the

decision-making process to "infuse" instructional technology (IT), not trained to make IT functional for them and their students, and ultimately may not recognize or agree that student learning outcomes are associated with IT utilization (Cuban, 2001). The Office of Technology Assessment (OTA, 1995) issued a call for the technology training of teachers to become a national priority. For preservice teachers, technology training has become a priority of sorts: most teacher education programs now require at least one course in technology in their degree program, some require two. Is it possible that only one or two 16-week undergraduate classes, primarily stressing computer competencies, are sufficient to ensure that once the students graduate from the university and find themselves in a classroom they will know how or want to integrate technology into the curriculum?

Several studies have shown that stand-alone technology courses only develop basic computer skills and do not prepare teachers to use technology in instructional settings. These studies also recommend that technology be infused throughout the undergraduate program and that field placements are technology-rich, providing preservice teachers the chance to observe modeling of technology integration (Hargrave, & Hsu, Y., 2000; Sandholtz, 2001).

Of all the possible barriers to technology use, lack of adequate training to use technology effectively stands out. Though most inservice teachers see the value of technology, and though most claim at least a novice-level of computer literacy, few are truly prepared to use technology resources in a classroom. Most of the instruction preservice teachers receive is *about* technology, rather than experiences using and integrating technology into the curriculum. One possible result is that when students transition from preservice to inservice, in charge of their own classroom, they feel ill-prepared to make use of a technologically-enriched classroom.

Teacher educators are failing to consistently model instructional technology use in their own education courses. Unfortunately, some, perhaps many, college of education administrators and faculty view instructional technology as an entirely separate content area, rather than an instructional tool that is necessary and helpful in teacher preparation programs. With the goal of critical inquiry and content area knowledge necessary for education students, modeling effective IT use during the preservice education experience bolsters IT use for inservice teachers. Bandura (1977) stated,

> Learning would be exceedingly laborious, not to mention hazardous, if people had to rely solely on the effects of their own actions to inform them what to do. Fortunately, most

> human behavior is learned observationally through modeling: from observing others one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action. Because people can learn from example what to do, at least in approximate form, before performing any behavior, they are spared needless errors. (p. 121)

Knowledge of the technology itself will not improve student learning outcomes, unless that knowledge is constructed from students' goals related to content areas. Surely, most educationists would agree that knowing how to use instructional technology, but not knowing what to use it for, does not improve teacher preparation curricula.

Bandura (1977) also observed that technological changes require self-appraisal capabilities through performance accomplishments. Performance accomplishments are successful attempts to perform a task and reinforce a sense of self-efficacy. Efficacy beliefs can affect how much effort people put forth, how long they will persist, and how resilient they are in dealing with failure or stress. Mager (1992) found a significant correlation between self-efficacy with motivation and sustained performance, and Olivier and Shapiro (1993) found evidence that efficacy predicts computer attitude and usage patterns. Kinzie and Delcourt (1993) confirmed this concept and recommended continued research in the relationship of computer self-efficacy and computer integration into instruction. Therefore, if a teacher education program fails to provide opportunities for preservice teachers to observe technology being modeled and to use technology as a part of their assignments and field experiences, it stands to reason that those preservice teachers would lack the skills and self-efficacy needed to infuse technology into the curriculum when they are placed in their own classroom.

The purpose of this study was to evaluate whether or not preservice computer experiences, modeling, or other personal experiences can predict the use of instructional technology in the inservice teacher's classroom curriculum. If a teacher education program stresses primarily basic computer competencies, will the graduates of the program use technology for more than classroom management as inservice teachers?

Method

Participants

A total of 168 K-12 teachers (34 men and 134 women) in Putnam County, Tennessee voluntarily completed the self-report questionnaire utilized to collect data on classroom instructional technology use. The sample was predominantly White (98.2%) with an average age of 40.58 years (SD=10.33). Due in part to State of Tennessee policy concerning teachers' salaries, 54% of the respondents held an advanced degree (i.e., Master's degree or Specialist in Education). Of the 168 teachers in the study sample, 12.5% had instructional responsibilities for grades K through 4 (i.e., elementary school), 41.6% taught grades 5 through 8 (middle school), and 45.8% taught grades 9-12 (high school). Respondents reported an average of 12.97 years (SD = 8.93) of experience in the K-12 educational system with a range of 1 year to 35 years.

Instruments

A fourteen-item anonymous questionnaire was used to assess technology utilization rates among elementary, middle, and high school teachers including the number of computers in the classroom, self-ratings of computer competency, and training opportunities. Additionally, teachers were asked to report the frequency of their computer usage for classroom management (e.g., maintaining class grades) and instructional development (e.g., searching the Internet for lesson plan preparation) using a 1 (never) to 5 (always) Likert-type scale. The questionnaire also requested sociodemogragphic identifiers, such as age, years of classroom teaching experience, and gender.

A cover letter was attached to the questionnaire and detailed the researcher's identity, the purpose of the survey, and the procedures for participating in the study. A statement informing potential volunteers that they would be providing informed consent to the use of their responses, grouped with all other responses, when they returned the completed questionnaire as instructed. The cover letter provided contact information (phone and electronic mail of the first author) for purposes of participants' questions or to request a copy of the final research manuscript. No participants contacted the authors and no one requested a copy of the final manuscript.

Procedure

The sampling frame included all of the 108 public schools in rural Middle Tennessee. To assure selection of teachers for the study sample who represented the range of teaching responsibilities from kindergarten to Grade 12, a stratified random sample of schools in a 14 county, rural region of Tennessee was selected. The final stratified sample included one school containing grades K-4, one school with grades 5-6, one school with grades 7-8, and one high school (grades

9-12). The researchers invited all of the teachers employed by these four schools to participate in the study. A total of 259 surveys were distributed via teachers' school mailboxes in the front office of each school. Each teacher received a 10" x 13" envelope, which contained the cover letter and questionnaire, a plain white security envelope, and a round blue sticker (approximately 3" in diameter). Teachers were instructed to place their completed questionnaire in the letter-sized envelope provided, seal the envelope flap, and place the blue sticker over the seal. The blue sticker seal was an added measure to assure the complete anonymity of study respondents. Teachers choosing to participate placed the sealed envelope containing their completed questionnaire in another 10" x 13" envelope located in the front office of their school.

One week (7 calendar days) after the study envelopes were distributed to all of the schools' teachers by front office staff, the first author returned to each of the four schools and collected all of the completed questionnaires placed in the front office collection envelope. Front office staff at each of the four schools confirmed that there were no completed questionnaires returned after the collection deadline.

Statistical Analysis

For statistical analyses, two dependent variable measures were used to summarize teachers' use of technology as either classroom management or instructional development tasks. Classroom management tasks include preparing instructional materials, recording/calculating grades, tracking attendance, creating tutorials, using drill and practice, creating documents in a word processing program, sending or receiving electronic mail, and surfing the Internet for personal research. Instructional development tasks include using technology to promote students' discovery learning and/or problem solving, searching databases or doing research, creating presentations, accessing a CD or DVD, and using the Internet for curricular research. Predictor variables included age, grade level, gender, highest degree received, years of classroom instructional experience, number of computers in the classroom, access to computer technology (e.g., printers, scanners, etc.), computer-related training, and computer self-efficacy.

Two separate hierarchical regression equations were calculated to predict computer usage for classroom management and instructional development. To examine the data for potential differences among grade level respondents' instructional technology use, a one-way analysis of variance (ANOVA) was also conducted.

Results

When asked to list the number one barrier to the use of technology in the classroom, 43.5% of the respondents listed lack of time, followed by lack of access to equipment (22.6%), and lack of training (16.1%). Lack of time was listed in either the number 1 or number 2 position by 78.8% of the respondents. This is consistent with other findings where teachers surveyed reported that lack of time was the biggest barrier for technology inclusion (e.g., Gibson & Nocente, 1998).

Table 1. Final Regression Model for Management Tasks

Block	Variable		t	p
1	Age	.06	.45	.65
	Gender	.03	.38	.71
2	Classroom Computers .04	.38	.71	
	Equipment			
	Computer	.14	1.63	.11
	Printer	.21	2.12	.04
	TV/VCR	.01	.1	.92
	Data video projector	-.12	-1.24	.22
	Visual presenter	.05	.46	.64
	Digital camera	-.03	-.26	.8
	Scanner	.17	1.42	.16
	Internet Access	.13	1.52	.13
	Instructional Software	-.15	-1.65	.1
3	Years Taught	-.13	-1.08	.29
	Graduate courses	-.002	-.02	.98
	Other training			
	Conferences	-.006	-.07	.95
	Inservice	.2	1.92	.06
	Professional training	-.02	-.16	.87
	Technology grant	.05	.51	.61
	Online resources	.03	.38	.73
	Assistance from coworkers	-.25	-2.19	.03
	Assistance from family	-.1	-1.08	.28
4	Computer Self-Efficacy	.21	2.23	.03

Results of the one-way ANOVA identified a significant difference in frequency of computer usage in the classroom between middle school teachers ($\underline{M}$=3.41, $\underline{SD}$=.63) and high school teachers ($\underline{M}$=3.74, $\underline{SD}$=1.02) compared to elementary school teachers ($\underline{M}$=2.56, $\underline{SD}$=.63) [$\underline{F}(2,163)$=15.92, $\underline{MS}_e$=.7, $p<.0005$]. For the purposes of developing prediction equations, scaled scores for classroom management computer use was regressed on the 22 predictor variables listed in Table 1. Predictors listed were dichotomous except for the

parametric variables of age, the number of computers in the classroom, years taught, the number of graduate courses involving instructional technology, and ratings of computer self-efficacy. Computer self-efficacy (_ = .21, t = 2.23, p <.03), access to a printer in the classroom (_ = .20, t = 2.12, p < .04), and computer assistance from a co-worker (_ = .25, t = -2.19, p < .03) significantly predicted classroom management computer usage (See Table 1).

Table 2. Final Regression Model for Instructional Tasks

Block	Variable		_	t	p
1	Age		-.14	-.19	.2
	Gender		.09	1.12	.26
2	Classroom Computers	.07	.83	.41	
	Equipment				
		Computer	.11	1.56	.12
		Printer	.02	.27	.79
		TV/VCR	.09	1.18	.24
		Data video projector	.12	1.43	.16
		Visual presenter	-.07	-.84	.4
		Digital camera	-.03	-.25	.81
		Scanner	.12	1.24	.22
		Internet Access	.06	.09	.42
		Instructional Software	-.06	-.73	.47
3	Years Taught		.03	.53	.8
	Graduate courses		-.07	-.83	.41
	Other training				
		Conferences	-.08	-.92	.36
		Inservice	-.04	-.42	.63
		Professional training	-.07	-.89	.36
		Technology grant	-.18	-2.16	.03
		Online resources	-.21	-2.56	.01
		Assistance from coworkers	.004	.04	.97
		Assistance from family	-.04	-.51	.61
4	Computer Self-Efficacy		.23	2.79	.006

In a separate regression analysis, scaled scores of instructional development computer use was regressed on the predictor variables listed above. Computer self-efficacy ratings (_ = .17, t = 2.79, p < .01), teachers who had received a State Technology Grant within the past 12 months (_ = .17, t = -2.16, p < .05), and teachers who located online resources for instructional development purposes within the past 12 months (_ = .25, t = -2.56, p < .01) were more likely to model instructional development technology use for their public school students (See Table 2).

Discussion

Access to technology remains a crucial, if not obvious, component of instructional technology use in the classroom. Current data demonstrate that access to a printer reliably predicts computer use for classroom management tasks, such as word processing handouts or tests, maintaining attendance records, grade calculation, and using e-mail. Computer literacy courses required as part of NCATE-accredited teacher preparation programs in the US provide adequate training for these classroom management tasks. The current data support the argument that the utility of this training and use of classroom technology is dependent on access to computers and printers in the classroom.

School districts experience the political pressure to have computers in the classroom, they purchase the instructional technology, often times without participation by those teachers expected to use the technology, and then the technology goes unused or underused (Cuban, 2001). Larry Cuban (1986) describes the technological-based education reform process as the "exhilaration / scientific-credibility / disappointment / teacher-bashing cycle" (p. 5) and attributes the cycle to "an unswerving, insistent impulse on the part of nonteachers [sic] to change classroom practice" (p. 6). This cycle illustrates the current political push for classroom instructional technology (i.e., computers) and lack of making that technology usable for teachers by also purchasing printers for classroom use. Of those teachers reporting a computer in their classroom, only 78% reported that they have classroom access to a printer.

The nearly significant finding that teachers who reported attending inservice training were less likely to use the computer for classroom management, is worth noting. This finding coupled with the significance of computer assistance by a coworker may be due to differences in the nature of the training received. Inservice computer training in these school districts addresses functional tasks (such as turning the computer on, logging in, navigating the hard drive, etc.) rather than specific classroom management tasks. It is likely that teachers who assisted coworkers did so for a specific IT question, such as creating a spreadsheet for grade calculation, thus increasing colleagues use of technology for classroom management (Blumfield, 1997; Harp, Satzinger, & Taylor 1997).

The current research highlights the importance that self-efficacy plays in the use of instructional technology for classroom management and instructional development purposes. Assuming access to instructional technology (e.g., computer, printer, and appropriate software), teachers may not use instructional technology due to low

levels of computer self-efficacy. Infusing technology use across the undergraduate teacher preparation curriculum may be the most direct and cost-effective avenue to foster instructional technology use (OTA, 1995). To achieve this goal it is necessary to replace "computer literacy" courses with "infused" instructional technology across these curricula. Modeling by faculty and requiring student use of instructional technology across content courses can be an effective method of improving this critical component of instructional technology use among K-12 teachers. This requires addressing faulty philosophical foundations of instructional technology use as an end-goal instead of as a tool for improving critical thinking, research, and communication skills. The current objectivist foundation of instructional technology curricula in teacher preparation programs presents a barrier to successful infusion of instructional technology. A more constructivist approach to technology utilization may provide a framework for college and university faculty to integrate usable technology based on student (i.e., learner) needs (Jonassen, 1991). Instead of assuming that an objective list of IT competencies can be delineated and transferred to preservice teachers via the instructional process, education students should engage technology when and where IT is needed. The "job" of education faculty is to facilitate this interaction and not direct it in stand-alone courses.

Limitations of external validity exist for the current study. Specifically, the random selection of one stratified school at each grade level, limits generalizability to other rural US schools, at best. Future research should take a longitudinal view of instructional technology utilization among teachers with support provided via technology grant projects of intuitive interest to the teacher-authors who propose those grants. This more constructivist view of instruction will allow preservice and inservice teachers to engage instructional technology on their terms and not those of technophile faculty in teacher preparation programs. Researchers need to seriously question IT utilization as a panacea for student learning. Involving classroom teachers and their students in decision making about IT utilization in the classroom would allow their frequently silenced voices to be heard.

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