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# Improving Pre-Service Teachers' Readiness to Integrate Technology with Cross-Curricular Adaptations

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**Abstract**

Pre-service teachers preparing to teach in twenty first century classrooms must recognize the call for greater student engagement, enhanced critical thinking, and authentic, real-world application. It is widely accepted that using technology and applicable Web 2.0 tools in the classroom not only provides hands-on learning, but also can encourage collaboration and meet the myriad learning styles of diverse learners. That being said, it is imperative that the use of technology be integrated into college coursework in order to better prepare pre-service teachers for their future classrooms. Researchers studied the impact that a technology integration workshop had on future teaching practices of pre service teachers using a mixed methods study. Based on responses from participants, researchers found an overwhelming amount of support that pre-service teachers not only found this hands-on workshop valuable, but also found effective tools that they feel adequately prepared to implement into future lesson plans and teaching. Additionally, the data supports the concept that pre-service teachers feel that technology can and should be readily implemented into future classrooms, used successfully in multiple content areas and for cross-curricular activities, and ultimately, feel better prepared to do so as a result of the technology workshop.

**Keywords:** technology, pre-service teachers, cross curricular, teacher education programs

## Introduction

To better prepare for teaching in twenty first century, technology-enriched classrooms, pre service teachers need increased exposure and multiple opportunities to engage in hands-on learning. They must have time to explore the many tools provided and understand how best to implement such tools in cross-curricular settings in an effort to enhance student learning. As educational standards, such as Common Core, InTASC, and CAEP Accreditation, continue to change, it is critical that teacher education programs remain current in their teaching and learning practices to ensure that pre-service teachers are ready for their future classrooms.

## The Research Problem and Purpose of the Study

The purpose of this study was to provide exposure to various Web 2.0 tools targeted for cross-curricular implementation to pre-service teachers for use in their future classrooms. The exposure to such instructional tools was provided through a hands-on technology workshop, which was offered to pre-service teachers in the teacher education program.

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Researchers modeled the application of the Web 2.0 tools, which allowed pre-service teachers an opportunity to not only see how each tool can be applied, but also understand how they can be used to differentiate instruction and meet the needs of all learners.

## Literature Review

Education is an ever-changing entity, which is documented in the continually changing reforms and standards used to teach, and as we continue to see state and national policies target the success of all students. In fact, it has long been the goal that educators narrow the gap among diverse groups of learners (NAEP, 2009). In an effort to do this, it is necessary that all pre-service teachers receive effective training and better preparation for their future classroom. In order to adequately serve the growing population of diverse students, many of whom are digital natives, it is critical that pre-service teachers receive effective instruction on the use of technology integration in the classroom (Young, Young, & Hamilton, 2013). Contemporary children are defined in part by the generational term referred to as digital natives (Fleer, 2011; Prensky, 2001a, 2001b). These digital natives live in a world consumed by technologies which are used in their everyday lives (Hague & Payton, 2010; Plowman, Stevenson, Stephen, & McPake, 2012). Unfortunately, most classroom teachers lack effective technology integration preparation (Bracewell, Sicilia, Park, & Tung, 2007; Ertmer, 2005). This creates the need for higher education to better prepare pre-service teachers to ensure they create educators who are ready to enter their own classrooms and meet these challenges. This can only be accomplished by modeling expectations, creating technology-rich learning environments, and challenging the status quo (DiBella & Williams, 2014). The integration of technology provides ways for learners to collaborate, interact, communicate, co-create, and share ideas and knowledge (Hartshorne & Ajjan, 2009; Shihab, 2008). By using such technologies, students are no longer passive recipients of information, but rather are active constructors of knowledge due to their experiences (Orehovacki, Bubas, & Konecki, 2009). In order for constructive classrooms such as those described above to exist, these experiences must be modeled in teacher education programs. It is imperative that pre-service teachers are provided appropriate time for hands-on practice, effective engagement, and reflective feedback.

## Overview of the Study

This mixed methods study investigated how pre-service teachers' perceptions of integrating Web 2.0 tools and analytical equipment into cross-curricular content changed following a technology based workshop. The workshop provided pre-service teachers the opportunity to participate in a hands-on approach to multiple cross curricular instructional strategies aimed at meeting multiple learning styles and better preparing pre-service teachers as future classroom teachers. The technology workshop offered targeted instructional strategies in reading and language arts, mathematics, and science education. The researchers sought to answer the following questions:

The quantitative component of this study examined the following questions:

*Research Question 1:* "Do pre-service teachers' perceptions of integrating technology into their cross-curricular teaching methodologies change after completing a technology integration workshop?"

*Research Question 2:* "How will future teaching practices improve through exposure to technology workshops?"

The qualitative component of this study examined the following question:

*Research Question 3:* "How has this workshop impacted your future teaching practices?"

## Methodology

This mixed methods study was intended to determine if exposure to technology resources in a hands-on learning environment would alter pre-service teachers' perceptions of technology. Additionally, researchers sought to determine if future teaching practices would improve through exposure to technology workshops. The null hypothesis for this study is that there would be no significant statistical difference between each respondent's pre and post survey responses. Conversely, the alternative hypothesis for this study is that significant statistical differences would exists between each respondent's pre and post surveys. Research was conducted at a four-year university set in a rural setting. Seventeen participants were included the sample population and represented current pre-service teachers enrolled in a Teacher Education Program with an emphasis on Early Childhood Education (Pre-K-3), Elementary Education (K-6), Middle School Education (4-8), or Secondary Education (7-12).

Emails were sent to students enrolled in the researchers' courses and flyers were posted in the education building requesting voluntary participation.

Researchers created instructional unit applications utilizing Vernier LabQuest 2, EduBlog, virtual manipulations, webquests, Go Animate, Class Dojo, and other types of technology resources that will enhance cross-curricular instruction. The instructional units were delivered via workshops during the Spring 2015 semester. Seventeen pre-service teachers voluntarily enrolled in the workshops and responded to an anonymous survey, created by the researchers, during the session introduction. 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. Participants were engaged in hands-on activities and technology applications focused on science, mathematics, and English language arts. Seventeen participants were exposed to multiple technology applications using a round-robin approach. Each content module allowed participants to experience an abundance of technology resources. Some resources, such as mathematical virtual manipulatives, could only be integrated into mathematics instruction; however, the majority of the resources shared were cross-curricular and could be used to increase student engagement in multiple content areas. The workshops concluded by having participants respond again to the anonymous survey, to determine if perceptions had changed. Sixteen of the 17 participants had both pre- and post- survey data, which was analyzed to provide insight into pre-service teachers' change in perceptions of the benefits of integrating technology into their cross-curricular teaching methodologies. The authors of the study analyzed students' pre and post surveys using non-parametric statistical techniques to determine if exposure to technology resources applications would foster change in their perception. Additionally, qualitative open-ended responses were analyzed to determine if common themes existed among participants at the conclusion of the workshop.

**Workshop Tools Implemented**

**Animoto:** A web-based tool that offers users the ability to produce videos from photos. There are "stock" music choices to use, but the user can also upload personal music from music library to personalize videos. Videos can be easily shared with others and embedded into several online components (i.e. Blogs, Facebook, etc.). To create longer videos, one must purchase an annual subscription, which may be a drawback for some, but the number of videos is unlimited.

**Blogger:** A free online Web 2.0 tool where users can set up a Blogging site. Users need only a Gmail account to initiate. A blog is a personal web journal that allows people to publish their ideas, thoughts, and comments. It is interactive in that it allows visitors to comment and respond on one's blog. Blogs are time stamped and allow users to upload many visual images, videos, and other embedded links.

**Class Dojo:** A web-based tool that teachers can use for student behavior management. Class Dojo allows for teacher/parent/student communication. It is used by classroom teachers to support student self-regulation (Maclean-Blevins & Mullenburg, 2013). Macleans-Blevins and Mullenburg found that the amount of positive behaviors among students increases when class dojo is implemented.

**Edmodo:** A site that is set up for educational purposes. It allows teachers and students to reach out and connect with on another to share information. To connect with others, users must be invited (similar to social networking). Teachers invite students and other classes, but remain in control of content.

**Edublog:** One of the most popular blogs created for educational purposes. Edublog offers a secure and safe place for students to interact via blogging with one another. (Unlike Blogger, it is not publicly published).

**Emaze:** An online presentation platform with several templates from which to choose. It allows users to create a visual experience for their audience.

**Geogebra:** A "free dynamic mathematics software for all levels of education that brings together geometry, algebra, spreadsheets, graphic, statistics, and calculus in one easy-to-use package. Interactive teaching and learning resources created with GeoGebra can be shared and used by everyone at tube.geogebra.org" (International GeoGebra Institute, 2015, ¶1).

**Glogster:** An online presentation platform that provides a visual experience for an audience. It is different in that it is an interactive poster made from visual images, text, and music.

**GoAnimate:** A Web 2.0 tool, is an easy method for creating an animated video or comic. It offers students a fun way to summarize any subject by writing a script and turning it into a video (Wanago, 2013).

**Kizoa:** Like Animoto, Kizoa is a web-based tool that offers users the ability to produce videos from photos. There are "stock" music choices to use, but the user can also upload personal music from music library to personalize videos. Videos can be shared via social media and email.

**Make Beliefs Comix:** An online educational comic strip creator. It is a free Web 2.0 tool where users can choose background colors, panel choices, characters, and much more. This site offers lots of ideas for classroom use as well as printable materials.

**National Council of Teachers of Mathematics (NCTM) Illuminations:** A free online resource that provides virtual manipulatives, lesson plans, and activities for elementary and secondary mathematics teachers and students. Resources are aligned with current Common Core State Standards.

**National Library of Virtual Manipulatives:** A free online tool containing Java applets and activities for all grade levels of elementary and secondary mathematics. The activities and virtual manipulatives can be used with the aid of projector or Interactive White Board (IWB).

**Prezi:** A presentation tool that can be used as an alternative to a PowerPoint slide presentation. Prezi provides a canvas, which is used to display information. It allows the user to zoom in and bring the current information to the forefront. There are arrow keys to move from one part of the canvas to the next. When the presentation is initially opened, it looks like a large paint canvas with small pictures or text, but each comes into view as it moves through the presentation.

**Promethean Planet:** Over 60,000 free teaching resources, including lesson plans, worksheets, and free interactive resources.

**Remind:** an app that allows teachers to send reminders to students. Teachers must download the (free) app, invite students and they choose how to receive messages: email or text. No phone numbers are exchanged. It can also include parents to help improve communication.

**Shelfari**: A social media site that focuses on books. (Think of it as a Facebook for readers). It allows users to catalog their books, build virtual bookshelves, and rate, review, and discuss their books.

**Skype**: A way to have a conversation with someone over the Internet while able to see one another. It is a free software tool that needs to be downloaded. It is a great to connect classrooms with one another and many authors now offer Skype visits.

**Slideshare:** A Web 2.0 tool that offers a "space" for people to collaborate and share documents, videos, webinars, PDF's, and presentations. Interestingly, it was founded in 2006 and acquired by LinkedIn in 2012.

**Smart Exchange:** Free internet resource that provides lesson plans and resources for the SMART Board.

**SmileBox:** A Web 2.0 tool that allows users to create digital collages, slideshows, and other multimedia creations. SmileBox can be shared with others. Invitations can also be created on this site.

**Tag Galaxy**: A Web 2.0 tool that helps students explore relationships between words and ideas. It is ideal for visual learners, as well, because it provides visual images of the various words in "the galaxy." Users just need to click on any word to move it to the middle of the galaxy and by clicking it again, the globe generates images tagged through Flickr.

**Tagxedo**: A Web 2.0 tool that can turn speeches, articles, slogans, themes, character analyses, etc. into a visual word cloud in the shape of your choice. You may have heard of Wordle, which is a tool that creates word clouds in horizontal or vertical lines using uploaded terms; however, Tagxedo allows you to place your words into a shape of your choice.

**Thing Link:** A Web 2.0 tool that allows images to become interactive. It allows users to turn an image or video into a multimedia experience. This platform can make presentations come alive with video, text, images, shops, music, and much more. Provides an interesting and engaging manner by which to share and present information.

**Vernier LabQuest Analytical Units**: The LabQuest 2, a stand-alone unit interface, can be used by teachers and students to collect data from a sensor. Slightly larger than a cell phone, the LabQuest 2 is equipped with built-in graphing and analysis applications that combine integrated software for data collection and inquiry.

Christmann (2013) feels that LabQuest 2 units is an outstanding tool to engage students in scientific inquiry. He stresses that these units help motivate them towards greater science achievement.

**Voki:** A free Web 2.0 tool that is easy to use and allows users to create a character and give it a voice. Users can customize their characters, backgrounds, and speaking voice as well as language. A Voki is a sun, interactive way to present & share information and ideas.

**Zunal**: A site for creating free WebQuests. There are numerous templates from which to choose, which provides educators and students flexibility in creating a WebQuest to fit individual needs. One needs only an email account to set up a Zunal account. In addition, users will have access to WebQuests that have already been published. Zunal is also mobile friendly, so WebQuests can be accessed from smart phones.

## Data Analysis

Sixteen respondents took both the pre-survey and post-survey. Table 1 lists the characteristics of the respondents. The pre-survey contained 21 Likert scale questions, and the post-survey contained an additional 3 open-end response questions. Each of the 21 questions was assigned a Likert scale value of 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, or 5 = strongly agree. To determine if the statistical results were normally distributed, a Shapiro-Wilk analysis was conducted on all respondent's answers using SPSS statistical software (version 22). As expected with Likert scale data, the Shapiro-Wilks test yielded probability values (*p*) less than 0.05 for each question, indicating that the data was not normally distributed (Table 2). Probability (*p*) values greater than 0.05 indicate that data is normally distributed. Initially, two statistical tests were considered to test for significant differences between respondents' pre and post surveys: *t*-test and Mann Whitney-Wilcoxon. A *t*-test is used to analyze data that is normally distributed, and a Mann Whitney-Wilcoxon analysis is usually run on non-normally distributed data (de Winter & Dodou, 2012). A Shapiro-Wilk test on the data indicated that the respondents' answers were not normally distributed; therefore the use of the *t*-test was eliminated. The end result was to use the Mann-Whitney-Wilcoxon test (MWW test). The MWW test is actually two analyses, the Mann-Whitney U test and the Wilcoxon Rank Sum test. The Mann-Whitney U test is the non-parametric equivalent of the standard independent *t*-test, and is frequently used to compare data collected in an experiment involving an independent groups design. The Wilcoxon Rank Sum test is the nonparametric equivalent of the paired *t*-test, and is used for data gathered in experiments involving repeated measures and matched pairs designs. The Wilcox Rank Sum nonparametric test is used in preference to the equivalent *t*-test when data are only of ordinal level of measurement or do not meet the assumptions required for parametric tests. SSPS software automatically runs both tests together. These combined tests (Mann-Whitney-Wilcoxon) were appropriate for use in this study since the same group of participants took the same pre and post survey. Mann-Whitney-Wilcoxon has greater efficiency than the *t*-test on non-normal distributions, such as a mixture of normal distributions, and it is nearly as efficient as the *t*-test on normal distributions (Bergmann et al, 2000). Table 3 shows individual Mann-Whitney-Wilcoxon results for each pre and post survey question. *P*-values less than 0.05 indicate significant differences between respondents pre and post survey responses. The null hypothesis for this study is that there would be no significant statistical difference between each respondent's pre and post survey responses. Conversely, the alternative hypothesis for this study is that significant statistical differences would exists between each respondent's pre and post surveys. The statistical significance level ($\alpha$) was selected as $\alpha = 0.05$.

**Table 1: Respondent Descriptives**

| **Gender** | | |
|---|---|---|
| | **Response** | **Percent** |
| Male | 2 | 13 |
| Female | 14 | 88 |
| Total | 16 | 100 |
| **Age range** | | |
| | **Response** | **Percent** |
| 18-22 | 11 | 69 |
| 23-27 | 2 | 13 |
| 27-32 | 2 | 13 |
| 33+ | 1 | 6 |
| Total | 16 | 100 |
| **Major** | | |
| | **Response** | **Percent** |
| Pre K-3 | 2 | 13 |
| K-6 | 12 | 75 |
| 4-8 | 1 | 6 |
| 7-12 | 1 | 6 |
| Total | 16 | 100 |
| **Area of specialization** | | |
| | **Response** | **Percent** |
| Early Childhood | 3 | 19 |
| History | 1 | 6 |
| Mathematics | 1 | 6 |
| Special Education | 1 | 6 |
| Other | 10 | 63 |
| Total | 16 | 100 |
| **Year in college** | | |
| | **Response** | **Percent** |
| Freshman | 0 | 0 |
| Sophomore | 3 | 19 |
| Junior | 8 | 50 |
| Senior | 5 | 31 |
| Total | 16 | 100 |

**Table 2: Shapiro-Wilk Test of Normality**

| | Statistic | *df* | Sig. |
|---|---|---|---|
| I have the technical skills I need to use technology. | .852 | 30 | .001 |
| I know about technologies that I can use for understanding and doing mathematics. | .825 | 30 | .000 |
| I know about technologies that I can use for understanding and doing literacy. | .774 | 30 | .000 |
| I know about technologies that I can use for understanding and doing science. | .789 | 30 | .000 |
| I can choose technologies that enhance the teaching approaches for a lesson. | .870 | 30 | .002 |
| I can choose technologies that enhance students' learning for a lesson. | .818 | 30 | .000 |
| My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom. | .647 | 30 | .000 |
| I think critically about how to use technology in my classroom. | .822 | 30 | .000 |
| I can adapt the use of technologies that I am learning about to different teaching activities. | .818 | 30 | .000 |
| I can teach lessons that appropriately combine mathematics, technologies and teaching approaches. | .810 | 30 | .000 |
| I can teach lessons that appropriately combine literacy, technologies, and teaching approaches. | .826 | 30 | .000 |
| I can teach lessons that appropriately combine science, technologies, and teaching approaches. | .846 | 30 | .001 |
| I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn. | .799 | 30 | .000 |
| I can adapt my teaching style to different learners. | .799 | 30 | .000 |
| I can use strategies that combine content, technologies, and teaching approaches that I learned about in my coursework in my classroom. | .748 | 30 | .000 |
| I can provide leadership in helping others to coordinate the use of content, technologies, and teaching approaches at my school. | .840 | 30 | .000 |
| I can choose technologies that enhance the content for a lesson. | .818 | 30 | .000 |
| My mathematics education professors appropriately model combing content, technologies, and teaching approaches in their teaching. | .743 | 30 | .000 |
| My literacy education professors appropriately model combining content, technologies, and teaching approaches in their teaching. | .769 | 30 | .000 |
| My science education professors appropriately model combing content, technologies, and teaching approaches in their teaching. | .823 | 30 | .000 |
| My professors outside of education appropriately model combing content, technologies, and teaching approaches in their teaching. | .863 | 30 | .001 |

**Table 3: Mann-Whitney-Wilcoxon Test Statistics**

| Grouping Variable: Pre or Post Survey | Mann-Whitney *U* | Wilcoxon *W* | Sig. *p* |
|---|---|---|---|
| I have the technical skills I need to use technology. | 7.000 | 143.000 | .000 |
| I know about technologies that I can use for understanding and doing mathematics. | 33.500 | 169.500 | .000 |
| I know about technologies that I can use for understanding and doing literacy. | 26.000 | 162.000 | .000 |
| I know about technologies that I can use for understanding and doing science. | 48.000 | 184.000 | .002 |
| I can choose technologies that enhance the teaching approaches for a lesson. | 85.000 | 221.000 | .084 |
| I can choose technologies that enhance students' learning for a lesson. | 65.500 | 201.500 | .008 |
| My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom. | 101.500 | 237.500 | .245 |
| I think critically about how to use technology in my classroom. | 33.000 | 169.000 | .000 |
| I can adapt the use of technologies that I am learning about to different teaching activities. | 46.000 | 182.000 | .001 |
| I can teach lessons that appropriately combine mathematics, technologies and teaching approaches. | 33.500 | 169.000 | .000 |
| I can teach lessons that appropriately combine literacy, technologies, and teaching approaches. | 30.500 | 166.500 | .000 |
| I can teach lessons that appropriately combine science, technologies, and teaching approaches. | 23.000 | 143.000 | .000 |
| I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn. | 50.000 | 186.000 | .001 |
| I can adapt my teaching style to different learners. | 33.000 | 169.000 | .000 |
| I can use strategies that combine content, technologies, and teaching approaches that I learned about in my coursework in my classroom. | 47.000 | 183.000 | .001 |
| I can provide leadership in helping others to coordinate the use of content, technologies, and teaching approaches at my school. | 24.000 | 160.000 | .000 |
| I can choose technologies that enhance the content for a lesson. | 60.500 | 196.500 | .005 |
| My mathematics education professors appropriately model combing content, technologies, and teaching approaches in their teaching. | 60.000 | 196.000` | .005 |

| | | | |
|---|---|---|---|
| My literacy education professors appropriately model combining content, technologies, and teaching approaches in their teaching. | 106.500 | 242.500 | .367 |
| My science education professors appropriately model combing content, technologies, and teaching approaches in their teaching. | 37.000 | 173.000 | .000 |
| My professors outside of education appropriately model combing content, technologies, and teaching approaches in their teaching. | 27.000 | 163.000 | .000 |

$\alpha = 0.05$

An additional objective of this study was to determine how the workshop impacted participant's future teaching practices (research question 3). To accomplish this goal, participants were asked to respond to 3 open-ended questions on the post-survey. The 3 questions were as follows:

1. How has this workshop impacted your future teaching practices?
2. Describe your experience with cross-curricular technology exposure as a result of this workshop.
3. Provide effective cross-curricular technology practices that you plan to implement in your classroom as a result of this workshop.

The purpose of the open-ended questions was to provide greater insight into student views of technology in the classroom and present an opportunity for them to share their experience in a more in-depth manner. Results indicated that all participants found different technology applications that could be incorporated into their future classrooms (See Appendix for all responses). Additionally, 82 percent indicated a positive experience with cross-curricular technology exposure as a result of the workshop. Two participants did not respond and one response was unclear to researchers stating, "Not so much?" Responses were varied as to which practices would be implemented into participants' future classrooms; however, reasoning patterns of participants were similar, regardless of the application that was chosen. Approximately 24 percent of participants specifically mentioned using the Remind application to foster parent involvement and keep them informed of upcoming assignments and opportunities. Two primary themes emerged from the data as follows:

Theme 1: Participants noted the value of student engagement through the use of technology applications.

Theme 2: Participants were able to engage in the applications through a hands-on approach, which increased their confidence in using technology in the classroom.

## Discussion

The study sought to determine, if pre-service teachers' perceptions of integrating technology into their cross-curricular teaching methodologies change after completing a technology integration workshop. Analyses confirm that pre-service teachers perceptions do change once they have been exposed to teaching strategies that utilize technology. Of the 21 questions in the pre and post surveys, 18 showed significant statistical differences in the respondents' answers. Table 3 lists the statistical results for all survey questions. Changes in respondents' pre/post survey answers indicate that their perceptions toward the use of technology in their cross-curricular teaching methodologies evolved. Three survey questions yielded no significant statistical differences between respondents' pre and post responses. Pre-service teachers responses to the question, "I can choose technologies that enhance the teaching approaches for a lesson" ($p$ = .084) did not change significantly. Several explanations are offered; teachers routinely use some form of technology in their instructional content delivery, and pre-service teachers are required to model learning activities that incorporate technology. Teachers routinely utilize computers, smart boards, and document cameras in their instruction. Consequently, pre-service teachers feel that they can choose technologies that enhance their teaching. There were no significant statistical differences in the majority of respondents' selection in question, "My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom" in both pre and post surveys ($p$ =. 245). The third question that showed no significant change in respondents' opinion was, "My literacy education professors appropriately model combining content, technologies, and teaching approaches in their teaching ($p$ = .367). Most respondents selected "Agree" for this prompt.

Participants in the study explored technologies that they indicated were new to them such as LabQuest analytical data collecting units, Class Dojo class management software, WebQuest, virtual math manipulatives, EduBlog, Blogger, Voki, Shelfari, Scratch computer programming, and other interactive technologies. By exposing pre-service teachers to teaching technologies other than smart boards, document cameras, desktop and laptop computers, participants were given opportunities to incorporate different technologies in their content areas. As a result of exploring new technologies, participants post survey responses were significantly different from their pre-survey responses as reported in table 3. The Mann-Whitney-Wilcoxon analysis indicated significant differences in the responses, "I know about technologies that I can use for understanding and doing mathematics" ($p$ = .000); " I can teach lessons that appropriately combine mathematics, technologies and teaching approaches" ($p$ = .000); "I know about technologies that I can use for understanding and doing literacy" ($p$ = .000); "I can teach lessons that appropriately combine literacy, technologies, and teaching approaches" ($p$ = .000); "I know about technologies that I can use for understanding and doing science" ($p$ = .000); "I can teach lesson that appropriately combine science, technologies, and teaching approaches" ($p$ = .000). The workshop facilitators presented pre-service teachers with technologies that they could integrate into their cross-teaching methodologies. Language arts, science, and mathematics cross-curricular integration was the focus of the workshop.

The results of this study supports the findings of Chen (2010) that suggested that after technology integration training, pre-service teachers were more inclined to specifically integrate technology rather that simply adding it to a lesson. Having completed the workshop, participants indicated that they would not be reluctant to implement technology. Furthermore, their beliefs concerning technology did indeed evolve upon completion of the technology integration workshop. This is evidenced by significant statistical differences in the pre/post questions, "I have the technical skills I need to use technology " ($p$ = .000), "I can choose technologies that enhance students' learning for a lesson" ($p$ = .008), and "I think critically about how to use technology in my classroom" ($p$ = .000). This is consistent with the findings of similar research (Anderson, Groulx & Maninger, 2011; Cullen & Greene, 2011).

This study also sought to determine how future teaching practices would improve through exposure to technology workshops. The data analysis indicates that pre-service teachers' perceptions towards using technology evolved at the completion of the workshop based on their responses to the following questions: "I can adapt the use of technologies that I am learning about to different teaching activities" ($p$ = .001); "I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn" ($p$ = .001); "I can adapt my teaching style to different learners" ($p$ = .001); "I can use strategies that combine content, technologies, and teaching approaches that I learned about in my coursework in my classroom" ($p$ = .000); I can provide leadership in helping others to coordinate the use of content, technologies, and teaching approaches at my school" ($p$ = .000); "I can choose technologies that enhance the content for a lesson" ($p$ = .005). Since all participants were pre-service teachers, it is assumed that they will incorporate these practices when they engage in their student teaching practicum and as teacher-practitioners. As expected by the authors of this study and supported by Chen's findings (2010), pre-service teachers, when exposed to cross-curricular technology applications tend to desire to incorporate them into their future teaching methodologies. Most survey respondents indicated positively that they plan to use more technology in their future classrooms. Prior to being exposed to cross-curricular technology application in the workshop, many pre-service teachers in this study primarily associated "technology" with smart boards, document cameras, laptop computers, iPads, and calculators. As a result, many in this study originally felt that they were very knowledgeable about technology. Most, if not all of their professors, incorporate some, if not all of these technologies in their instruction. Based on survey responses, the authors have concluded that the participants perceptions of integrating technology into their cross-curricular teaching methodologies evolved to consider using many different types of technology, including hardware and software. Some participants' responses were:

"This workshop helped me to think about all of the different technologies available for my classroom. I will now make sure to consider technology as much as possible instead of always putting pen to paper."

"This workshop has allowed me to see what technology is available in other content areas that I do not normally use. Being exposed to these technologies will help me engage students in multiple ways while still covering content. Students are coming in with so much more technological knowledge that our classrooms need to evolve into more technological classrooms to accommodate their growing minds.'

"This workshop has taught me that the Internet is full of programs, websites, etc. that I can use in my future classroom. I now know that I have these resources to use when I'm trying to find ways to engage my students in different subject areas."

"This workshop has made me realize that there are so many resources available. I just have to search for them!"

"I was able to view several different technologies outlets as a result of this workshop. We weren't just told about the technology. Everything was hands-on. We navigated the websites, created our own accounts, and played with interactives and conducted experiments as a result of this workshop."

"I feel much more confident about my technology skills after attending this workshop. I am better prepared to teach a lesson using technology to further my students' comprehension of the content."

"I loved seeing technology exposure in multiple subjects and also seeing that most of the technology can be used in multiple curriculum areas."

"I intend to use the LabQuest 2 in my science lessons to keep the students actively engaged and having fun while participating in science experiments. I also plan to use the Promethean board resources in math lessons to have the students active during the lesson and not just sitting. I think that the Promethean and Smart Board software are a great use of technology in every content area.

Students love technology so why not involve it in the classroom as well? I plan to use EduBlog forreading. Students love to talk and tend to shy away from speaking up in the classroom. These students need to let their voice be heard and I believe this is a great and safe way to allow students to voice their opinions."

"I plan to try and use technology everyday in my future classroom."

Participant responses were varied as to which technology practices they planned to implement in their future classrooms. Results support the need to provide multiple technology applications so future teachers have a variety of tools that can be successfully incorporated into their classrooms. Varied technology practices, integrated throughout teacher preparation programs, allow pre service teachers to choose those resources they are most comfortable with and those which will be more valuable to their students, based on varied learning styles and student needs.

## Limitations

The primary limitation of this study was the sample population. Efforts were made to enroll a minimum of 50 participants for the technology workshop; however, various factors beyond the researchers' control limited enrollment to 17 participants. Additionally, the participants were at different levels of their teacher preparation program which may have altered their responses to survey questions. Specifically, students who were preparing for their student teaching internship may have found the tools to be of greater benefit than individuals who were only in their first year of their program. Although all participants were exposed to multiple resources, they may not have explored all technology applications, which may have altered the study outcomes. Finally, prior experiences with the instructors or with the technology applications presented may have altered participant responses on the survey instruments.

## Conclusion

Today's pre-service teachers are embarking on a journey to educate students who do not recognize a world void of computers, search engines, gaming systems, and cell phones. Educators of twenty-first century learners must embrace technology in the classroom and allow students to learn in the digital environment they are accustomed to. Instructors in higher education are tasked with preparing these future teachers to create engaging and challenging lessons in a technology-rich environment. Hands-on learning that exposes these future teachers to the abundance of technology resources available is critical to achieving this challenging task. Participant responses from this study support the value of offering a plethora of technology resources while allowing individuals to experience the various modalities of technology. Therefore, as educators in institutions of higher learning, we must challenge pre-service teachers to become confident in their technology proficiency in order to challenge today's digital learners by modeling the expectations and strategies needed to achieve this goal. It is our hope that this research will not only serve to demonstrate the need to be proactive in modeling and integrating technology into higher education classrooms to better prepare pre-service teachers, but also be used to improve teacher education programs in an effort to produce higher quality classroom teachers.

**References**

Anderson, S. E., Groulx, J. G., & Maninger, R. M. (2011). Relationships among preservice teachers' technology-related abilities, beliefs, and intentions to use technology in their future classrooms. Journal of Educational Computing Research, 45(3), 321-338. Retrieved from http://search.proquest.com/docview/964183094?accountid=29025

Ball, D. M., & Levy, Y. (2008). Emerging educational technology: Assessing the factors that influence instructors' acceptance in information systems and other classrooms. Journal of Information Systems Education, 19(4), 431-443.

Bergmann, R., Ludbrook, Will P. J. M., and Spooren (2000). "Different Outcomes of the Wilcoxon-Mann-Whitney Test from Different Statistics Packages". The American Statistician 54 (1): 72–77. doi:10.1080/00031305.2000.10474513. JSTOR 2685616.

Bracewell, R.J., Sicilia, C., Park, J., & Tung, I. (2007). The problem of wide-scale implementation of effective euse of information and communication technologies for instruction: Activity theory perspectives. Tracking adoption and nonadoption of ICT activities by teachers. Paper presented at the 2007 Annual Meeting of the American Educational Research Association (AERA), Chicago, IL.

Chandra, V., & Fisher, D. L. (2009). Student perceptions of a blended web-based learning environment. Learning Environments Research, 12, 31-44.

Chen, R. (2010). Investigating models for preservice teachers' use of technology to support student-centered learning. Computers & Education, 55(1), 32-42. doi:http://dx.doi.org/10.1016/j.compedu.2009.11.015

Christmann, E.P. (2013). LabQuest2, The Science Teacher, 80(1), 75.

de Winter, J. C. F. and Dodou, D. (2012). Five-point Likert items: t test versus Mann Whitney-Wilcoxon. Practical Assessment, Research & Evaluation, 15(11).

DiBella, K.S. & Williams, K.G. (2014). Preparing today's teachers for tomorrow's classrooms: Pre-service teachers' perceptions of technology implementation. National Social Science Technology Journal, 4(2).

Ertmer, P.A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? Educational Technology Research and Development, 53, 25-39.

Fleer, M. (2011). Technologically constructed childhoods: Moving beyond a productive to a productive and critical view of curriculum development. Australasian Journal of Early Childhood, 36(1), 16-24.

Hague, C. & Payton, S. (2010). Digital literacy across the curriculum. Bristol, UK: Futurelab.

Han, I., Eom, M., & Shin, W. (2013). Multimedia case-based learning to enhance pre-service teachers' knowledge integration for teaching with technologies. Teaching and Teacher Education, 34, 122-129.

Hargrave, C.P., & Hsu, Y. (2000). Survey of instructional technology courses for pre-service teachers. Journal of Technology and Teacher Education, 8(4), 303-314.

Hartshorne, R. & Ajjan, H. (2009). Examining student decisions to adopt Web 2.0 technologies: Theory and empirical tests. Journal of Computing in Higher Education, 21(3), 183-198.

Howe, E.B. (1998). Integrating information technology into and across the curriculum: A short course for secondary students. Knowledge Quest,26(2), 32-40.

International GeoGebra Institute. (2015). Retrieved from https://play.google.com/store/apps/ details?id=org.geogebra&hl=en

Lee, C., Shin, S., Yoo, I., & Lee, T. (2000). Model of ICT utilization curriculum for pre-service teachers. Korean Journal of Computer Education, 3(1), 87-95.

Llorens, S., Salanova, M., & Grau, R. (2002). Training to technological change. Journal of Research on Technology In Education, 35(2), 206-212.

Maclean-Blevins, A. & Mullenberg, L. (2013). Using Class Dojo to Support Student Self-regulation. In . Jan Herrington et al. (Eds.), Proceeding of World Conference on Educational Multimedia and Telecommunications 2013 (pp. 1684-1689. Chesapeake, VA: AACE.

National Assessment of Education Progress. (2009). The Nation's Report Card. Retrieved from http://nces.ed.gov/nationsreportcard/pdf/main/2009/2010458.pdf.

O'Bannon, B. & Judge, S. (2005). Implementing partnerships across the curriculum with technology. Journal of Research on Technology in Education, 37(2), 197-216.

Orehovacki, T., Bubas, G., & Konecki, M. (2009). Web 2.0 in education and potential factors of Web 2.0 use by students of information systems. ITI '09. Proceedings of the ITI 2009 31st International Conference on Information Technology Interfaces: Cavtat, Croatia.

Plowman, L. Stephen, C., & McPake, J. (2010). Supporting young children's learning with technology at home and in preschool. Research Papers in Education, 25(1), 93-113. Doi: 10.1080/02671520802584061.

Prensky, M.(2001a). Digital natives, digital immigrants part 1. On the Horizon, 9(5), 1-6.

Prensky, M.(2001b). Digital natives, digital immigrants part 2. On the Horizon, 9(6), 1-6.

Russell, M., Bebell, D., O'Dwyer, L., & O'Connor, K. (2003), Examining teacher technology use: implications for pre-service and in-service teacher preparation. Journal of Teacher Education, 54(4), 297-310.

Schmidt, D. A. et al. (2010). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers. Journal of Research on Technology in Education, 42(2), 123-149.

Serim, F. (2001). Technology across the curriculum. MultiMedia Schools, 8(6), 6-7.

Shihab, M. (2008). Web 2.0 tools improve teaching and collaboration in English language classes. Presented at the National Educational Computing Conference, 2008, San Antonion, TX, Retrieved April 20, 2010, from http: www.iste.org/Content/NavigationMenu/Research/NECC_Research_Paper_Archives/NECC2008/Shihab.pdf.

Tomel, L.A. (2003). Challenges of teaching with technology across the curriculum: Issues and solutions. Hershey, PA: Information Science Publishing.

Wanago, N. (2013). Effective web 2.0 tools for your classroom. Techniques: Connecting Education & Careers. 88(1), 18-21.

Young, J.R., Young, J.L., & Hamilton, C. (2013). The use of confidence intervals as a meta-analytic lens to summarize the effects of teacher education technology courses on pre-service teacher TPACK. Journal of Research on Technology in Education, 46,(2), 149-172.

## Appendix

Participant responses to open-ended questions to assess how the technology workshop will impact their future teaching practices

| Question 7: How has this workshop impacted your future teaching practices? | Question 8: Describe your experience with cross-curricular technology exposure / as a result of this workshop. | Question 9: Provide effective cross-curricular technology practices that you / plan to implement in your future... |
|---|---|---|
| This workshop has taught me that the internet is full of programs, websites, etc. that I can use in my future classroom. I now know that I have these resources to use when I'm trying to find ways to engage my students in different subject areas. | I was able to view SEVERAL different technology outlets as a result of this workshop. We weren't just told about the technology. Everything was hands-on. We navigated the websites, created our own accounts, and played with interactives, and conducted experiments as a result of this workshop. | I plan to use Promethean Planet to find flipbooks and simulations that I can use to present lessons to my classroom. I plan on using the Remind app to privately communicate with my students' parents/guardians. I hope to have my students understand and engage with geometry by using Geogebra. These are just a FEW of the cross-curricular technology practices that I plan to implement in my future classroom as a result of this workshop. |
| This workshop helped me to think about all of the different technologies available for my classroom. I will now make sure to consider technology as much as possible instead of always putting pen to paper. | I feel much more confident about my technology skills after attending this workshop. I am better prepared to teach a lesson using technology to further my students' comprehension of the content. | I intend to use the LabQuest 2 in my science lessons to keep the students actively engaged and having fun while participating in science experiments. I also plan to use the promethean board resources in math lessons to have the students active during the lesson and not just sitting. I think that the Promethean and Smart Board software are a great use of technology in every content area. Students love technology so why not involve it in the classroom as well? And I plan to use edublog for reading. Students love to talk and tend to shy away from speaking up in the classroom. These students need to let their voice be heard and I believe this is a great and safe way to allow students to voice their opinions. |

| | | |
|---|---|---|
| This workshop has allowed me to see what all technology is available in other content areas that I do not normally use. Being exposed to these technologies will help me engage students in multiple ways while still covering content. Students are coming in with so much more technological knowledge, that our classrooms need to evolve into more technological classrooms to accommodate their growing minds. | I feel much better about incorporating technology into my classroom. I knew some of the technology that was covered during the workshop, but several websites I had little knowledge of or knew nothing about that would be awesome to bring in to the classroom. | Incorporating Proquest into science lessons will allow a new approach to science experiments. The virtual manipulatives would allow many students to grasp math concepts that are in other words difficult for students grasp. Using the Remind app would allow me to contact parents quick and effectively without giving out information they do not necessarily need. |
| I will be able to use many different types of technology within the class room. Tech. Integration is very important for students. | It was all very informational. There are many instances where multiple curriculars can be covered using the same type of technology. | I will be taking history and geography and cross it with both technology and teaching approaches. Tech. will be used to help teach the curriculum. |
| I have had the opportunity to learn about items that are out there for teachers. By learning about these new technological items, I can bring these into my classroom to help gives a different view, rather than the working on a worksheet. | I feel like a have a better understanding of some of the technology that is out there for teachers to take advantage of. | Once I have time to sit down and work through and play around with all of the links and websites that we were given today, I believe that I will try my hardest to incorporate as many of these tools as I can. |
| By giving me resources that will allow me to incorporate technology into the classroom | No response | No response |
| I have received a lot of very good resources to use in my classroom and as a teacher. | I have a better understanding of how to use technology in subject specific areas as well as overall in my teaching career. | I plan to implement remind, some of the presentation software, and some of the manipulatives and lessons websites. |
| It has given me lots of resources to use in my future classroom. | I feel more confident using technology now. | I plan to try and use technology every day in my future classroom. |
| I have lots of great resources I can now use, thanks to you all!! | I feel more comfortable and more educated on how to implement technology into my future classroom. | promethean board, lesson plans, visual aids |
| I have a major list of resources that I could use in my classroom in many grade levels and many subjects. | I loved seeing technology exposure in multiple subjects and also seeing that most of the technology can be used in multiple curriculum areas. | promethean planet, voki, tagxedo, taggalaxy, remind, make belief comix, edublog, and much more! |
| It has opened some doors for using technologies | Not so much? | Definitely going to try to do that. |
| This workshop has given me a lot of resource to help when I get my own classroom. | I didn't know that so many resources were out there. I really enjoyed having a variety of website to choose from. | No responses |
| This workshop has made me realize that there are so many resources available. I just have to search for them! | I am excited about using technology in my classroom. I have always wanted make learning fun for my students, and I believe that technology will aid in that process. | I will definitely be using the NCTM illuminations in my class because after my math courses I have realized that I struggle with explaining. Hopefully, the visual aids will assist in my instruction so that it is more clear. I also plan on incorporating many of the literacy resources for writing. I want my students to have fun with literature, not see it as a difficult task. |
| This workshop has definitely changed my outlook on teaching with technology. It has showed me that there are many different types of technology to assist teaching and many different methods. | I feel comfortable using technology in any subject I will have to teach in the future. | I will use the Promethean and Smart boards. I will use most all of the websites and links given throughout each of the subjects taught today. |
| It has showed me quite a few different ways to use technology in the classroom. | I am not much on technology in the classroom, but this workshop has opened my mind to integrate it in the classroom. | I really liked looking at the Emaze program because it is a lot like the Prezi. I also love the NCTM Illuminations website. |
| I feel like I just gained some very important resources that I can incorporate into my lesson plans. | | |