Technology-Based Instruction: Are Pre-Service Teachers Prepared to Meet the Challenge?

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Abstract

Teaching and learning in the twenty-first century calls for greater student engagement, enhanced critical thinking, and authentic, real-world application. Utilizing technology in the classroom provides effective hands-on learning, positively impacts literacy, and encourages meaningful collaboration to meet the needs of diverse learners. Results from a 2014 study indicated that approximately 90 percent of pre-service teachers recognized a changing digital world for students and the need to evaluate existing teaching practices; however, less than 50 percent of pre-service teachers felt adequately prepared to utilize technology in their future classrooms. These findings were not only alarming to researchers, but also indicated a need for further research. The current research study expanded initial findings and the sample population targeted pre-service teachers who were completing their student teaching practicum. Results obtained from this study indicate that the majority of students are confident in their ability to choose technologies that enhance teaching and student learning.

Keywords: technology, teaching, pre-service, higher education

1. Introduction

Teaching and learning in the twenty-first century calls for greater student engagement, enhanced critical thinking, and authentic, real-world application. Utilizing technology tools in the classroom provides effective hands-on learning; positively impacts literacy, encourages meaningful collaboration, and meets the needs of diverse learners. While students are performing such tasks at astonishingly younger ages than in previous years, it is imperative that pre-service teachers be adequately prepared, knowledgeable, and ready to take on such dynamic, technology-enhanced classrooms.

1.1 The Research Problem and Purpose of the Study

Results from a 2014 study of pre-service teacher revealed that approximately 90 percent of participants recognized a changing digital world for students and the need to evaluate existing teaching practices; however, less than 50 percent of our pre-service teachers felt adequately prepared to utilize technology in their future classrooms. These findings were not only alarming to researchers, but also indicated a need for further research. The purpose of this study was to expand existing research data and survey students who were completing student teaching, signaling their readiness to graduate. Technology has expanded exponentially and it is imperative that pre-service teachers are not only prepared for the challenges that lie ahead, but also are prepared to positively impact student learning and achievement.

2. Literature Review

The use of technology in today's classrooms continues to increase significantly as educators strive to engage learners and enhance instruction. Technological advancements have provided educators with access to a myriad of resources allowing for student engagement, content diversity, and differentiation of instruction (Ball &Levy, 2008; Chandra & Fisher, 2009). Not only do we see an increase in the accessibility of computers to students and teachers, but also see technology being integrated across the curriculum (O'Bannon & Judge, 2005).

With the adoption of the Common Core Standards, there is an expectation that students be college and/or career ready. To achieve such readiness, it is imperative that students are computer literate and that they are able to demonstrate effective uses of new informational technologies as lifelong learners and users of information (Howe, 1998). As pressure mounts for students to think more critically and solve problems more readily, educators continue to find new ways to improve instruction and engage twenty-first century learners. It is widely accepted that students learn best when leaning is authentic and when they are engaged in activities that are relevant and purposeful. In fact, some see the role of the educator as a facilitator of learning, rather than an instructor or manager (Serim, 2001). In this role, learning can be transformative, whereby students use higher order thinking skills, but also take responsibility and ownership of their learning. Furthermore, technology can support learning by diagnosing individual learning and providing instruction based upon the needs of individual students (Tomel, 2003). In this manner, technology can greatly impact learning across all curricula.

Although it is evident that technology can enhance overall learning, it is interesting to note that actual use of computers in the classroom remains limited (O'Bannon & Judge, 2005). While lack of training and support are often cited as the causes, most researchers conclude that pre-service teachers often feel unprepared to incorporate technologies into the classroom as a way to enhance education (Han, Eom, & Shin, 2013). In fact, researchers claim that university teacher preparation programs are not teaching students how to integrate technology into the classroom, but rather, placing an emphasis on a mastery of basic computer skills (Lee, Shin, Yoo, & Lee, 2000; Llorens, Salanova, & Grau, 2002; Russell, Bebell, O'Dwyer, & O'Connor, 2003). Furthermore, it is recognized that a majority of teacher education programs address teaching with technology in a single, isolated technology course (Hargrave & Hsu, 2000). Acknowledging that such shortcomings currently exist in many teacher education programs, it is becoming increasingly important that such programs should not only provide multiple exposures throughout the curriculum, but also improve the level of training. Institutes of higher education are tasked with creating educators who are ready to enter their own classrooms and meet these challenges, which can only be accomplished by modeling expectations, creating technology-rich learning environments, and challenging the status quo (DiBella & Williams, 2014). To do this, pre-service teachers will need to learn how to implement technology to engage learners and enhance learning, and this can only be done with the effective use of multiple technologies interwoven throughout their college coursework.

3. Overview of the Study

This quantitative study investigated the effects of implementing technology tools in higher education classrooms for pre-service teachers. In this quantitative research study, researchers sough to answer the following:

Research Question 1: How does the implementation of technology tools impact pre-service teachers' preparedness to integrate technology tools into their future classrooms?

Research Question 2: What is the difference between participants' age ranges and their self-assessment of technology proficiency readiness?

Research Question 3: What is the difference between student licensure programs of participants and their self-assessment of technology proficiency readiness?

Instructional technology tools such as blogs, Story birds, Web Quests, Student Response Systems, Skype and other types of technology resources are currently implemented into some coursework for pre-service teachers. Students who were preparing to complete their student teaching and graduate were requested to anonymously respond to a survey using Qualtrics, an online survey instrument, which provided data as to their preparedness to utilize such tools into their future classrooms. Data was also collected to determine if any variations were present based on the age or major of the pre-service teachers surveyed.

3.1 Methodology

This quantitative study was intended to determine if the implementation of technology tools into required coursework would prepare pre-service teachers to integrate technology tools into their future classrooms. Additionally, researchers sought to determine if significant statistical differences existed between the age ranges or licensure programs of pre-service teachers and self-assessment data of technology proficiency. The first research question will be addressed using descriptive data obtained from results of a Likert-scale survey.

Additionally, the null hypotheses for this research study are as follows:

$H_0$1: No significant statistical difference exists between participants' age ranges and their self-assessment of technology proficiency readiness.

$H_0$2: No significant statistical difference exists between participants' licensure programs and their self-assessment of technology proficiency readiness.

Research was conducted at a four-year university situated in a rural setting. Investigators developed a survey instrument that was adapted from the Technological Pedagogical Content Knowledge (TPACK) survey because of its reliability and validity. The internal consistency (alpha) ratings of the TPACK vary from .75 to .92 (Schmidt et al, 2009). All questions on the survey were not applicable to pre-service teachers; therefore, some questions were omitted. Survey links were emailed to all pre-service teachers enrolled in their student teaching practicum during the spring semester. Requests for voluntary participation were sent to 92 individuals who met the student-teaching requirement for that semester. Initially, 25 pre-service teachers responded to the survey. Reminders were emailed on a weekly basis for the following two weeks, and 37 surveys were completed, representing a 40% return rate.

3.2 Data Analysis

Thirty-seven respondents completed the Pre-Service Teachers' Use of Technology survey. Table 1 lists the characteristics of the participants. The survey contained four demographic questions as well as 24 Likert scale questions. The Likert scale questions were assigned a value of 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, or 5 = strongly agree. Numerical data was analyzed and mean scores were used for each question to determine if statistically significant differences were present (see Table 2 and Table 3). Research Question 1: How does the implementation of technology tools impact pre-service teachers' preparedness to integrate technology tools into their future classrooms? Researchers' goal was to determine if pre-service teachers were ready to step out into the world of teaching and be immediately prepared to address technology needs of twenty-first century learners. Figure 1 represents the data supporting teaching readiness. Eighty-six percent of participants indicated they are prepared to enter the classroom and implement technology resources. Unfortunately, three percent do not feel adequately prepared and another 11% did not choose a definitive response.

Mean scores were calculated for each survey item, by subgroup, to provide additional insight into pre-service teachers' perceptions of their preparedness to integrate technology. Summary results for each subgroup are represented in Table 2 and Table 3. Further analysis was required to address the null hypotheses for this study. The researchers planned to use an analysis of variance (ANOVA) to analyze results for each independent sample but conducted a Shapiro-Wilk analysis initially to determine if the data was normally distributed (Shapiro & Wilk, 1965). Results validated that the data was not normally distributed, eliminating the option of using an ANOVA. Researchers decided to use the Kruskal-Wallis H Test, a non-parametric alternative that takes into account not only the sums of the ranks of data, but also the averages (Lowery, 2012), to determine if each of the null hypotheses should be rejected. The statistical significance level (α) was selected as $\alpha = 0.05$ and each data set was analyzed using SPSS Statistical software.

Research Question 2: What is the difference between participants' age ranges and their self-assessment of technology proficiency readiness?

$H_0$1: No significant statistical difference exists between participants' age ranges and their self-assessment of technology proficiency readiness.

A Kruskal-Wallis H test was conducted on mean scores for each sample question to determine if participants' self-assessment of technology proficiency readiness was different for four age ranges: (a) 18-22, (b) 23-27, (c) 27-32, and (d) over age 33. Statistically significant differences were not present between the four groups, $x^2(3) = 2.86$, $p=0.4137$ as represented in Table 4; therefore, the null hypothesis cannot be rejected.

Research Question 3: What is the difference between student licensure programs of participants and their self-assessment of technology proficiency readiness?

$H_0$2: No significant statistical difference exists between participants' licensure programs and their self-assessment of technology proficiency readiness.

A second Kruskal-Wallis H test was conducted on mean scores for each sample question to determine if participants' self-assessment of technology proficiency readiness was different for four groups that were pursuing licensure in: (a) Early Childhood Education, Pre-K-3; (b) Elementary Education, K-6; (c) Middle School Education, 4-8; and (d) Secondary Education, 7-12. Statistically significant differences were present between the four groups, $x^2(3) = 13.28$, $p=0.0041$ as represented in Table 5. Therefore, the null hypothesis rejected.

3.3 Discussion

The intent of this study was to determine the readiness of pre-service teachers to implement technology into their future classrooms. Integration of technology is a non-negotiable in classrooms today and is also required at institutions of higher learning according to CAEP accreditation standards. Determining pre-service teacher readiness to integrate technology into their future classrooms cannot be determined by this study alone because of the sample sizes of the sub-populations. However, several fundamental principles of technology integration into higher education can be gleaned from the research. The data revealed that 86 percent (32 out of 37) of participants agreed or strongly agreed that their literacy education professors appropriately model combining content, technologies, and teaching approaches, and similarly, 78% agreed or strongly agreed that their educational foundation professors were successful at modeling as well.

Participant responses indicated some discrepancies in their self-assessment results. For example, 11 out of 37 (30%) participants neither agreed or disagreed that they keep up with important new technologies; however, 34 out of 37 (92%) either agreed or strongly agreed they can choose technologies that enhance the teaching approaches for a lesson. This poses the question, "If pre-service teachers do not keep abreast of changing technology resources, how do they know the most effective strategies to integrate into the classroom?" Additionally, 49% (18 out of 37) participants disagree or neither disagree that their mathematics education professors appropriately model teaching approaches; whereas 51 percent (19 out of 37) agree or strongly agree that they do appropriately model teaching approaches. Clarification is needed to determine the variation in responses. Researchers were also alarmed about the failure of many participants to respond in a definitive manner to several other survey prompts. Specific examples are as follows:

- Forty-six percent (17 out of 37) participants neither agree nor disagree that they explore different technology.
- Thirty-five percent (13 out of 37) participants neither agree nor disagree that their science education and social studies education professors appropriately model combining content, technologies, and teaching approaches in their teaching.

Data analysis supported that a significant difference was present between licensure areas; however, no significant difference was found between age and self-assessment technology. Distinct implications for practice were derived from participant responses, indicating areas where improvement is needed. First, we must model the use of technology in our higher education classrooms. Second, we must determine which courses integrate effective technology strategies and work collaboratively to build a technology-rich program. Finally, all educators must evaluate their current instructional practices, critically analyzing the integration of purposeful technology, and determine how instruction can be modified to meet the changing needs of twenty-first century learners.

3.4 Limitations

The primary limitation of this study was the lack of survey responses. Efforts were made to obtain a minimum of 50 participants and to obtain data from male and female pre-service teachers. Approximately 56% of the sample population was comprised of Elementary Education Majors, which may have also had an effect of survey results; however, this percentage is representative of the total students enrolled in the Teacher Education Program. No male students participated in data collection, which eliminated the possibility of analysis by gender. Additionally, the assumption was made that all students had completed their program of study at the four-year University. Follow-up data collection will require researchers to be very explicit about the number of courses being taken at the University, the participants' definition of technology, the tools they had experimented with in the past, and their level of exposure to technology applications. Several pre-service teachers indicated that they neither agreed nor disagreed with a majority of survey questions; therefore, this option should be removed as a response choice. Participants may have had varied experiences with technology applications, which may have altered the study outcomes. Finally, prior experiences with instructors may have altered participant responses on the survey instruments.

4. Conclusion

Institutions of higher learning face the challenge of transforming post-secondary students into future teachers who exemplify the characteristics of effective instructional leaders. Therefore, we must ensure that pre-service teachers are prepared to face the challenges of educating today's digital natives in a technology-rich environment. Results from this study supported that future research is needed to better determine pre-service teachers' readiness to integrate technology into their teaching methodologies however, replication is also needed on a larger scale to ensure reliability of findings. Current and future educators must continue to challenge themselves to embrace change and ensure all students are ready for the ever-changing world of the twenty-first century and more importantly, institutions of higher education must also be willing to adapt coursework, so that pre-service teachers are better prepared to teach tomorrow's learners.

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Table 1

Participant Descriptives

Gender

	Response	**Percent**
Male	0	0
Female	37	100
Total	37	100

Age Range

	Response	**Percent**
18-22	20	54
23-27	6	16
27-32	5	14
33+	6	16
Total	37	100

Major

	Response	**Percent**
Pre K-3	4	11
K-6	21	57
4-8	6	16
7-12	6	16
Total	37	100

Table 2

Mean Scores by Question and Licensure Area

	Licensure Area			
	Pre-K-3	K-6	4-8	7-12
I can learn technology easily.	4.25	4.29	4.33	3.83
I keep up with important new technologies.	3.5	3.86	3.83	3.67
I frequently explore different technology.	3	3.71	3.17	3.33
I know about a lot of different technologies.	3.25	3.62	3.67	3
I can choose technologies that enhance the teaching approaches for a lesson.	4.5	4.19	4	4
I can choose technologies that enhance students' learning for a lesson.	4.5	4.24	4.17	4.17
My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.	4.75	4.14	3.67	4.33
I think critically about how to use technology in my classroom.	4.75	4.1	3.83	4
I can adapt the use of technologies that I am learning about to different teaching activities.	4.75	4.14	4	4.17
I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn.	4.75	4.14	4.17	3.83
I have sufficient knowledge about literacy.	4.25	4.1	4	4.33
I have various ways and strategies of developing my understanding of literacy.	4	4.19	3.83	4.17
I can adapt my teaching based upon what students currently understand or do not understand.	4.5	4.38	4.33	4.17
I can adapt my teaching style to different learners.	4.5	4.29	4.33	4.17
I can select effective teaching approaches to guide student thinking and learning in literacy.	4.5	4.1	4.33	4.17
My mathematics education professors appropriately model combining content, technologies, and teaching approaches in their teaching.	3.75	3.9	2.83	3
My literacy education professors appropriately model combining content, technologies, and teaching approaches in their teaching.	4.5	4.29	3.33	3.83
My science education professor appropriately model combining content, technologies, and teaching approaches in their teaching.	3.5	3.29	3.67	3.5
My social studies education professors appropriately model combining content, technologies, and teaching approaches in their teaching.	3.75	3.24	2.83	3.4
My educational foundation professors appropriately model combining content, technologies, and teaching approaches in their teaching.	4.25	3.86	3.33	4
My instructional technology professors appropriately model combining content, technologies, and teaching approaches in their teaching.	4.25	3.71	3.17	3.83
My professors outside of education appropriately model combining content, technologies, and teaching approaches in their teaching.	4	3.57	3	3.4
I can adapt my teaching style to different learners.	4.75	4.33	4.5	4.17
I feel adequately prepared to implement technology into my future classroom	4.5	4.1	4	4
Overall Mean Score	4.2	4.0	3.8	3.9

Table 3				
Mean Scores by Question and Age				
	Age Range			
	18-22	23-27	27-32	33+
I can learn technology easily.	4.4	4.4	4.2	3.9
I keep up with important new technologies.	3.9	4	3.8	3.3
I frequently explore different technology.	3.2	3.4	3.7	3.3
I know about a lot of different technologies.	3.7	3.7	3.2	3.1
I can choose technologies that enhance the teaching approaches for a lesson.	4.1	4.5	4.3	4
I can choose technologies that enhance students' learning for a lesson.	4.2	4.5	4.3	4
My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.	3.9	4.2	4.5	4.3
I think critically about how to use technology in my classroom.	4.0	4.0	4.3	4.1
I can adapt the use of technologies that I am learning about to different teaching activities.	4.2	4.4	4.2	4.1
I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn.	4.1	4.3	4.2	4.3
I have sufficient knowledge about literacy.	4.0	4.2	4.2	4.3
I have various ways and strategies of developing my understanding of literacy.	4.1	4.3	4.2	4.0
I can adapt my teaching based upon what students currently understand or do not understand.	4.3	4.3	4.7	4.3
I can adapt my teaching style to different learners.	4.2	4.5	4.5	4.3
I can select effective teaching approaches to guide student thinking and learning in literacy.	4.1	4.3	4.3	4.1
My mathematics education professors appropriately model combining content, technologies, and teaching approaches in their teaching.	3.7	3.5	3.3	3.7
My literacy education professors appropriately model combining content, technologies, and teaching approaches in their teaching.	4.1	3.8	4.2	4.0
My science education professor appropriately model combining content, technologies, and teaching approaches in their teaching.	3.6	3.9	2.5	3.7
My social studies education professors appropriately model combining content, technologies, and teaching approaches in their teaching.	3.2	3.1	2.8	4
My educational foundation professors appropriately model combining content, technologies, and teaching approaches in their teaching.	4.0	3.9	3.7	4.0
My instructional technology professors appropriately model combining content, technologies, and teaching approaches in their teaching.	3.6	4	4	3.9
My professors outside of education appropriately model combining content, technologies, and teaching approaches in their teaching.	3.5	3.5	3.8	3.6
I can adapt my teaching style to different learners.	4.3	4.5	4.3	4.3
I feel adequately prepared to implement technology into my future classroom	4.2	3.9	4.2	3.9
Overall Mean Score	3.9	4.0	4.0	3.9

Table 4: Kruskal-Wallis Test H – Age and Self-Assessment of Technology Proficiency Readiness

Age Range	Obs	Rank Sum
18-22	24	43.6
23-27	24	53.8
27-32	24	52.8
33+	24	43.8
chi-squared = 2.86 with 3 d.f.		
probability = 0.4137		

Note: Observations are the mean scores for each survey question by licensure area.

Table 5: Kruskal-Wallis Test H – Licensure Areas and Self-Assessment of Technology Proficiency Readiness

Licensure Area	Obs	Rank Sum
Early Childhood (Pre-K-3)	24	65
Elementary Education (K-6)	24	49.3
Middle School (4-8)	24	38.4
Secondary Education (7-12)	24	41.2
chi-squared = 13.28 with 3 d.f. probability = 0.0041		

Note: Observations are the mean scores for each survey question by licensure area.

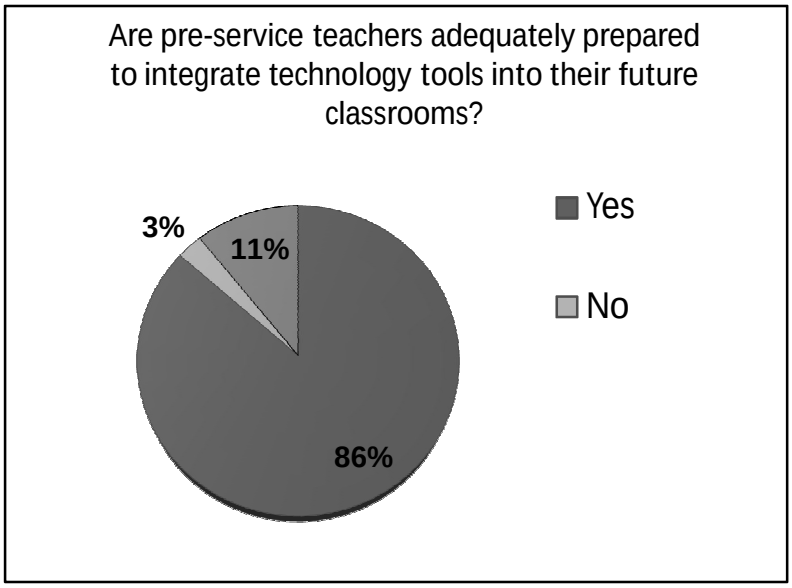

Figure 1: Participant Responses to Readiness to Integrate Technology Tools into Their Classrooms