Using TPCK with digital storytelling to investigate contemporary issues in educational technology

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Abstract

Digital storytelling is recognized as a motivating instructional approach that engages students in critical thinking and reflective learning. Technology tools that support digital storytelling are readily available and much easier to use today than they were in years past. The convergence of these factors has facilitated the inclusion of digital storytelling in pre-service educational technology courses. Some researchers have expressed concern over the tendency to approach technology instruction with an emphasis on learning to use the technology tool itself over careful consideration of the educational value of the tool, speculating that such approaches are unlikely to result in powerful uses of technology in schools. Mishra and Koehler (2006) proposed a conceptual framework that examines the complex relationships between content, technology and pedagogy. With emphasis on the development of Technological Pedagogical Content Knowledge (TPCK), the model reframes the approach to educational technology courses for pre-service teachers. This case study illustrates the application of the TPCK conceptual framework to a digital storytelling project in an undergraduate teacher education course.

Keywords: digital storytelling, educational technology, Technological Pedagogical Content Knowledge, TPCK

INTRODUCTION

The 2011 annual Horizon Report (Johnson, Adams, & Haywood, 2011) identified inadequate digital media literacy training for in-service and pre-service teachers as among the top five challenges facing K-12 education, positing that "digital literacy is less about tools and more about thinking" and concluding that "skills and standards based on tools have proven to be somewhat ephemeral" (p. 5). While most teacher education programs include at least one course in instructional technology, the challenge of adequately covering technology applications, pedagogies appropriate to the use of those technologies, and social/ethical issues associated with the use of technology in K-12 school environments remains daunting. Exploring opportunities to connect these three critical areas is imperative. This paper will discuss the pedagogical use of digital storytelling to engage pre-service teachers in deeper understanding of contemporary issues related to the integration of technology in schools.

The emergence of Web 2.0 tools transformed the Web from a read-only medium to one in which anyone can publish, share content, and collaborate (Solomon & Schrum, 2007). Today's K-12 students expect to be able to use these tools to interact, compose and remix (Prensky, 2010). To prepare tomorrow's teachers to work with these "digital natives," undergraduate teacher education programs often include application training as part of their curricula. In addition to learning how to create digital stories, pre-service teachers may learn to create podcasts, websites, wikis and blogs. However, the learning focus is often on the tool itself rather than on the potential of the tool to stimulate inquiry, knowledge construction, critical thinking, or reflection. Robin (2008) noted that advocates of instructional technologies in schools have been urging policy makers for some time to "change the focus from the technology itself to ways that technology can be used to bring out the very best in how teachers teacher and how students learn." It can be argued that pre-service educational technology courses should place less emphasis on the technology applications themselves and more emphasis on instructional strategies that are supported and enhanced through the use of those technologies (Pitler, Hubbell, Kuhn &Malenoski, 2007).

Mishra and Koehler (2006) proposed a framework that challenges the "tendency to only look at the technology and not how it is used" prevalent in pre-service teacher education (p. 1018). With roots in earlier work by Shulman (1986), Mishra and Koehler's Technological Pedagogical Content Knowledge (TPCK) framework focuses on the "connections, interactions, affordances, and constraints between and among content, pedagogy, and technology" (p. 1025). While each aspect of knowledge—content, pedagogy, and technology—might be an area of isolated study, the authors contended that the intersection of all three areas represents the real work of effective teaching with technology. To illuminate TPCK in the context of teacher education, the authors cited three examples—two of which involved graduate students and one that described professional development for faculty. Elements of the first student example, "Making Movies," have been incorporated into the design of a digital storytelling project for undergraduate students in this case study. Figure 1 (Appendix) illustrates the TPCK model.

DIGITAL STORYTELLING

Storytelling is an ancient art that precedes modern technology and historical recordkeeping. Reliance on stories and storytelling is woven into the fabric of everyday life. People use stories to communicate and share information. In formal settings—such as schools

and workplaces—stories are used to convey meaning and provide context. It is through stories that humans understand history, themselves and the world. Robin (2011) defined digital storytelling simply as the "practice of using computer-based tools to tell stories." Digital stories generally include multiple forms of media: images and/or video, music, text and narration. As a vehicle for expression, digital storytelling is highly motivating to both K-12 and post-secondary learners (Gregory & Steelman, 2008; Sadik, 2008). Learner motivation and engagement notwithstanding, there is a compelling argument to be made for the efficacy of digital storytelling as an instructional strategy. Much has been written about the power of digital storytelling to encourage reflection (Jenkins & Lonsdale, 2007; Genereux & Thompson, 2008; Sandars & Murray, 2009), improve reading and writing (Gregory &Steelman; Kajder, 2004; Sylvester & Greenidge, 2010), increase understanding of content (Sadik, 2008), facilitate critical thinking (Borneman & Gibson, 2011) and help learners to construct meaning (Rossiter & Garcia, 2010).

Knowledge of content

Mishra and Koehler define content as "the actual subject matter that is to be learned and taught" (p. 1025). It goes without saying that teachers who do not have a firm grasp of content in their area of teaching may cause damage to their students that is difficult to reverse. The Internet can be a substantial resource for content knowledge if care is taken to evaluate the reliability of sources (Gregory & Steelman). Quality resources—both informational and pedagogical—are increasingly available to educators. Sites such as Discovery Education Curiosity in the Classroom (http://curiosityintheclassroom.com/) and PBS Learning Media (http://www.pbslearningmedia.org/) provide accurate and compelling content across all disciplines. Resources for curriculum development and lesson design, such as Thinkfinity (http://www.thinkfinity.org), Teaching Channel (http://www.teachingchannel.org/) and Curriki (http://www.curriki.org/) allow pre-service teachers access to a professional community of content mentors.

Knowledge of pedagogy

Pedagogical knowledge is defined by Mishra and Koehler as the "process and practice or methods of teaching and learning" (p. 1025). Teachers with deep pedagogical knowledge apply theories of social and cognitive development to instructional design and learner assessment. In an age of high-stakes testing and overstuffed curricula, teachers can ill afford to select any instructional activity solely because students will enjoy it. Likewise, there should be a clear and compelling pedagogical case for selecting digital storytelling as a means of accomplishing learning goals. Digital storytelling is widely recognized as a medium appropriate for elementary, middle and secondary students (Cennamo, Ross & Ertmer, 2010; Pitler, et al, 2007; Porter, 2005). During the planning phase of instruction, teachers must ask, "How will students' skills and understandings be strengthened through the use of digital storytelling?" For tasks that require students to analyze, evaluate or synthesize material, digital storytelling is a good fit. Through the process of researching and organizing information, selecting images and or/capturing video, choosing music and creating a narrative script, students have opportunities for deep mastery of the material they are learning.

Knowledge of technology

In the TPCK framework, Mishra and Koehler defined technology inclusively—ranging from technologies that are commonplace, such pencils and chalkboards, to those that require application training, such as software programs and Internet tools (p. 1023). Teachers and their students must have technology knowledge—a functional understanding of computer hardware, software and operating systems—to use computer applications competently in a learning environment. As a result, educational technology courses and workshops commonly focus on computer literacy—helping teachers to acquire the skills they need to use software applications and Internet tools. Acquiring these skills, however, is not an end in itself, but a means to an end. Teachers must also have an understanding of how these technologies change content instruction by providing opportunities for learning that would not otherwise exist. Such understanding is labeled "technological content knowledge" in the TPCK framework.

The availability of free authoring tools and the ability to publish on the web have opened new possibilities for learners and their teachers (Czarnecki 2009). There are more similarities than differences between software applications that allow novice users to produce digital stories. For instance, in tools such as Photo Story, Movie Maker, iMovie and Animoto, users begin by uploading images or video clips into a storyboard where they can be edited and reordered. Each of these programs prompts users through a process of selecting or recording audio and incorporating music tracks. All of the programs allow users to work with transitions and special effects to create the mood they are seeking. In short, familiarity with one program is likely to result in a set of skills that are transferrable to other, similar programs. Therefore, it is important to share the program commonalities with pre-service teachers and to allow platform/product choice during production. Exploring a range of tools that exist for a learning task and discussing how to choose the right tool can help pre-service teachers to develop technological content knowledge. Because technologies evolve, Mishra and Koehler also stress the importance of cultivating a willingness to learn and adapt.

Technological pedagogical content knowledge

At the intersection of content, pedagogy and technology is technological pedagogical content knowledge, but this form of knowledge is greater than the sum of its parts. While it is helpful to look at each area separately, it must be noted that the convergence of all three areas represents the work of master teachers, well-versed in both content and pedagogy associated with their disciplines and technology applications that support learning in that discipline . TPCK requires the development of "a nuanced understanding of the complex relationships between technology, content and pedagogy, and [the use of] this understanding to develop appropriate, context-specific strategies and representations" (Mishra &Koehler, p. 1029). For that reason, the TPCK framework calls into question teacher education practices that separate content, pedagogy and technology. Coursework that focuses on generic technology applications, separated from the context in which those applications might be useful learning tools, is unlikely to produce teachers who are agile users of technology for pedagogy. While no single assignment in an educational technology course can adequately address the multifaceted needs of the pre-service teacher, measures can be taken to place technology instruction in the context of good teaching practice. Mishra and Koehler (p. 1035) identified a "learning-technology-by-design" approach – characterized by a decrease in lecturing and an increase in "learning by doing"—that shows

promise for engaging learners in genuine inquiry. The example in the following section is offered as an illustration of how this approach has been used with undergraduate pre-service teachers.

TPCK APPLIED TO UNDERGRADUATE TEACHER EDUCATION

In two sections of an undergraduate course in instructional technology (n=39), pre-service teachers explored the concept of digital storytelling as pedagogy, considered examples of the approach in their grade-level/content areas, and produced their own digital stories in the form of short documentaries on topics related to the implementation of technology in K-12 schools. Students in these classes met formally once a week for two hours. While many other topics were covered over the course of the 16-week semester, digital storytelling was the focus of three class sessions.

Session One

Students were introduced to digital storytelling through examples of stories created by elementary and secondary students and representing science, social studies, and language arts content areas. Following this experience, they were asked three questions, which were discussed first in small group "learning teams" of four to five students, and afterward, as a whole group:

1. In what ways are students learning through the process of designing, creating, and sharing digital stories? (Connect these insights to what you know about Bloom's Taxonomy and Depth of Knowledge.)
2. What evidence of learning do you see in students' finished products?
3. How might you apply this instructional approach to teaching in your grade-level/content area?

The next segment of instruction during the first class meeting involved looking at examples of digital stories produced by undergraduate students in the previous semester of the same course. These examples were introduced as short documentaries on topics pertinent to the implementation of technology in schools. Students were asked to consider the following questions as they viewed each documentary:

1. What is the purpose of the story?
2. How do images, music, narration and text contribute to the central message in the story?
3. Is the documentary an effective communication of the message? If so, what elements contribute most to its effectiveness?

Once again, students discussed the questions in their learning teams before offering their insights to the larger group. However, with the second set of questions, each small group focused on one documentary example of its choosing.

During the last segment of the class period, students were provided with a list of potential topics to research for their own digital story products. These topics included K-12 global learning projects, the use of cell phones as instructional tools, Internet safety and cyber-bullying. Students were also encouraged to investigate topics of their own choosing related to the use of technology in schools. Seven students (18%) choose topics other than those suggested by the instructor. These topics included digital footprints, "sexting," and the use of social media tools—such as Twitter and Facebook—to extend classroom learning. Resources to get students

started in their investigations were posted in folders in the Blackboard (online) learning environment created for the course. The rubric that would be used to evaluate students' finished work was presented and discussed in class (Figure 2).

At the end of the first class period, students were instructed to research their chosen topics and to prepare a digital story script prior to the next class meeting. They were also asked to locate and save the media (photos, graphics, and music) they would need to begin working on the story production. A Digital Story Planning Guide (figure 3) was provided to assist students in thinking about purpose, audience and mood, as well as to help them consider how to best sequence the information in their stories. Since citations for information sources, image sources and music tracks were required, students were asked to document that information, as well. In the final product, students were permitted to use music that they had created (original recordings or music composed with the synthesizer built into Photo Story 3) or music that was retrieved from creative commons websites (http://creativecommons.org/legalmusicforvideos).

Session Two

The second class session began with an overview of digital storytelling applications. Because students were working in a Windows computer lab, emphasis was placed on Windows Photo Story 3 and Windows Movie Maker. However, the two students who brought MacBook computers to class were invited to explore iMovie web resources and use iMovie to prepare their digital stories. Students were given quick reference guides for Photo Story 3 and Windows Movie Maker. The process for uploading, arranging, and editing images in the movie project was demonstrated on an interactive white board at the front of the classroom. The processes for adding text, recording narration, editing the motion and duration of frames, selecting transitions, and adding music were likewise demonstrated. Students worked on their projects during the demonstration segment and then used the remaining 40 minutes to continue working. During this time, the instructor assisted small groups and individuals.

Session Three

Students were given two weeks to complete their digital story documentaries. In the interim session, a portion of class time (approximately 15 minutes) was allotted for peer review using the evaluation rubric. Optional lab time was provided for students who wanted to work on their projects with assistance. Students submitted their final stories for evaluation by posting them to their individual professional websites and supplying the url to the instructor via Blackboard. Three weeks after the introduction of the assignment (and prior to instructor evaluation), students presented their final digital stories to their peers. Learning teams met first to view and discuss their documentaries. Each learning team selected one story to be presented to the whole group. Although the treatment of some topics—namely Internet safety and cyber bullying—was sobering, the atmosphere during session three was celebratory. Viewing digital stories on the "big screen" elevated the work from an assignment to a creative production. Each interpretation of topic contained unique elements. Through the sharing of perspectives on contemporary issues in educational technology, students were able to deepen their understanding of a range of topics. Through the production of their own stories, students were able to connect the topics they researched to their own life experiences and to their future roles as educators.

Lessons learned

The approach to digital storytelling described in this paper evolved over the course of three semesters and continues to evolve. Throughout that timeframe, several areas emerged as relevant to the implementation of digital storytelling as pedagogy. These insights are shared as a basis for ongoing research and dialogue around the most effective approaches to pre-service teacher education.

1. Reflection was an elemental component of learning to apply the new technology. In learning to use digital storytelling, it was important for students to think about, talk about, and write about their experiences as learners. It was equally important for them to consider the learning value of digital storytelling for students they would teach in the future. The online discussion board in Blackboard offered an ideal environment for extending personal reflection into classroom dialogue.
2. Self-assessment and peer review strengthened the quality of students' final products. An additional benefit to incorporating self and peer assessment was the opportunity to extend pre-service teachers' experience with rubric evaluation tools. The use of rubrics in this project was foundational in the design of students' own rubrics for WebQuests later in the semester.
3. The Digital Storytelling Planning Map (Figure 3) helped to emphasize the importance of well-researched content over technical mastery of the software. It also provided structure for the creative thinking process by helping students to organize ideas and media for their stories.
4. In an early iteration of the digital storytelling project, students were taught to use digital storytelling in one class period and then asked to gather media and produce their stories as out-of-class assignments. The results were unsatisfactory. Students struggled to apply what they had practiced in class and this frustration led to a focus on the technology tool rather than on learning about the issue they had chosen to research. A better approach, as described in this study, was to ask students to bring the raw material (planning map, narrative script, photos and/or videos, and music) to class and to focus an entire lab period on story production.
5. Students needed explicit instruction on the legal use of digital media. This was especially important because their final products were published on websites.
6. Requiring students to publish their finished projects on professional web pages increased their investment in the finished project. More importantly, it provided an opportunity for the participants to contribute to the larger educational community. This component of the assignment served to underscore one of key themes in the course: Authentic work—that which has real-world value beyond its completion for a course grade—results in greater commitment to quality and greater probability that the learning that will last beyond the tenure of the course.

CONCLUSION

Statistics suggesting that the cost of educational technology cannot be justified in K-12 schools continue to make local and national newspaper headlines. Of particular interest is the question of whether or not instructional technology improves students' performance on the high stakes achievement tests required by No Child Left Behind. However, many would say that the

benefits using technology for creative, inquiry-based work are not measured by these tests. Initiatives such as the Partnership for 21st Century Learning and the Common Core State Standards clearly insist that technology tools are key to critical thinking, problem-solving, creativity and innovation—important skills for success beyond high school. Continued research is needed to understand how successful teachers bring together their knowledge of content, pedagogy and technology to design appropriate and effective instruction for their students. Further research is also needed to examine the relationship between pre-service teacher preparation and technology integration in later years. With this research, a more concrete picture of how to best design technology experiences within teacher education programs may emerge.

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APPENDIX

Figure 1: Pedagogical Technological Content Knowledge (Mishra & Koehler, 2006)

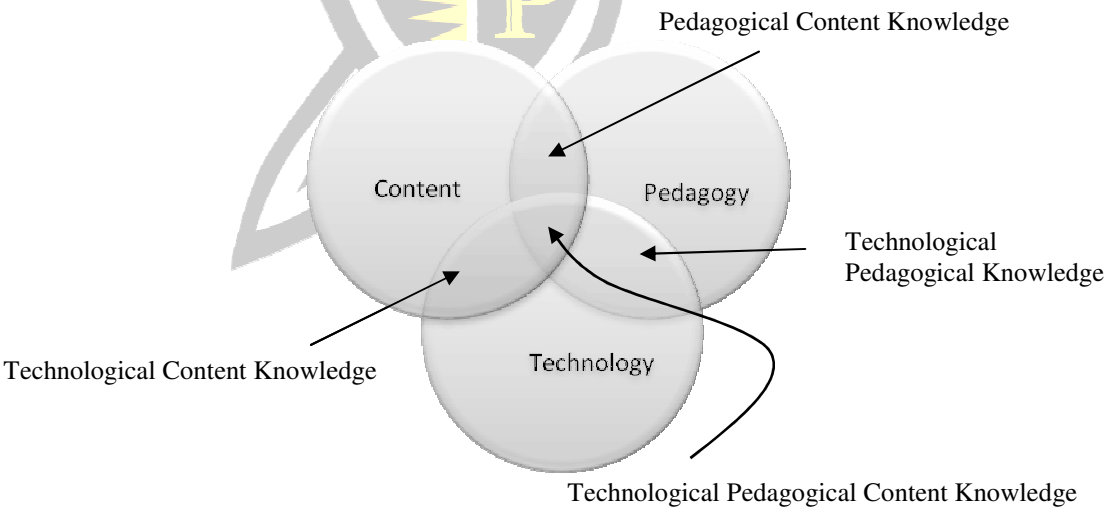
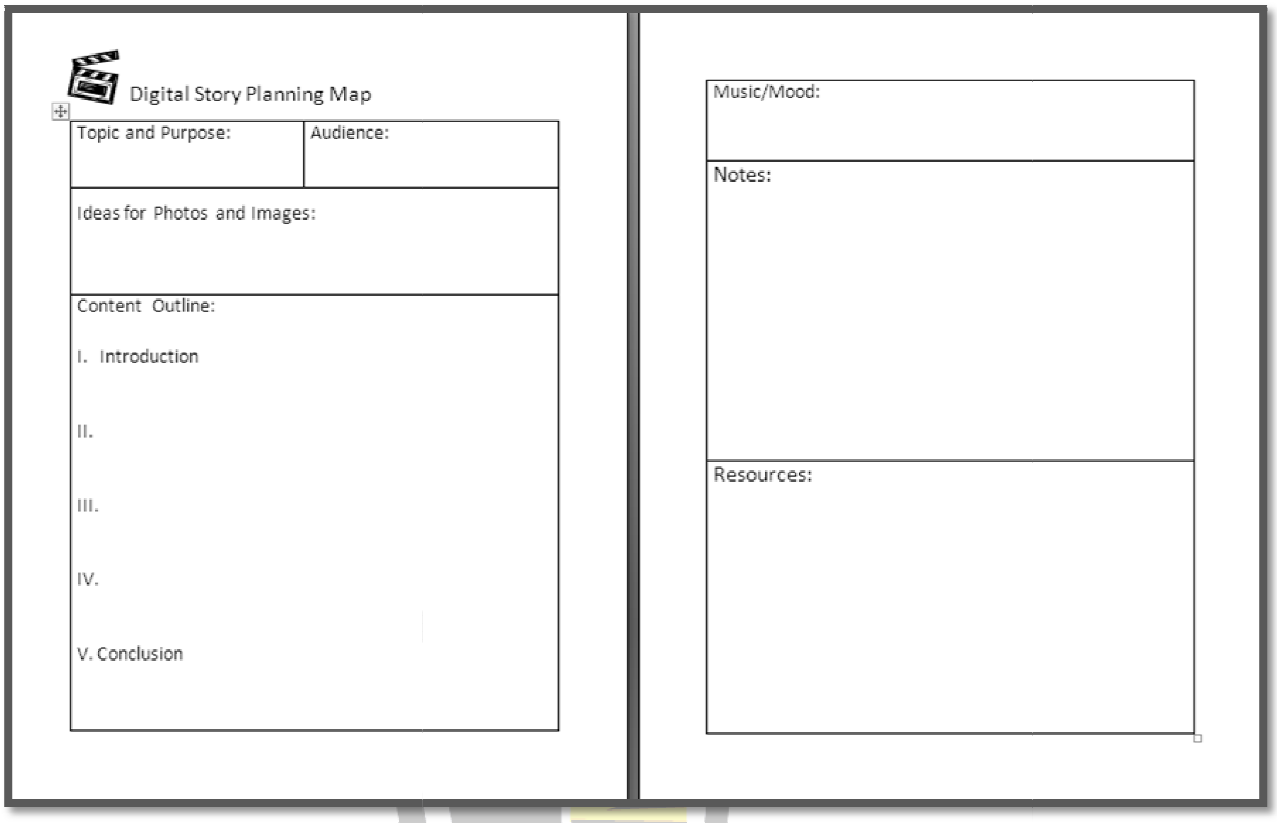


Figure 2: Digital Storytelling Rubric

CATEGORY	4	3	2	1
Purpose	Establishes a clear purpose early on and maintains a clear focus throughout.	Establishes a purpose early on and maintains focus for most of the presentation.	There are a few lapses in focus, but the purpose is fairly clear.	It is difficult to figure out the purpose of the presentation.
Awareness of Audience	Strong awareness of audience in the design. Students can clearly explain why they felt the vocabulary, audio and graphics chosen fit	Some awareness of audience in the design. Students can partially explain why they felt the vocabulary, audio and	Some awareness of audience in the design. Students find it difficult to explain how the vocabulary, audio and	Limited awareness of the needs and interests of the target audience.
Musical Selection	Music stirs a rich emotional response that matches the story line well.	Music stirs a rich emotional response that somewhat matches the story line.	Music is not distracting, but it does not add much to the story.	Music is distracting, inappropriate, OR was not used.
Image Selection	Images create a distinct atmosphere or mood that matches different parts of the story. The images communicate through symbolism and/or metaphors.	Images create a mood in some parts of the story. A few of the images communicate symbolism and/or metaphors.	An attempt was made to use images to create an atmosphere/mood this area needed more work. Image choice is logical.	Little or no attempt to use images to create an appropriate atmosphere/tone.
Narration	Voice quality is clear and consistently audible throughout the presentation.	Voice quality is clear and consistently audible throughout the majority (85-95%) of the presentation.	Voice quality is clear and consistently audible through some (70-84%)of the presentation.	Voice quality needs more attention.
Accuracy and Detail	The story is told in a meaningful way -- with exactly the right amount of detail throughout. Care is taken to present information accurately. The story is neither too short nor too long.	The story composition is typically good, though it seems to drag somewhat OR need slightly more detail in one or two sections.	The story seems to need more editing. It is noticeably too long or too short in more than one section.	The story needs extensive editing. It is too long or too short to be informative or compelling.
Citation of Sources	Information, music, photos and/or video clips are properly cited in a Credits frame at the end of the story.	Most of the information, music, photos and/or video clips are properly cited in a Credits frame at the end of the story.	Some of the information, music, photos and/or video clips are properly cited in a Credits frame at the end of the story.	The Credits frame is missing from the digital story.

Figure 3: Digital Story Planning Guide



Digital Story Planning Map

Topic and Purpose:	Audience:
Ideas for Photos and Images:	
Content Outline: I. Introduction II. III. IV. V. Conclusion	

Music/Mood:
Notes:
Resources: