

USE OF TECHNOLOGY IN
TEACHER PREPARATION PROGRAMS

by

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ABSTRACT

The purpose of this study was to investigate variations of two technology integration formats in elementary teacher preparation programs. Two program designs were identified in the research literature. The first was an integrated program design that infused technology across the program based on the identified elements, and the second was a non-integrated program design.

The following research question was explored. Is a teacher preparation program that is characterized by a more technology integrated environment, associated with: an increase in readiness and expertise to use technology for complex student projects, an increase in teacher proficiency with using technology, more student-centered instructional practices, an increased ability to locate resources and/or assistance for using technology, and a decreased perception of obstacles to technology use? All five areas are critical attributes affecting technology use in the classroom. To answer this question, the preservice format of the LoTi Questionnaire was administered in the spring and fall of 2006. The scores for each of the five critical areas were gathered from students completing preservice programs that represented both program designs. A total of 88 preservice students participated. Five separate *t*-tests were performed on the data with Program Design as the independent variable (Program Design A and Program Design B) across five dependent variables.

When participants' overall scores in the two program design groups were compared, the results showed that mean scores in the non-integrated model consistently represented higher readiness on all five areas in the study, though only two were found to be statistically significant. The two areas of significance were: teacher proficiency with technology use and current instructional practices. These findings were counter to the research question. Equally powerful is

the finding that program design appears not to impact teacher preparation with respect to incorporating technology into complex thinking tasks, the ability to locate technology based resources and assistance, and perceptions surrounding challenges to embedding technology into teaching.

Additional follow-up questionnaires were administered to a subset of the survey sample to provide a statement of preservice teachers' experiences in their undergraduate programs.

RESEARCH PROBLEM

Specifically, this study addressed the following question:

- 1) Is a teacher preparation program that is characterized by a more technology integrated environment, associated with:
 - a. an increase in readiness and expertise to use technology for complex student projects requiring problem solving, critical thinking, and real world applicability;
 - b. an increase in teacher proficiency with using technology;
 - c. more student-centered instructional practices;
 - d. an increased ability to locate resources and/or assistance for using technology; and
 - e. a decreased perception of obstacles to technology use?

Definitions of Variables

This study contained one independent variable with two levels, undergraduate program design with respect to the component of technology. The two program designs were selected specifically based on their approaches to these explicit technology elements of program design: available technology, educational technology instruction, faculty training and use of technology, integration of technology across multiple methods courses, and field experiences. The two program designs differed significantly on their approaches to these elements. The two levels of the independent variable were labeled: A and B program designs. The traditional program design was represented by A. Program Design A represented the dominant approach nationally of teacher preparation programs to prepare their teachers to use technology (Hargrave & Hsu, 2000; Hofer, 2005). The integrated program design was represented by B. Design B was selected because it was reported as an exemplary design by the International Society for Technology in

Education (ISTE) National Educational Technology Standards (NETS) Distinguished Achievement Award in 2002 (Hofer, 2005). Both programs were represented by schools located in the central region of the country.

Program design A was represented by one school for the purpose of this study. As part of its five-year Bachelor of Science plus graduate work teacher education program, Design A provided technology resources in its educational classrooms and laboratory settings. It also had ten laptops available for student check out. Program Design A required graduates to complete one three-hour course on instructional technology. This course was the primary resource for future teachers to learn technology integration methodology. It did not incorporate field experiences. A few of the instructors of the methods courses provided opportunities to work with technology related to their content area; however, there was no systematic approach to training faculty members to weave technology integration methods across the teacher preparation program experience. Approximately half of the students at the university in this study received additional exposure to technologies as part of a collaborative course in the Professional Development School (PDS) course sequence. Video conferencing was extensively incorporated into the course, and students were required to use technology as part of their assignments. Technology integrated into instruction was not emphasized. There were approximately 75 students available to participate in the study during the spring of 2006, and approximately 54 available in the fall.

Program Design B was represented by two schools for the purpose of this study. The program design found in these schools was quite different from Program A. Program Design B incorporated a laptop initiative for its future educators as part of its Bachelor of Science teacher education program. The use of technology facilitated by these laptops was integrated across methods courses on a regular basis. Faculty and staff were trained on technology literacy skills,

integration methods, and curriculum revision to support this technology. Technology was also integrated across field experiences. One of the schools representing Design B did not require a technology course. Computer skills were part of the sequence of courses in the program. Optional computer literacy course courses, however, were available. The other school in Design B offered two courses on technology to its preservice teachers. There were approximately 125 students who qualified to participate in the study during the spring of 2006, and approximately 185 who qualified in the fall.

The study contained five dependent variables that addressed the integration of technology into teaching: use of technology for complex student projects; proficiency with technology; current instructional practices; ability to locate resources and/or assistance; and perceived obstacles to technology use. The LoTi questionnaire for preservice teachers was administered to fifth year students representing Program Design A in the spring and fall of 2006, and graduating seniors representing Program Design B in the spring and fall of 2006 to measure all five dependent variables. The first dependent variable, use of technology for complex student projects, measured authentic classroom technology use and the ability to integrate technology in an exemplary manner that supports problem-solving with a purpose, experiential learning, and performance-based assessment practices. The second dependent variable, proficiency with technology, evaluated comfort and skill level with using a personal computer. The third dependent variable, current instructional practices, assessed preservice teachers' current instructional practices relating to a subject-matter versus a student-centered curriculum approach. The fourth dependent variable, resource location, monitored ability to locate resources and/or assistance to increase classroom technology use. Finally, the fifth dependent variable, challenges

to technology use, measured perceptions of limitations that prevent the integration of technology into teaching such as time, teacher priority, and available training.

REVIEW OF LITERATURE

Summary

A review of literature and research revealed that both the National Education Technology Standards and the National Council for Accreditation for Teacher Education expect new teachers to teach with technology through advanced methods, and yet the majority of our preservice teachers are not prepared to do so. Universities across the nation are responding to this phenomenon by exploring new options for program design features of elementary teacher preparation programs related to technology. These program design features focus on available technology, educational technology instruction, faculty use of technology, integration of technology across multiple methods courses, and field experiences. Confidence and multiple experiences with computers are critical attributes that affect new teachers' use of technology in the classroom. Applications of authentic, student-centered, problem-based approaches are other critical attributes associated with technology use in teaching. Academic achievement is influenced when technology is connected to higher-order thinking. The Level of Technology Implementation scale is a nationally administered instrument to monitor the technology integration, personal computer use, and current instructional practices of teachers.

The literature suggests that preservice teachers completing programs which integrate technology throughout their program will be better prepared to integrate technology into their teaching. There is no study, however, which specifically examines the acquisition of skills and knowledge associated with readiness and expertise to infuse technology into teaching based on the National Educational Technology Standards. As a result, this study examines both an

integrated and non-integrated technology design for teacher preparation based on five specific variables associated with the national standards.

METHODOLOGY

Participants

Participants were from a voluntary pool at three state universities located in the central region of the United States. Participants in this study were preservice teachers with elementary emphases who were completing programs at these three universities. Volunteers at School A formed one group based on the technology components of program design at their school. Volunteers at Schools B₁ and B₂ formed the second study group. There were approximately 150 students completing the fifth year of the program at School A, approximately 250 graduating seniors from School B₁, and approximately 60 graduating seniors from School B₂.

Instruments

One instrument with five components was used to measure the five dependent variables in the study. The Levels of Technology Implementation (LoTi) questionnaire for preservice teachers was administered to students in the spring and fall of 2006. It was a web-based questionnaire. This questionnaire contained five subcomponents: use of technology for complex student projects, proficiency with using technology, current instructional practices, ability to locate technology based resources and/or assistance, and perceptions related to obstacles of preservice teachers' use of computers in the classroom. The Preservice form of the instrument has never been tested for validity; however, the Inservice version of the instrument with similar items was tested for validity in the winter of 2005. The LoTi Survey reveals evidence of construct validity among Inservice teachers (Stoltzfus, 2005).

The researcher in this study used the Preservice format of the instrument, as its items were similar to the items found on the Inservice version which was tested for and achieved validity. Following administration of the instrument, the researcher conducted reliability tests of

the coefficient alpha based on the samples in this study to confirm reliability of the five domains. Questions in four of the five domains were altered as a result of the analysis.

Program Design: Technology Components

This study looked at technology design components of two undergraduate education programs. Three schools represent the two program designs. Program Design A is represented by School A. School A is a five year program, in which preservice teachers earn their Bachelor of Science in Education degree in four years. The fifth year is used for student teaching, an internship, and graduate level coursework. School A is NCATE (National Council for Accreditation of Teacher Education) accredited at both the initial teacher preparation and advanced preparation levels. Program Design B is represented by Schools B₁ and B₂. School B₁ is a four year program, in which graduates earn a Bachelor of Science in Applied Learning and Development. An internship is embedded in the fourth year of the program. School B₂ is a four year program in which students earn a Bachelor of Science in Education degree. School B₂ is also fully accredited by NCATE at both the initial teacher preparation and advanced preparation levels. Students complete a fifteen week student teaching experience during the last semester of the four year program.

The two program designs have significant variations in their teacher preparation programs for elementary teachers with respect to technology: available technology, educational technology instruction, faculty training and use of technology, integration of technology across multiple methods courses, and opportunities to integrate technology in field experiences. For the purpose of this study, Program Design A represented a segmented approach to technology. Program Design B represented an integrated approach, based on the above categories of incorporating technology.

Data Analysis

The data were analyzed using five separate independent samples *t* tests. The alpha levels were set at $p < .05$ for the data analysis. A separate questionnaire was also administered to a subsample of the preservice teachers participating in both program designs. The purpose of this questionnaire was to further explore the relationship between the program description and actual undergraduate experience with respect to teacher preparation and technology. Additional interviews were also conducted with a faculty member at each institution.

RESULTS AND DISCUSSION

Demographics

Demographics of Participants

	Program Design A	Program Design B	Total
Participants	37	51	88
Ages			
21-30	36	40	76
31-40	1	4	5
41-50	0	4	4
50+	0	1	1
Gender			
Female	34	46	80
Male	3	2	5
Obstacles			
Time	14	24	38
Access	10	13	23
Other Priorities	12	7	19
Lack of	1	4	5
Professional			
Development			

Reliability Analysis

Following administration of the instrument, the researcher conducted reliability tests of the coefficient alpha based on the samples in this study to seek confirmation of the reliability of the five domains.

Quantitative Results

To answer the research question, the scores for each of the five criterial areas were gathered from students completing preservice programs that represented both program designs. Five separate *t*-tests were performed on the data with Program Design as the independent variable, Program Design A and Program Design B, across five dependent variables.

Overall Results

When participants' overall scores in the two program design groups were compared, the results showed that mean scores in the non-integrated model consistently represented higher readiness on all five areas in the study, though only two were determined to be statistically significant. Differences were statistically significant in two of the five constructs, teacher proficiency with technology use ($t(86) = 2.61, p = .01$) and current instructional practices ($t(85) = 2.75, p = .007$).

Table of LoTi Subscales

Dependent Variables	Program Design A		Program Design B		<i>t</i>	<i>p</i>
	Mean	SD	Mean	SD		
Complex Thinking Projects	67.56	15.30	62.43	18.43	1.38	.17

Teacher Proficiency	78.95	11.97	71.18	14.89	2.61	.01
with Technology Use						
Current Instructional	78.68	14.42	68.97	17.45	2.75	.007
Practices						
Locating Resources	68.36	18.49	63.62	19.13	1.15	.25
Overcoming Challenges	51.35	21.18	57.32	19.51	-1.36	.17

Qualitative Results

While qualitative research was not a central focus of this study, it was applied through a follow-up questionnaire with students and faculty representing both Program Designs A and B.

Program Design A

The qualitative data were gathered to clarify the results found in the quantitative analysis. Several trends emerged from the interviews regarding Program Design A. First, most of the exposure to technology that students experienced occurred through one three-hour course on educational technology. Perhaps one student captured the overall description of the program design in saying: “Technology was not required, but encouraged.”

When asked about the types of technology utilized by the faculty members within the school of education, students universally referred to PowerPoint for lecture. Many respondents also mentioned their instructors’ use of BlackBoard, Elmo, and Advanced Learning Technologies in Education Consortia’s (ALTEC) tools such as RubiStar and QuizStar. When a faculty representative from Program Design A was interviewed, he shared his use of BlackBoard, online activities, and an outdoor experience using GPS devices. One student mentioned the use of video conferencing in her PDS class as part of her fifth year experience.

The video conferencing system enabled them to work collaboratively with a class meeting in England. The researcher asked a faculty member about the PDS video conferencing experience and was told that it is a collaborative PDS class which blended multiple topics such as special education, educational psychology, measurement, and policy. They were given an assignment to pick one technology about which they knew nothing and incorporate it into another assignment. The resulting presentations included relatively advanced technologies.

Students representing Program Design A were asked about the learning experiences they had with regard to technology in their undergraduate program. All interviewees mentioned the creation of a webpage as part of their technology class. Most respondents also mentioned iMovie and WebQuests. Several noted the resources on the ALTEC website. Another noted the technology workshop offered to the teachers and interns working together at PDS schools.

One of the key components of the program design that represented the concept of integration was the use of technology across the program and in methods courses. Students at Program Design A, when asked about this program-wide use, cited examples of technology use to increase productivity and for presentations.

Another simply said, "In half of the methods courses, we didn't use any technology."

When asked about access and use of technology based resources in the education department resource center, students mentioned the Learning Resource Center (LRC) and its employees.

Program Design B

The questionnaire responses from future teachers in Program Design B were different than those from Design A. These student responses were coupled with faculty conversations about the program. Students indicated a variety of types of technology used in their undergraduate

program: iPod, laptop, notebook, Internet, Elmo overheads, tape players, and projectors. They noted using this technology to learn how to implement technology in the classroom.

When asked about access and use of technology in a student center, one student shared that she used the laptops and the computers to finish assignments and create lessons. Another said:

“The IRC is a wonderful lab, other than when major department wide assignments (i.e. an internship notebook) are due. Having laptops and cameras (video and still) was a major help through my undergrad work... It is very nice to be able to have the space where it can be quiet to work alone or meet as a group. It is also nice to have the majority of the students in the IRC in the teacher ed program. This gives us a person to bounce ideas off of and to ask for help/clarification.”

In addition to follow-up conversations with students in Program Design B, the researcher also interviewed a faculty member about the program. When asked about integration across methods courses at the elementary level, this was her response:

“There is good integration. The majority of the instructors are integrating it practically every class period. They are getting out laptops and doing things on them. This is happening in math/science, language arts, social studies, correction of reading, diverse learners, effective classrooms, and professional practice and observation, which is an early field experience.”

Conclusions

One possible explanation for the results indicating that students in Program Design A are more proficient with technology use can be found in the timing and demographics of the survey. Qualitative data indicates that there were rich technology opportunities available for students participating in the PDS program at Program Design A. Coincidentally, most of the students who completed the survey for Program Design A participated in a PDS internship (29) as opposed to students who were completing their fifth year coursework in non-PDS schools (8). Therefore, the results may have been influenced by the timing and demographics of the survey. Because qualitative data indicates that there were rich technology opportunities available for students

participating in the PDS program and since most of the student representatives in this sample were participating in a PDS program sequence, the technology proficiency of these students may have increased the mean.

A second possible explanation that the students in Program Design A were more proficient with technology use might be found in the quality of the educational technology course, itself.

Overwhelmingly, students completing their studies within both program designs A and B feel that they demonstrate high skill level with using computers for personal use.

The second area that revealed statistically significant differences is current instructional practices. The research literature on the LoTi framework was again used to evaluate the results in this domain. Based on this framework, students completing their academic program within Program Design A have student-centered instructional practices. Students in Program Design B, according to the LoTi framework, approach student influences on instructional practices differently. This occurs through a combination of student-centered and subject-matter based approaches.

This research study focused on program components related to technology design, not general teacher training and instructional practices. One possible explanation for these results is that this domain does not rely on technology or related skills for predicting success with technology integration, which was the focus of this investigation.

It is also important to note the lack of significance within the other three variables: the use of technology for complex thinking, the ability to locate resources and/or assistance to increase classroom technology use, and the perceived challenges to preservice teachers' use of computers in the classroom. The students experiencing Program Design A did score higher on

these three areas, although not at a significant level. One possible explanation why the use of technology for complex thinking was not statistically significant is that students at both programs assessed themselves at the Target Technology Level as defined by the National Education Technology Standards (NETS) and Technology Standards for School Administrators (TSSA).

One possible explanation that the ability to locate resources and/or assistance to increase classroom technology use was not significantly different is that both program designs contain a student resource center which appears to be regularly utilized by the students.

Perceived obstacles to preservice teachers' use of computers in the classroom were not significantly different. One possible explanation can be found in the demographic data surrounding the study. Participants in both program designs have similar perceptions to obstacles that may prevent them from integrating technology into their teaching practices. Preservice students appear to have common fears about using technology in teaching despite differing program designs.

CONCLUSIONS AND RECOMMENDATIONS

The U.S. Congress, in 1994, announced that facilitating teachers to use technology effectively may be the most important step to ensuring that current and future investments in technology are fulfilled (U.S. Congress, April, 1995). Throughout the twenty-first century, technology will continue to play a role in the education of our nation's young people. Clearly, the presence of computers in schools is increasing. As a result, preservice teachers are expected to leave teacher preparation programs with an understanding of technology and an ability to connect it technology to core content and higher order thinking. Thus, the role of school of education faculty members in modeling technology usage is important for teacher preparedness. It is necessary to develop teacher preparation methods that equip our beginning teachers to confidently embed these tools into their teaching practices, and to develop research that provides an understanding of the effectiveness of these teacher preparation program designs. This study contributes to the greater body of knowledge on teacher preparation programs with respect to technology program design, and can be applied at the university level to inform the development of successful professional programs. The goal is to purposefully prepare teachers to use technology in their teaching, thus supporting the instructional practices of educators.

Directions for Further Research

Further research on teacher preparation program designs would be valuable, as program designs with respect to technology are continually evolving, as is technology itself. This study identified components of program design with respect to technology that the literature suggested might influence teacher preparation. The examination of an integrated versus non-integrated model alone was not potent enough to account for all sub skills associated with technology use in

the classroom. Future studies need to identify and examine other elements which are related to increasing teacher readiness to use technology. In order to do identify these core components, future research should track teacher utilization of technology throughout the teacher preparation experience and during initial years in the classroom in order to connect these results back to teacher preparation program design. This longitudinal study could be facilitated by interviews with the teachers, their students, faculty members, and building principals overseeing novice teachers in the field. Their qualitative accounts of new teacher performance could provide further evidence connected back to teacher preparation programs. The involvement of school principals is important, as prior research reveals that school leaders believe new teachers to be overwhelmingly average in their ability to integrate technology into their teaching (Grunwald, Associates, & Rockman, 2002). A longitudinal study such as this would drive the discovery and analysis of the process through which a new teacher progresses in each of the five domains associated with success in technology integration. Perhaps by closely monitoring this process and identifying specific components of both success and need, results could inform design of preservice teacher programs. This type of longitudinal study should be followed up by a quantitative analysis of the specific components distilled out through the qualitative examination. Additionally, these questions would warrant a close examination of the role of technology within professional development programs, mentorship programs, and job coaches for these new teachers.

Conclusions

Teacher preparation with respect to technology is a notable issue. Children have a vision for their education that includes technology. During the fall of 2004, NetDay sponsored its “Speak-Up Day for Students.” Through online questionnaires, more than 160,000 students

answered questions about their vision of future education technologies. Thirty-eight percent of the respondents were in grades K-6, and 62 percent were students in grades 6-12. Children from both public and private schools and from both urban and rural areas participated. Most of their answers addressed needs related to mathematics and reading. Four themes of technology devices emerged from their responses: digital devices, access to computers and the Internet, intelligent tutors, and ways to learn using technology. Children want future technologies to be small and multifunctional, like a “digital Swiss army knife.” Children believe that each child should have a computer that is wireless, fast, safe, and available 24-7. They want technology that will allow them to visit virtual worlds, take online classes, and work digitally. Children are very interested in addressing reading needs through ebooks and interactive texts. A vignette offered by the authors of the report reveals a picture of what children hope for the future with respect to learning technologies:

Every student would use a small, handheld wireless computer that is voice activated. The computer would offer high-speed access to a kid-friendly Internet, populated with websites that are safe, designed specifically for use by students, with no pop-up ads. Using this device, students would complete most of their in-school work and homework, as well as take online classes both at school and at home. Students would use the small computer to play mathematics-learning games and read interactive e-textbooks. In completing their schoolwork, students would work closely and routinely with an intelligent digital tutor, and tap a knowledge utility to obtain factual answers to questions they pose. In their history studies, students could participate in 3-D virtual reality-based historic reenactments (Evans & Spero, 2005).

To understand the future of learning, we must understand the future of technology and the vision children hold of its potential. Then we must train teachers to harness this potential.

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