e-Books to Support Preservice Science Teacher Development

Patricia Waters
Saint Joseph's College of Maine

This study used mixed methods to understand the role of e-books in developing preservice science teachers' digital literacy (DL) and technological, pedagogical, and content knowledge (TPACK). Undergraduates created e-books to review science content and to prepare for Praxis. A pre- and post-survey was used to understand the role of e-books in developing DL and TPACK. A focus group was conducted to understand participant experience and to develop a preliminary coding scheme for preservice teacher e-books and reflections. Results from this study highlight the need for educational technology to become an intentional part of teacher preparation programs.

Keywords: teacher preparation, educational technology, digital literacy, pedagogical knowledge, content knowledge, TPACK

INTRODUCTION

Technology is increasingly being used as a tool to support teaching and learning. It is seen not only as a goal of education to prepare digitally literate citizens, but as a tool for addressing the needs of an increasingly diverse student population. Today's students, viewed as 'digital natives', are learning differently. Ng (2012) proposed a digital literacy model to clarify the competencies possessed by digital natives. In response, teacher preparation programs must prepare teachers to effectively use technology to promote teaching and learning and create digital classrooms. Efe (2011) observed that teacher training programs play a fundamental role in the development of future teachers' knowledge and skills to effectively integrate technology into educational contexts. Koehler and Mishra (2009) developed the TPACK framework to understand the technology, pedagogy, and content knowledge needed to teach in a digital era. This study seeks to understand the role of e-books in developing pre-service teachers' digital literacy (DL) and technological, pedagogical, and content knowledge (TPACK).

THEORETICAL FRAMEWORK

High quality teachers use two domains content knowledge and pedagogical knowledge to promote meaningful learning. Shulman (1987) added an additional dimension, pedagogical content knowledge to describe the integration of the two needed to promote meaningful learning. The proliferation of technology use has resulted in a third, technological, domain. Equally important are the interactions between and among domains known as PCK, TCK, TPK, and TPACK. PCK is understanding of how pedagogy and content can be used to address needs of diverse learners (Shulman, 1987). TCK is understanding of how content dictates appropriate technology use, TPK how use of technology impacts

teaching and learning. TPACK can be defined as combined knowledge that a teacher should have regarding the use of pedagogical and technological knowledge together in teaching a certain content area effectively (Koehler & Mishra, 2009).

According to Prensky (2001) digital natives are surrounded by technologies and actively use technology to access, create, and share information via online platforms. Digital natives not only have different patterns of thinking, but they process information in different ways, some of which are not known to teachers. Ng (2012) proposed a digital literacy model to clarify the competencies possessed by digital natives. These include technical knowledge needed to use technology for daily life activities, the cognitive skills needed to ethically process digital information, and socioemotional skills involved in navigating digital activities. Therefore digital literacy skills are a possible predictor of TPACK competencies.

METHODS

This study used mixed methods to understand preservice teachers' perception about completing an e-book and opinions about the value of e-books for increasing DL and TPACK. Undergraduates enrolled in NS 100 Science for Elementary Education create a digital book to review course content. The book serves as a comprehensive content review of the course and a preparation tool of Praxis 2 test. The digital book must include specific concepts and vocabulary for each of the three essential science areas (Life, Earth and Space, and Physical), utilize technology, and be formally presented to the instructor and peers. In doing so, pre-service teachers develop DL and TPACK.

DATA

Data for this study came from three complimentary sources. First, a survey was administered at the beginning and end of the course. The survey consisted of questions to be answered using a likert-scale and will assess knowledge in the following areas; 1) technology, 2) content, 3) pedagogy, 4) pedagogical content, 5) technological content, 6) technological pedagogical, and 7) technological pedagogy and content. Near the end of the course, a focus group was held to further understand preservice teachers' opinions about the value of e-books. Questions for the focus group were similar, but more in depth discussion of students' responses will be encouraged. During the focus group, students were also asked to reflect on instances when faculty, cooperating teachers, peers and/or themselves have modeled combining content, technologies and teaching approaches in a classroom lesson. Additional data came from student e-books and reflections. All participants received an implied consent form prior to participating and assured their confidentiality would be respected and that information would be reported with anonymity.

RESULTS

To understand the role of e-books in developing pre-service teachers' DL and TPACK, the research questions guiding this study are:

- What are pre-service teachers' perceptions of creating an e-book?
- What is the impact of creating an e-book on pre-service teachers' development of DL?
- What is the impact of creating an e-book on pre-service teachers' development of TPACK?

The Survey of Preservice Teachers' Knowledge of Teaching and Technology (Schmidt, D. Baran, E., Thompson, A., Koehler, M., Mishra, P., Shin, T., 2009) was used to understand the the impact of creating an e-book on pre-service teachers' development of DL and TPACK. The survey contained 28 items for measuring preservice teachers' self-assessments of the seven TPACK domains: 6 TK items, 3 CK items, 7 PK items, 1 PCK item, 1 TCK item, 9 TPK items, and 1 TPACK item. For these items, participants answered each question using a five-point Likert scale. Each item is scored with a value 1-5 and the items in each category are averaged to produce a single score in each domain.

The survey was administered to undergraduates enrolled in NS 100 Science for Elementary Education before and after completing the digital book assignment. Seventeen students completed the survey; 4 males, 13 females. Ten participants were freshman, six were sophomores, and one was a transfer student. Thirteen participants were elementary education majors, three were special education majors, and one was undeclared. Results of the survey are summarized in table 1.

TABLE 1
SURVEY RESULTS

	TK	CK	PK	PCK	TCK	TPK	TPACK
Pre	3.27	3.12	3.09	2.63	2.63	3.42	2.75
Post	3.83	3.55	3.82	3.53	3.88	3.85	3.71
Change	.56	.43	.73	.9	1.25	.43	.96

There was positive change across all seven TPACK domains with the greatest change being in Technological Content Knowledge (1.25), Technology Pedagogy and Content Knowledge (.96), and Pedagogical Content Knowledge (.9). Students self-ratings on the pre-survey were lower in these domains and consequently there was greatest room for growth.

Males possessed reported higher content knowledge (4.34) and technological content knowledge (4) in the pre-survey than compared to females (3.3/3.6). Sophomore-level students reported higher Technological Pedagogical Content Knowledge (4.3) than compared to freshman-level students (3.97). There was no difference across majors.

The post-survey included five additional open-ended questions about likes, dislikes, and impact of the e-Book on preservice teachers' science content knowledge, teaching, and understanding of technology. Responses were coded using the TPACK domains.

In response to, "what did you like about the digital book project," six responses were consistent with the technological domain. One student responded, "combine rich media into the project, freedom in deciding the layout and style of my book." Five responses were consistent with the Technological Pedagogical domain; "we got to put our own teaching style out there, but also learned a lot from it." Four responses related to the content domain; "reviewed what I learned throughout the semester." One response related to the pedagogical domain, "that I will actually use this book most likely." One response related to the logistics of the assignment, "that it was spread out throughout the semester."

In response to, "what would you change about the digital book project," the majority of responses related to technical aspects of the book with ten students commenting on the audio required for the book and one student commenting on the particular book creator tool. Additional comments related to the amount of content in the book, the time it took to create the book, and one student expressed the desire to create a physical book.

In response to, "how did the digital book project impact your science content knowledge," the majority of comments (13) pertained to value of the e-book in reinforcing content covered in the class. However, four responses highlighted the assignment's role in developing preservice teachers' pedagogical content knowledge

> "It helped me understand things that I didn't know because it allowed me to write things in a way that younger kids would be able to understand."

> "It improved my knowledge on science content from learning new facts and taking that information for the future of teaching."

"It helped me really understand how I can teach certain content."

"It definitely improved my knowledge because I had to create activities and content related to what we learned."

In response to, "how did the digital book project impact your teaching," the majority of responses related to the pedagogical domain. Nine students indicated the project helped them "create activities for instruction" while two students indicated the project helped them plan developmentally-appropriate instruction, "It made me careful and aware of grade level vocab and topics to teach." Two additional comments related to the technological pedagogical domain, "It allowed me to learn to use technology in teaching my students."

In response to, "how did the digital book project impact your understanding of technology," five students reported an increase while two students reported no change. Five comments indicated the project engaged students in problem solving, "It improved my knowledge of how to use iBooks Author, as well as how to solve technology problems on my own." Two students commented on the impact of the project on their approach to teaching, "it helped me learn to teach using technology." A final comment, "it was a lot of work but all the hard work I put in made me prouder of the final result," was coded as self-competence.

Near the end of the semester a focus group was held to further understand pre-service teachers perception of the value of e-books. Eight individuals participated in the focus group; two males and six females. Five participants were freshman and three were sophomores, five were elementary education majors and three were special education majors. Participants were asked what they liked about the project, what they would change, and what they learned. Responses were similar to the survey. Participants liked the creative freedom associated with the book as a way to demonstrate their content knowledge, and disliked the technical aspects of the book. Participants readily identified learning about technology and content, but had to be prompted to reflect on the impact of the project on teaching. Creating a book that appealed to "all the ways kids learn" was viewed as an unintentional benefit of the project.

CONCLUSION

Results from this study suggest that e-Books are an effective way to increase pre-service teachers' content, pedagogical, and technological knowledge while also supporting the TPACK framework for understanding the interconnectedness of these domains. On the survey in which questions were categorized, pre-service teachers showed positive change across all seven TPACK domains. In the focus group, when the questions were open ended, pre-service teachers described mainly the technological and content domains. This may be due in part, to the fact that participants were freshman and sophomores with minimal teaching experience.

In the post-survey, pre-service teachers likewise commented on the value of the project on their science content knowledge, teaching, and understanding of technology. Pre-service teachers saw as embedded within their content knowledge the ability to apply project ideas to their teaching (PCK). When asked to reflect on their teaching, pre-service teachers reported the ability to plan developmentally appropriate activities (PK) while also being able to use technology as a tool for instruction (TPK). In addition to directly impacting their ability to use technology, the project also engaged teachers in problem solving leading to increased self-competence.

This study contributes to best practices for integrating technology into pre-service teacher education. First, this study contributes to the literature on e-books and their role in DL and TPACK development among pre-service teachers. It also identified correlations between preservice teachers' educational technology experience, their intention to use educational technology, their intention to have students use educational technology, and the perceived value of educational technology for learning science. Positive

experience with educational technology may help preservice teachers develop confidence which in turn elevates its perceived value and increases the likelihood of effectively integrating educational technology into instruction. Previous research (Galanouli & McNair, 2001) suggests it is more difficult for experienced teachers to adapt to the use of educational technology in their classrooms. Therefore, it is essential to incorporate educational technology into teacher preparation programs.

REFERENCES

Efe, R. (2011). Science student teachers and educational technology: Experience, intentions, and value. *Educational Technology & Society*, 14(1), 228-240.

Galanouli, D., & McNair, V. (2001). Students' perceptions of ICT-related support in teaching placements. *Journal of Computer Assisted Learning*, 17, 396-408.

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, 9(1), 60-70.

Ng, W. (2012). *Empowering scientific literacy through digital literacy and multiliteracies*. New York: Nova Science Publishers.

Prensky, M. (2001). Digital natives, digital Immigrants part 1. *On the Horizon*, 9(5), 1–6.

Schmidt, D. A., Baran, E., Thompson A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009-10). 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.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1-22.