THE IMPACT OF TPACK AND DIGITAL STORYTELLING AS A LEARNING EXPERIENCE FOR PRE-SERVICE TEACHERS IN A LEARNING-BY-DESIGNING PROJECT

by

CÁTIA LUZIA SILVA HARRIMAN

(Under the Direction of Robert Maribe Branch)

ABSTRACT

There are three types of knowledge that competent teachers should demonstrate nowadays: knowledge of technology, pedagogy, and content. The interplay of these three kinds of knowledge constitutes the TPACK (Technological Pedagogical Content Knowledge) framework.

This research explored the role that the TPACK framework has on digital storytelling, a design-based learning opportunity for pre-service teachers taking a technolgy integration course at a southeastern american university. The study was guided by the following questions:

1) What is the description of the process of designing digital stories when pre-service teachers use the TPACK framework?
2) What are the pre-service teachers' perceptions of the TPACK framework as it relates to their projects?
3) How do instructors perceive the effectiveness of the TPACK framework in the design of their students' digital stories?

The primary sources for data collection were interviews with pre-service teachers and the instructor, observations of class activities, surveys, and artifacts analysis - artifacts analysis involved course web portfolios and digital stories developed by the pre-service teachers, as well as any handouts provided by the instructor.

Data were analyzed inductively according to the concepts of the underlying theoretical framework. Specifically, triangulation of data sources guaranteed the internal validity of the research. All interviews were transcribed using Express Scribe software and analyzed using *Microsoft Word*® as a tool for qualitative data analysis. Surveys were used to produce frequency distributions.

The results indicated that there were gains in the technological pedagogical and content knowledge of the pre-service teachers involved in the research and that they acquired a holistic view of the process of teaching with technology, as a consequence of their participation in the designed digital storytelling project.

Further research is needed to understand how and to what extent teachers' actual digital storytelling practices compare with those modeled during their teacher education in college; to detect whether student performance reflects the effectiveness of their teachers' digital storytelling practices; and finally to explore the impact that the alignment of the TPACK framework with digital storytelling has on pre-service teachers' understanding of specific content areas, as well as student assessment practices.

INDEX WORDS: digital storytelling, pre-service teachers, TPACK, teacher education, technology integration, learning-by-design

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CÁTIA LUZIA SILVA HARRIMAN

Bachelor of Social Communication, Universidade Federal do Ceará, Brazil, 1994

Master's of Education, Universidade Federal do Ceará, Brazil, 2001

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

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CÁTIA LUZIA SILVA HARRIMAN

Major Professor:	Robert Maribe Branch
Committee:	Chandra Orrill
	Kathy Roulston
	Mary Ann Fitzgerald

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
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DEDICATION

To the memory of my beloved mother, Rita de Cássia de Oliveira.

It was all possible because of you.

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TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1

Introduction

Contemporary schooling poses new challenges for prospective teachers. Learning how to teach today involves not only the traditional roles of classroom management, knowledge of teaching techniques and attainment to curriculum goals but also how to potentially increase the learner's educational experience with the technological affordances found in today's world. The existence of the Internet, web-based resources, and multimedia tools has augmented this challenge.

During my personal experience as a teacher educator I realized that despite the fact that technology is becoming more present in the lives of pre-service teachers the pedagogical use of technology is not inherent to the acquisition of the tool itself. The personal uses that prospective teachers make of technology do not necessarily have the same application in the educational context. Mishra and Koehler (2006) agree with this notion when they state that "merely knowing how to use technology is not the same as knowing how to teach with it" (p. 1033). Therefore, the use of technology for teaching and learning involves an educational process that makes expertise evolve as a consequence of responsibly designed learning opportunities.

Based on a pilot study involving the development of digital storytelling by pre-service teachers from a Southeastern American university attending its Introduction to Computers for Teachers course during the month of May 2009, I realized that most students had difficulty articulating how they could use digital stories to teach specific contents, such as Math, in their future classrooms. I concluded from the pilot study that although the students were able to learn

how to use the technological tools in order to put the project together, there was still a lack of pedagogical knowledge for the application of the final products in the educational context.

This study stresses the importance of viewing technology as a tool to enhance learning. Although there is controversy as to whether technology can positively impact student achievement (U.S. Department of Education, 2007), the efficient use of technology in the educational context may enhance learning, contributing to more creative processes and serving as a cognitive tool (Jonassen & Reeves, 1996). However, the effective use of technology as cognitive tools depends on the efficient pedagogical preparation of prospective teachers that reaches beyond technical skills acquisition.

Considering that the inclusion of computers in schools alone will lead to better learning outcomes is a misconception. Cuban (2001) claims that computers have been oversold and underused in education. Furthermore, there are ineffective applications of technology in schools, and the primary reason seems to be improper pedagogical preparation of prospective teachers. Ely (2002) stated that "many professionals in education, however, know that teachers require training in the operation and use of the new technologies if they are to be competent in their work with students and colleagues" (p. 31). The purpose of this study is to investigate the impact that digital storytelling, a design-based learning opportunity, has on the technological pedagogical content knowledge of teachers taking a pre-service technology integration course.

Rationale

Qualitative change in the way technology is used in the classroom has its roots in teachers' pre-service education. Willis (1997) proposed an alternative strategy in the way teachers are prepared, claiming that teachers must be trained to learn with computers, not about

computers. Bransford, Darling-Hammond and LePage (2005) agree that there is the need for a new type of knowledge that meets the needs of changing times, and thus state:

> To meet the expectations they now face, teachers need a new kind of preparation – one that enables them to go beyond "covering the curriculum" to actually enable learning for students who learn in different ways. Programs that prepare teachers need to consider the demands of today's schools in concert with the growing knowledge base about learning and teaching if they are to support teachers in meeting these expectations. (p. 2)

The preparation of prospective teachers to use technology must create opportunities for meaningful uses of technology as a tool to enhance learning. Luke, Moore and Sawyer (1998) state that "to a large extent, a teacher's ability to integrate technology into the classroom depends on the modeling and classroom experience that person had as a pre-service teacher" (p. 56). The modeling of pedagogical practices needs to happen in the real life context of their present realities leading to skill development, knowledge transfer and the expression of the self (Luke et al., 1998). Moreover, pre-service teachers need to construct a clear vision of how to integrate technology into their teaching, going beyond the mere development of technical skills. Ertmer, Conklin, Lewandowski and Osika (2003) affirm "In order to translate skills into practice, teachers need specific ideas about how to use these skills to achieve meaningful learning outcomes under normal classroom conditions" (p. 96). The educational process focused solely on the development of skills is connected to a technology-centered approach to educational technology where its pedagogical potential is disregarded.

Insufficient modeling of effective instructional practices in pre-service teachers' education remains a problem. Ertmer, Conklin, Lewandowski and Osika (2003) refer to a

document published by the National Center for Education Statistics in 2000 informing the fact that "nearly 70 percent of teachers report not feeling well prepared to use computers and the Internet in their teaching" (p. 95). Luke, Moore and Sawyer (1998) propose the "finding the self" approach to encourage technology-using teachers in pre-service training (p. 57). Luke et al. argue that pre-service teachers need to view technology as a meaningful tool that helps them in the present time of their lives and as a way of self-expression. Self-expression can occur through narratives as Luke et al. state: "Pre-service teachers begin to construct the "bridge" when they describe themselves as technology-using teachers through narratives, role playing and self-as-teacher discussions" (p. 58). Therefore, new approaches need to be offered in order to improve the pre-service teachers' ability to integrate technology into their teaching.

One of these new approaches is Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPCK or TPACK). Mishra and Koehler's TPCK theoretical framework has received increased attention in the field of educational technology as it refers to what teachers must know in order to efficiently integrate technology into their teaching as well as how teachers should integrate technology into their teaching. Mishra and Koehler's framework is offered as a way to solve the lack of more grounded theoretical basis for technology integration in the field of educational technology. Mishra and Koehler state, "The basis of our framework is the understanding that teaching is a highly complex activity that draws on many kinds of knowledge. Teaching is a complex cognitive skill occurring in an ill-structured, dynamic environment" (Mishra & Koehler, 2006, p. 1020). Mishra and Koehler explain that teacher education should emphasize three types of knowledge: knowledge of technology (skills related to the operation of standard and advanced technologies - TK), knowledge of pedagogy (methods of teaching - PK) and knowledge of content (subject matter - CK). The TPCK approach is

appropriate for this study because it offers a holistic framework to study the integration of technology in pre-service teacher's education.

The TPACK framework explains the three types of knowledge individually, and the ways in which the three types of knowledge interact with each other (three pairs of knowledge intersection) and how they all interact together (one triad) (Mishra & Koehler, 2006; Barbour, Rieber, Thomas & Rauscher, 2009). Figure 1 illustrates the way each type of knowledge in the framework intersects with the other types of knowledge.

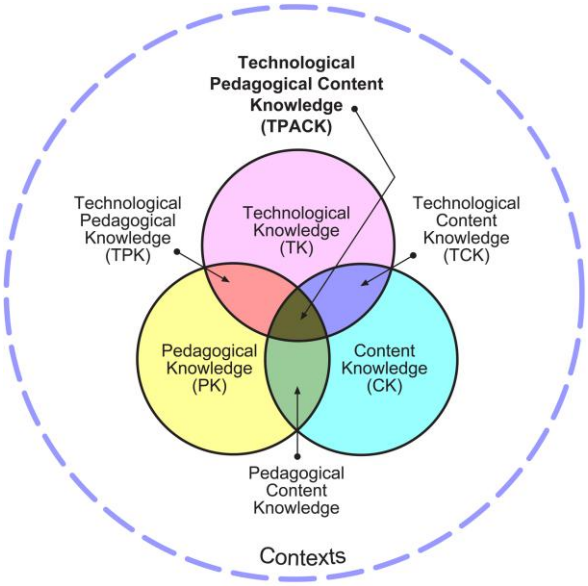

Figure 1. The Technological Pedagogical Content Knowledge Theoretical Framework. Source: http://tpack.org/

Pedagogical content knowledge refers to the methods of teaching that are applicable to specific contents. Technological content knowledge is related to the possible representations of content through the affordances of technology. Technological pedagogical knowledge addresses the reciprocity between processes and methods of teaching and technology. Finally, technological pedagogical content knowledge (TPACK), as defined by Mishra and Koehler (2006) is:

> The basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones. (p. 1029)

Mishra and Koehler (2006) also argue that the TPACK theoretical framework is directly related to practice, as teachers engage in learning technology by design. Mishra and Koehler explain this approach:

> In the learning-technology-by-design approach, emphasis is placed on learning by doing, and less so on overt lecturing and traditional teaching. Design is learned by becoming a practitioner, albeit for the duration of the course, not merely by learning about practice. Learning through design embodies a process that is present in the construction of artifacts (such as online courses, digital videos, and so on), which is often located in the interplay between theory and practice, between constraints and tradeoffs, between designer and materials, and between designer and audience. Learning technology by design affords students the opportunity to transcend the passive learner role and to take control of their learning. (p. 1035)

Digital storytelling practices, for instance, figure as an alternative tool to boost prospective teachers' contact with technology in several different levels, providing them with opportunities to experience real constructivist learning as they design their stories.

The intersection of TPACK and digital storytelling resides on the fact that technology can be used in the classroom to promote meaningful learning opportunities.

Robin (2008) has a critical vision of some digital storytelling practices, however:

> This technology, although powerful, is currently being used in K–12 and higher education classrooms with an emphasis on technical skills and without the greater level of thought and consideration to the subject matter, the teaching strategies, and the real world needs of today's classrooms. (Robin, 2008, p. 9)

Storytelling can be used as a learning tool and it has gained increased popularity in higher education (McDrury & Alterio, 2003). New views on the nature of learning and the importance attributed to reflection in education have led these authors to develop a five-stage learning process through storytelling. They have, in fact, placed storytelling as a theory of learning. Storytelling is embedded in human experience. Schank (1995) states that thinking is related to how we explain reality through storytelling. A story - personal, someone else's or conversational - represents one's own struggle to understand and explain the world, building knowledge. Storytelling and intelligence are, thus, correlated: "To the extent that intelligence is bound up with our ability to tell the right story at the right time, understanding a story means being able to correlate the story we are hearing with one that we already know" (Schank, 1995, p. 21). People tell stories because they have communicative intentions. Teachers are frequent storytellers. Storytelling is in the center of the teaching process and that author adds: "A good teacher is not one who explains things correctly but one who encourages explanations in a memorable (i. e., interesting) format" (Schank, 1995, p. 15). Storytelling seems to be an inherently educational activity. McDrury and Alterio (2003) define storytelling as follows:

> Storytelling is a uniquely human experience that enables us to convey, through the language of words, aspects of ourselves and others, and the worlds, real or imagined, that we inhabit. Stories enable us to come to know these worlds and our place in them given that we are all, to some degree, constituted by stories: stories about ourselves, our families, friends and colleagues, our communities, our cultures, our place in history. (p. 31)

Combining the ancient tradition of telling stories with the technological affordances of today's world, digital storytelling figures as one possibility for engaging pre-service teachers in projects that place technology as a meaningful tool for teaching and learning. Robin (2008) remarks that digital storytelling is not a new idea among educational practices. However, digital Storytelling has benefited from the growing affordability and easy access to multimedia resources tools (cameras, computers, microphones, editing software, scanners), expanding the possibilities of the oral tradition, and has proved to be a practical and simple way to promote authorship among students and teachers. McLellan (2006) defines digital storytelling as "the art and craft of exploring different media and software applications to communicate stories in new and powerful ways using digital media" (p. 66). While developing multi-literacies, such as media literacy, digital literacy, and visual literacy when dealing with digital images, text and sound to construct narratives, pre-service teachers are faced with the opportunity of being creators of educational product content.

Importance

The results of this study should directly benefit prospective teachers and teacher educators in general because it has the potential to demonstrate the benefits of multimedia projects, such as digital storytelling, for pre-service teachers, as they engage in learning by

designing their own educational products, conquering authoring skills and breaking the tradition of being mere consumers of educational products designed by third parties. This study also has the potential to show the benefits of the unique characteristics of digital storytelling (such as self-expression, voice, reflection, motivation) to the education of pre-service teachers. Furthermore, this study may provide prospective teachers' education with a more holistic view of the teaching process with technology, since it goes beyond the technical skills acquisition. Finally, it is important to align the learning-by-designing approach to the TPCK theoretical framework. Robin (2008) states:

> Perhaps by combining the convergence of digital storytelling in education as earlier described with the theoretical framework of TPCK, researchers will arrive at a deeper understanding of the different and more powerful roles that digital media can play in both teaching and learning. (p. 227)

The convergence of digital storytelling and TPACK framework provides a more complete experience of technology integration for pre-service teachers, benefiting their future classrooms. The adoption of the TPCK framework in digital storytelling projects figures as a way to prevent the fragmented contact with educational technology in which only its technological possibilities are explored.

Research Questions

This study intends to explore the role that the TPACK framework has on digital storytelling, a design-based learning opportunity for teachers taking a pre-service technology integration course. The delimitations of the study (aspects that keep the work manageable) refer to the population and to the scenario chosen for the study - this study is limited to pre-service

teachers enrolled in a technology introduction course at a Southeastern American university. The main research questions are:

4) What is the description of the process of designing digital stories when pre-service teachers use the TPACK framework?
5) What are the pre-service teachers' perceptions of the TPACK framework as it relates to their projects?
6) How do instructors perceive the effectiveness of the TPACK framework in the design of their students' digital stories?

CHAPTER 2

Review of Related Literature

The purpose of this review of literature is to delineate, understand and correlate the key theories, concepts and ideas that serve as foundations for the investigation of the role of the technological pedagogical content knowledge framework on the design of digital storytelling products by pre-service teachers as a means for effective technology integration. The review of literature related to this study includes these major areas: technology integration, technological pedagogical content knowledge and digital storytelling.

Regarding biases, this literature review might be influenced by my experience as an instructor of pre-service teachers. I have constructed beliefs about what should be taught and how. I also have personal beliefs on the role of technology in the world and specifically in the learning context. I believe that technology can be a powerful pedagogical tool when used effectively. I also believe that such effectiveness can be taught and teacher education nowadays lacks a more comprehensive curriculum related to technology integration.

Some of the limitations found during the pursuit of this review are related to limited budget for the purchase of more research resources, leading to major reliance on digital resources. Also, these same digital resources are limited in what they can offer.

Tools and Resources for Literature Review

Most of the studies reviewed for this literature review have been found using the GALILEO database and GIL catalog available from The University of Georgia library system (http://www.libs.uga.edu/). Additional resources were found in the World Wide Web, mainly

using the Google Scholar (http://scholar.google.com/) and World Cat (http://www.worldcat.org/) search engines. The following search terms were used to find this literature: teacher education, pre-service teacher education, digital storytelling, TPACK, TPCK, technological pedagogical content knowledge.

Technology Integration

The definition of technology integration has evolved over the years from a technology-centered perspective to a more pedagogical one. Ertmer (1999) considers that "integration is better determined by observing the extent to which technology is used to facilitate teaching and learning" (p. 50). Despite the fact that the definition has evolved, the literature on teacher technology integration points to the fact this development in ideas has had little impact on the daily practices of the schools (Ertmer, 1999) and on the teaching and learning process (Russell, Bebell, O'Dwyer & O'Connor, 2003). Teachers, in general, remain unprepared and do not feel confident to use technology in their classrooms (U. S. Department of Education, 2003; Willis, Thompson & Sadera, 1999; Ertmer et al. 2003; Russell et al., 2003).

Some of the causes of this situation can be identified. The majority of the teacher-preparation programs, for instance, are held responsible for being ineffective in providing suitable modeling for technology integration (Willis, 1997; Strudler & Wetzel, 1999; Schrum, 1999; Ertmer et al., 2003, Russell et al., 2003). Another factor is that personal uses of technology by teachers outside the classroom do not necessarily translate into efficient pedagogical uses inside the classroom (Russell et al. 2003). The pedagogical use of technology is a unique one and requires preparation, both in pre-service and in-service periods.

Ertmer (1999), and Pierson and McLachlan (2004) do recognize that educators face various challenges while trying to integrate technology into their teaching. Ertmer (1999), for

instance, calls attention to first and second-order barriers to change in technology integration. First-order barriers refer to "those obstacles that are extrinsic to teachers" (p. 50). Generally, they refer to a lack of resources (e.g., training, time, equipment). Second-order barriers "are typically rooted in teachers' underlying beliefs about teaching and learning and may not be immediately apparent to others or even to the teachers themselves" (p. 51). This other type of barriers has great influence on the first-order ones and is less tangible.

There is also general agreement that teachers do need preparation in order to integrate technology efficiently into teaching (Byrum & Cashman, 1993; Willis & Mehlinger, 1996; Luke et al. 1998; Russell et al. 2003) and that teacher training is different in nature from other staff development programs (Schrum, 1999). Reverting the situation of technology integration today should involve the pursuit for alternative ways for teacher development (Willis, 1997; Schrum, 1999), besides formulating approaches to facilitate teachers' technology integration (Willis et al., 1999) and reformulating the school culture in relation to technology use (Ertmer, 1999).

Regarding prospective teachers, a study conducted by Byrum and Cashman (1993) about the problems, perceptions and preparation of pre-service teachers in technology integration found that "24% of the respondents had been required to develop lesson plans integrating computers, yet 83% felt prepared to integrate computers into the curriculum" (p. 259). Byrum and Cashman (1993) also address pre-service teachers' beliefs in relation to technology and how these beliefs are shaped by their experience in college, in general. Moreover, their study concluded that future teachers were not being exposed to good technology integration modeling, since most of the instruction was teacher-centered and focused on the technological element rather than on pedagogical practices.

Pierson and McLachlan (2004) conducted a longitudinal research study to explore pre-service teachers' developing vision of technology in teaching and learning. Pre-service teachers' beliefs and their perception of their role as teachers were also examined. Practically the same issues reported by Byron and Cashman (1993) were encountered: deficient modeling, and narrow view of technology integration. However, Pierson and McLachlan detected that pre-service teachers do intend to use technology in their future classrooms as their confidence grows in the technology integration courses and are aware of the unique challenges inherent to such endeavor. The students themselves are identified as agents of change:

> Perhaps the natural willingness of these students to actively drive the change process demands that we openly recognize the role of student agency in large scale change of teacher education programs. Students could provide the link between the technology tools and strategies and other faculty development initiatives or as a catalyst when such efforts prove ineffective. (Pierson & McLachlan, 2004, p. 14)

Historical analysis of technology integration preparation of pre-service teachers leads to the conclusion that technical skills were prevalent in relation to pedagogical knowledge. As Byrum and Cashman (1993) have noted, pre-service teacher education "usually centers on the mechanics of running the computer and using basic tools and applications rather than integration into the curriculum. As a result, many teachers graduating from teacher education programs are unprepared to teach using computers" (p. 260). Breaking such reality demands a different, more holistic way to look into teacher technology integration. The teacher technological pedagogical content knowledge has arisen as one possibility.

Technological Pedagogical Content Knowledge

The teacher technological pedagogical content knowledge (TPCK or TPACK) offers a theoretical framework to analyze teacher knowledge on technology integration. The TPACK framework has been qualified as useful (Hofer & Swan, 2006) and robust (Polly & Brantley-Dias, 2009). The framework is also considered to have profoundly impacted the field of educational technology (Cox & Graham, 2009; Robin, 2008).

The TPACK framework is an expansion of Shulman's pedagogical content knowledge (PCK) that tried to close the gap between content and pedagogical process. Schulman (1986), after analyzing several early teachers' examination tests, concluded:

> The assumptions underlying these early tests are clear. The person who presumes to teach subject matter to children must demonstrate knowledge of that subject matter as a prerequisite to teaching. Although knowledge of the theories and methods of teaching is important, it plays a decidedly secondary role in the qualifications of a teacher. (p. 10)

Schulman goes on to propose the idea of subject matter knowledge for teaching, relating content and pedagogy. Addressing the challenges of technology integration into teaching, Mishra and Koehler (2006) have developed the idea of technological pedagogical content knowledge, which is a pragmatic (not philosophical) concept of knowledge. Knowledge is considered to be a tool designed to serve a specific purpose. This is the foundation of the "learning technology by design" approach (Koehler & Mishra, 2005).

Koehler and Mishra (2008) discuss the teaching process as a complex, ill-structured one, and say that teaching is "a classic example of an ill-structured discipline with a high level of variability across situations as well as a dense context-dependent inter-connectedness between knowledge and practice" (p. 4). Once technology is integrated into teaching, and having in mind

that particular technologies have specific affordances and constraints, teaching becomes then a "wicked problem" because there can be several solutions to different educational problems (Koehler & Mishra, 2008).

The TPACK framework addresses three knowledge areas- technology, pedagogy and content – in an articulated, connected way. It is a framework to address not only what teachers do, but also what teachers know (Polly & Brantley-Dias, 2009). Please refer to chapter 1 for a graphical representation of the framework.

Regarding teacher training, Koehler and Mishra (2008) propose that teachers develop TPACK in a spiral manner, starting with familiar technologies moving to more non-familiar scenarios. Using the TPACK framework also allows teachers to become authors and decision-makers (Mishra, Koehler & Kereluik, 2009). However, several authors still point to the need of more research involving TPACK and several aspects of the development of teacher knowledge. Robin (2008) remarks the need for more studies about the benefits of multimedia allied to TPACK for teaching and learning. Polly and Brantley-Dias (2009) ask for more research on how teacher educators and developers can help teachers further develop TPACK. Cox and Graham (2009) call for more research involving teachers in different levels of technology integration and in different school contexts.

Specifically in relation to pre-service teachers' education, Niess (2008) considers that the methods courses are an opportunity to observe students' technology use through case studies. TPACK in this context serves as a new way of thinking, leading to the development of 21st century skills. Niess (2008) states:

> With the addition of an integration of new and emerging twenty-first century technologies as tools for learning, the preparation of teachers must evolve toward

> preparing preservice teachers to teach in ways that help them to guide their students in learning with appropriate technologies. (p. 223)

Developing literacies figures among the challenges faced by teachers in order to achieve 21st century skills. Digital storytelling, according to Niess (2008) is one vehicle to effectively engage students and teachers in this endeavor: "Elementary preservice teachers must deal with issues of engaging children in digital storytelling – experiences that they themselves have not had" (p. 225). Multimedia projects, such as digital storytelling, allied to a framework that considers the act of teaching and learning with technology in a more holistically way can enhance the acquisition of 21st century skills, since they engage teachers and students in a participatory process rather than in a passive one.

As teachers learn how to design digital stories, they become aware of how they can ally creativity and critical thinking to the art of teaching. They also become aware of ways to engage the students in their own creations. The practice of design of their own pedagogical materials that is not based solely on technology, but also on the relationship between pedagogy, content and technology models a new way to learn that will impact how they teach in the future.

Examples of TPACK can be found in the literature, however, Özgün-Koca, Meagher and Edwards (2010) advert that "there is a dearth of research on the mechanisms for preservice teachers' development of the pedagogical knowledge necessary for effective use of such technologies"(p. 10). These authors have explored the emergence of TPACK with a group of secondary Math pre-service teachers who participated in a methods course. Through the analysis of the learning activities designed by the students, the authors detected TPACK developments. Technological knowledge, for instance, was detected when the students mentioned the skills they were acquiring when learning to operate calculators and the extent to which they felt encouraged

to keep learning about them. The authors concluded that "lack of TK for a particular technology could be an important factor in preservice teachers' consideration of whether to use that technology in their future classrooms" (Özgün-Koca, Meagher & Edwards, 2010,p. 16)

Content knowledge referred to the high school content knowledge the students needed to work during the course (e.g. algebra, geometry), through the teacher's perspective. Even though the students considered that they were not learning any new content at that point, they were having the opportunity to remember those contents. Moreover, the students were focusing more on the "why" aspect of the content, instead of merely on "how". The students' CK served as the foundation for their PCK (e.g. the representations of mathematical content using tables, graphs), and especially when they started reflecting on the connection between content and technology integration .

Participants in Özgün-Koca, Meagher and Edwards' research (2010) could relate to pedagogical knowledge when discussing the use of manipulatives, problem solving etc, but had difficulty articulating such knowledge with the technological element.

Using a survey as the basis for the analysis if TPACK, the authors concluded that the students could clearly see the influence of content on teaching methods, but not vice-versa. The participants also stressed the importance of appropriate uses of technology, focusing on the technology capabilities when discussing the influence of technology on content. For instance, some advanced technologies make certain content more accessible. As for the relationship between technology and pedagogy, the students could see the use of technology as a pedagogical tool.

Özgün-Koca, Meagher and Edwards (2010) conclude that pre-service teachers development of TPACK is connected to a shift in identity – from being Math learners to teachers.

Niess (2005) investigated the development of TPACK in the context of a science and mathematics teacher preparation program. At the conpletion of the program, Niess concluded that the students had made varying degrees of progress in the development of TPACK. Among the author's findings, we can cite: only some students could recognize the interplay of the content (Science) and technology. Students resisted recognizing the science embedded in the technology, considering it merely as a tool to study science. This might have resulted from the discomfort that certain students had with technology, leading them to consider technology an unnecessary component of the learning process. While some students were successful implementing learning experiences with particular technologies, others were more comfortable leaving the technology aside and continuing to perform lectures. In that particular teacher preparation program, microteaching had a very important role to model instructional strategies.

Hofer and Swan (2006) studied the development of TPACK through a case study of moviemaking in the classroom. The authors detected that the participants in their research were able to connect several curricular contents to the moviemaking project. The participants even used the project to go beyond, addressing more contents than those suggested in curriculum standards. Regarding History standards, according to Hofer and Swan (2006) "students used a variety of historical sources to research their topics and later write the script for their documentaries" (p. 187).

Pedagogically, a moviemaking project demands some structure but also that freedom is granted to the students, which can be challenging for teachers used to a more teacher-centered

approach. The participants in Hofer and Swan's research, however, were experienced teachers who strived to implement more participatory teaching strategies that involved the students actively through project-based work. Examples of this approach are collaborative dramas, reading circles, exhibit boards etc. They spent less time lecturing and more facilitating student work. The teachers did not fear to appear not teaching content while engaging in the moviemaking project and knew how to manage their classrooms well.

Concerning pedagogical content knowledge, the strategy of using note cards was used in order to guide research on the Internet related to History content and avoid plagiarism. Also, the process of writing scripts was divided in five moments, each with its respective feedback to students.

There are several technological demands in a moviemaking project that can be very challenging for teachers, despite the fact that software programs nowadays are more simplified. The participants in the research, however, had some level of technological knowledge and were able to manage all technological tasks effectively, even helping their students to troubleshoot difficulties.

Technological content knowledge was more prevalent in the research phase of the moviemaking project, especially the one performed online (e.g. researching web-based historical archives).

The movie production phase put much stress on technological pedagogical knowledge. Windows Movie Maker was used and much guidance had to be provided to students not only on how to use the software but also on what kinds of images suited better the students' ideas.

Storyboarding was the phase of the project that better exemplified the acquisition of technological pedagogical content knowledge:

> In the storyboarding phase, students were challenged to create a synthesis of their individual scripts in their groups, parse the script to fit different scenes in the storyboard, select images to correspond with the script, and identify any music or sound effects that might be appropriate to support their story. (Hofer & Swan, 2006, p. 193)

This phase resulted very challenging especially due to the linear nature of the storyboard, when the process itself is nonlinear.

Jaipal and Figg (2010) researched four pre-service teachers who participated in a school-based collaborative initiative to integrate technology in the classroom. Through cross-case analysis, the autors performed the description of the general characteristics of the three technology knowledge components of the TPACK framework - TK, TPK, and TCK. Regarding technology knowledge (technical skills and efficient personal use of the tools), the participants in the research revealed being at different comfort levels with technology, although they all had previous knowledge of Word processing, e-mail, PowerPoint, and Internet use. One of the participants, not being aware of specific training on the technological tool in the context of the subject matter had an unsuccessful lesson planning and implementation.

According to Jaipal and Figg (2010), technological content knowledge is "the the demonstration of the ability to match the technology to the subject matter content to achieve specific subject matter goals or learning" (pp. 15-16). In their research, Jaipal and Figg have concluded that this is the most neglected area of the TPACK framework. Corroborating such idea, all the participants in their research need help with this aspect. For instance, one pre-service teacher often requested help with technological tools to support brainstorming and flowchart activities to conduct a Geography unit.

Technological pedagogical knowledge was translated in the context of the aforementioned research as practical teaching competencies while planning and implementing lessons supported by technology in order to reach learning outcomes. Jaipal and Figg (2010) concluded that "planning elements, such as differentiating for students, introducing only a few technical skills or procedures in one lesson, and then sequencing activities to build those skills emerged as significant TPK characteristics that impacted the success of the lesson" (p. 17).

Harris and Hoffer (2011) conducted a descriptive study of secondary teachers' Curriculum-Based, Technology-Related Instructional Planning during a professional development initiative. Their key findings concerning TPACK were:

Regarding pedagogical content knowledge, the participants considered first and foremost the content standard to be addressed while planning a learning activity. Once the content standard was chosen, they selected activities that would most likely engage students. Technology was considered to engage students intellectually, rather than affectively. The timing of each activity was also accounted for.

Concerning technological content knowledge, technology was viewed by the participants as a way to extend students' learning. Technology does not change the content learned, but increases its depth. Also, technology was planned to be used to allow a deeper learning process, enhancing traditional ways of teaching rather than supporting completely new pedagogical approaches (TPK).

Harris and Hoffer finally concluded about the teachers' TPACK:

> When learning about new educational technologies, several of the teachers noted particular pedagogical affordances in the use of those new tools that "fit" with content that they teach. In other words, they used the content for which they are responsible as an arbiter in their decision-making about possible adoption of tools and resources. If they weren't able to discern a clear connection

> between a technology's affordances and the content to be learned, they didn't plan to use the tool instructionally. (Harris & Hoffer, 2011, p. 224)

Digital Storytelling

Digital storytelling can motivate students to imprint their own expression to a finalized multimedia product as they engage in a reflective process. The authoring activity becomes more personal and meaningful. Digital storytelling is also a tool for meaningful technology integration and learning (Sadik, 2008). Digital storytelling, additionally, can be an effective way of communication and expression (Abidin & Razak, 2003).

As McLellan (2007) stated, "the main focus of digital storytelling is the creation of personal narratives rather than interactive stories or games" (p. 66). According to Ohler (2008), digital storytelling "uses personal digital technology to combine a number of media into a coherent narrative" (p. 15). First-person voice narratives seem to be the powerful communicative factor of digital storytelling.

Robin (2008) points out that digital storytelling is not a new idea among educational practices. The Center for Digital Storytelling emerged in the 1980s in California and has provided training and various other resources for those interested in becoming more skilled digital storytellers. The Center's rich resources can be found on the Web at http://www.storycenter.org/index1.html. According to the Center, there are at least seven constitutive elements in a digital storytelling: point of view, dramatic question, emotional content, the gift of voice, the power of soundtrack, economy and pacing (Robin, 2008, p. 223). Figure 2 delineates each element:

1. Point of view	What is the main point of the story and what is the perspective of the author?
2. A dramatic question	A key question that keeps the viewer's attention and will be answered by the end of the story.
3. Emotional content	Serious issues that come alive in a personal and powerful way and connects the story to the audience.
4. The gift of your voice	A way to personalize the story to help the audience understand the context.
5. The power of the soundtrack	Music or other sounds that support and embellish the storyline.
6. Economy	Using just enough content to tell the story without overloading the viewer.
7. Pacing	The rhythm of the story and how slowly or quickly it progresses.

Figure 2. The Center for Digital Storytelling's Seven Elements of Digital Storytelling, Robin (2008, p. 223)

Digital Storytelling has benefited from the growing affordability and easy access to multimedia resources tools (cameras, computers, microphones, editing software, scanners), expanding the possibilities of the oral tradition and has proved to be a practical and simple way to promote authorship among students and teachers.

As a definition of digital storytelling, Robin (2008) offers:

> At its core, digital storytelling allows computer users to become creative storytellers through the traditional processes of selecting a topic, conducting some research, writing a script, and developing an interesting story. This material is then combined with various types of multimedia, including computer-based graphics, recorded audio, computer-generated text, video clips, and music so that it can be played on a computer, uploaded on a web site, or burned on a DVD. (Robin, 2008, p. 4)

Hull and Nelson (2005) define digital storytelling as:

> A form of multimedia composing that consists of images and segments of video combined with background music and a voice-over narrative. Digital stories are, in effect, brief movies distinctive in featuring the digitized voice of the author who narrates a personally composed story and an assemblage of visual artifacts (photographs old and new, images found on the Internet, snippets of video, and anything that one can convert to digital form). (p. 231)

The University of Houston hosts The Educational Uses of Digital Storytelling website (http://digitalstorytelling.coe.uh.edu/) with examples and numerous resources on how to develop digital stories. The following definition is presented on the main page:

> Digital Storytelling is the practice of using computer-based tools to tell stories. As with traditional storytelling, most digital stories focus on a specific topic and contain a particular point of view. However, as the name implies, digital stories usually contain some mixture of computer-based images, text, recorded audio narration, video clips and/or music.

Some of the most common software resources for digital storytelling are described in Figure 3.

Software	Use	Platform	Cost	Collaborative Tools
Microsoft Photo Story 3 (screen shot provided below)	Creates digital stories from still images and audio.	Windows only	Free (but requires Windows XP)	No
Windows Movie Maker	Creates digital stories from still images and video clips plus audio.	Windows only	Free (with Windows Operating System)	No
Apple iMovie	Creates digital stories from still images and video clips plus audio.	OS X for Apple Macintosh Only	Free (with Apple OS X Operating System)	No
Adobe Photo Shop Elements	Modifies images used in digital stories.	Apple Macintosh and Windows	Trial version available; around $69 per copy for educators	No
Storybird http://storybird.com	Creates stories from pre-produced scenarios and characters. Adds text.	Online	Free	Yes, authors alternate their participation.
Animoto http://animoto.com	Creates digital stories from still pictures, video and audio.	Online	Basic account has limitations.	No
Voice Thread http://voicethread.com	Creates digital stories from still pictures, video, audio, and documents.	Online	Basic account has limitations.	Yes: collaborative work through microphone, webcam, telephone, text, and audio file (mp3/wav).

Figure 3. Overview of popular software applications useful for digital storytelling (adapted from Robin & Pierson, 2005, with additional information about online tools and collaborative capabilities).

Chung (2007) also presents a table similar to the one above when discussing technological tool possibilities, but adds the software PowerPoint, which is for Windows and Mac platforms.

Besides being affordable and easy to access, the types of software used for digital storytelling present increasingly user-friendly interface. One example is Photo Story 3 for

Windows. According to Robin(2006), Photo Story 3 "is a very powerful Digital Storytelling authoring program, which is available for free" (p. 714) (Figure 4).

Figure 4. Photo Story 3 for Windows.

Personal narratives, historical documentaries, and stories that instruct figure among the types of digital stories. The stories can also be teacher or student-created. Among educators, the development of digital stories can lead to a shift from being simple users and consumers of third-party products to authors of their own materials, according to their own needs. Robin (2008) comments on other benefits of self-created digital stories:

> Teacher-created digital stories may also be used to enhance current lessons within a larger unit, as a way to facilitate discussion about the topics presented in a story and as a way to make abstract or conceptual content more understandable. (p. 224)

Authorship can also be encouraged among students – individually or in groups. Robin (2006) explains that students:

> Develop enhanced communication skills as they learn to conduct research on a topic, ask questions, organize their ideas, express opinions, and construct meaningful narratives. Students who participate in the full digital storytelling experience may also benefit from learning to critique their own work, as well as the work of others, facilitating social learning and emotional intelligence. (p. 224)

Focusing K-12 education, Ohler (2008) has outlined a generic five-phase media production process for digital storytelling: 1) Planning; 2) Identifying and gathering materials, expertise; 3) Development and implementation; 4) Honing, editing, and finalizing; 5) Sharing with others. The benefits for student-created digital stories are mainly connected to the development of 21st Century Skills.

The Partnership for 21st Century Skills is a leading organization responsible for infusing 21st century skills into education. According to the partnership, these skills refer to the digital age literacies and can be described as the combination of a group of interconnected abilities. Figure 5 compiles information regarding these literacies, presented by Robin (2008, p. 224).

21st Century Skill	***Description***
Digital Literacy	The ability to communicate with an ever expanding community to discuss issues, gather information, and seek help
Global Literacy	The capacity to read, interpret, respond, and contextualize messages from a global perspective
Technology Literacy	The ability to use computers and other technology to improve learning, productivity, and performance
Visual Literacy	The ability to understand, produce, and communicate through visual images
Information Literacy	The ability to find, evaluate, and synthesize information

Figure 5. 21st Century Skills

As an educational resource, digital storytelling can be used to boost attention to the introduction to new topics and to facilitate discussion. Robin (2008) presents the graphic in Figure 6 as a way to summarize the characteristics, possibilities and affordances of digital storytelling in education.

Figure 6. The convergence of digital storytelling in education.

Authorship and self-expression through the development of personal narratives seem to be two of the greatest values of the use of digital storytelling in education. Barret (2006) believes that digital storytelling helps the convergence of four student-centered learning strategies (student engagement, reflection for deep learning, project-based-learning, and the effective integration of technology into instruction), represented in Figure 7.

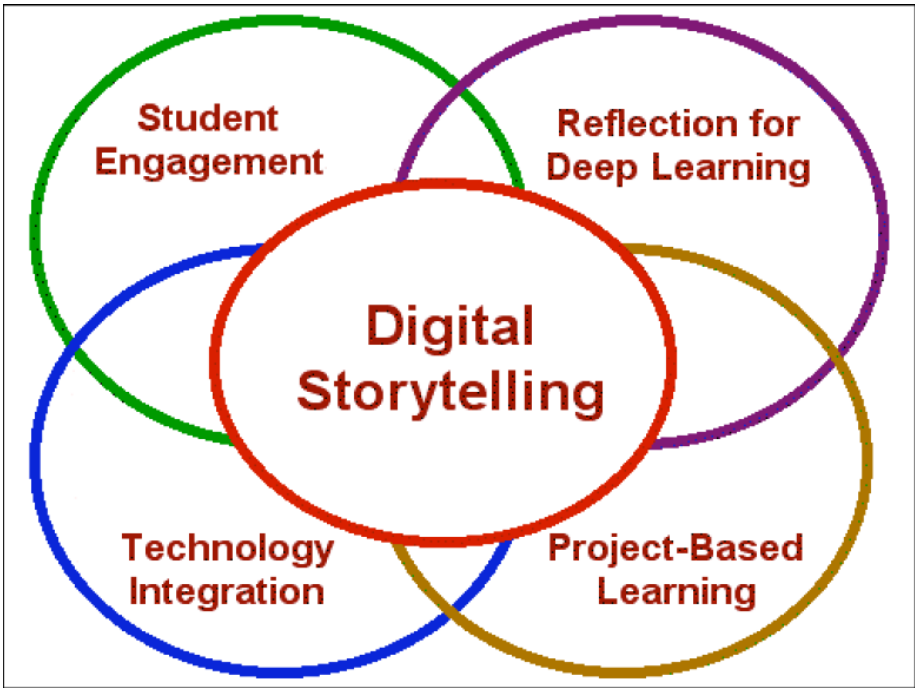

Figure 7. Convergence of Student-Centered Learning Strategies. Barrett (2006, p. 1)

Ganske (2007) argues that most available information related to storytelling is based on opinions instead of structured research. Although research has proliferated in the field of digital storytelling, demonstrating that it is an engaging vehicle to enhance learning (Sadik, 2008), Barret (2006), Robin (2006), and Dogan and Robin, (2008) stress the need for more research in the area. As an example of research conducted in the area of digital storytelling, Hull and Katz (2006) conducted a comparative case study drawn from a larger ethnographic research project that portraits how a child and a young adult craft agentive selves through multimedia storytelling in the social context for learning provided through a community technology center called DUSTY (Digital Underground Storytelling for Youth). One of the research questions in the context of this study was: "How did digital storytelling through DUSTY help position these participants to articulate pivotal moments in their lives and to assume agentive stances toward their present identities, circumstances, and futures?" Hull and Katz used the writings, interviews, digital stories, field notes that were analyzed through thematic coding and critical

discourse analysis. The authors concluded that the enactment of an agentive self is pivotal for learning and motivation, and that multimedia and multimodality is powerful form of communication and means to represent social world (Hull, & Katz, 2006).

Berg, Longman, Hepting, and Doolittle (2006) performed an action research in Canada to study aboriginal students' thoughts about future careers using traditional (paintings) and technological ways (DVDs) of storytelling. The research investigated issues related to the participants' dream job, their comfort level with technology and whether the workshops impacted their ideas about their dream jobs. The hands-on activity of developing a digital story and having it on a DVD resulted very useful, helping students reflect on their future career choices.

Sadik (2008) conducted a study to assist Egyptian teachers in developing teaching and learning through the application of digital technology. There were three main research questions: 1) To what extent can students be engaged in authentic learning tasks with digital storytelling?; 2) How effective is a digital storytelling approach in supporting teachers to effectively integrate technology into learning?; 3) What are the teachers' concerns and views regarding the implementation and integration of digital storytelling into learning? The findings of this research suggest that digital storytelling is an effective tool to increase students' understanding of curricular content and that teachers are willing to adopt digital storytelling practices in Egypt.

Abidin and Razak (2003) developed a study aimed at evaluating how multimedia storytelling is effective in representing the traditional contents of Malay folklore in the education of children. Six animated stories were analyzed through the conduction of a survey based on a questionnaire that had more than a hundred respondents (Film Animation students). Also, six

short clips were captured and attached to the survey form for a comparative study in order to understand the effectiveness of conveying the message. Abidin and Razak concluded that animation has the potential to convey ideas compared to text-based or analogue medium.

Regarding pre-service teacher education, digital storytelling represents a powerful way to let students progress beyond the technical skills acquisition and to promote an integrative approach to the use of basic productivity tools. Robin and Pierson (2005) remark that digital storytelling is a solution for a rich technology-integrated teaching and learning model for undergraduate teacher education students. During a research conducted at the University of Houston, digital storytelling was used as an instructional tool in a pre-service course. Students were encouraged to develop stories to meet certain instructional objectives. Digital storytelling was also used to demonstrate that it can add support to any part of the lesson cycle.

Figg and McCartney (2010) Conducted a longitudinal research to study the integration of writing, digital video stories and diversity. They focused on pre-service teachers' development of technological, pedagogical, and content knowledge in a practice teaching setting. Their research has indicated that the student teachers gained in the understanding of new techniques and different instructional strategies.

Heo (2011) also studied digital storytelling in the context of pre-service teacher education and concluded that digital storytelling is an efficient tool to promote constructive and authentic learning experiences. Heo's quasi-experimental research about the pre-service teachers' self-efficacy and dispositions toward change with regard to new technological approaches detected that self-efficacy and openness towards technology improved as a consequence of the digital storytelling activity. This study reinforced the key conclusions in Heo's first research (Heo, 2009) about the same topic.

As a summary, telling stories is a practice inherent to the human behavior and prevalent in the act of teaching. Telling stories permits us to understand and explain the world, as we reflect about the past and project the future. Digital storytelling has become a way to maximize the experience through traditional storytelling, as it articulates creativity, inquiry and critical evaluation.

Learning by design makes use of the multimedia resources in a meaningful way, leading to the development of multiliteracies. Students and teachers learn collaboratively as they interact during the creative process.

Learning to develop digital stories and reflecting on ways to enhance the students' learning process, pre-service teachers move beyond the mere acquisition of technical skills. The application of the TPACK framework in this context has the potential to engage pre-service teachers' reflection on technology, pedagogy and content in a connected and purposeful way. There is still the need, however, to conduct more research in the area in order to advance the understanding of the TPACK framework when used in educational multimedia projects and to delineate the benefits of such use for prospective teachers' education.

CHAPTER 3

Research Method

The purpose of this study was to explore the role of the TPACK framework in the design of the pre-service teachers' digital storytelling. The research questions were:

1) What is the description of the process of designing digital stories when pre-service teachers use the TPACK framework?
2) What are the pre-service teachers' perceptions of the TPACK framework as it relates to their projects?
3) How do instructors perceive the effectiveness of the TPACK framework in the design of their students' digital stories?

Subjectivity Statement

No one's interpretation of reality happens in a state of "suspension" or, better said, disconnected from one's own reality. Researchers do not constitute a special category in this regard. When acknowledging my own subjectivity I need to consider my epistemological beliefs, biases and personal background.

First, I will cite my ideas about reality, truth and knowledge: I believe that reality is a constructed meaning. It is relative, based on personal experiences and the cultural, social and political context in which I live. Different people have different perceptions of reality. This brings me to the idea of truth – different perceptions of truth cannot lead to only one accepted truth – the Truth. And finally, knowledge is also constructed, in our negotiations with our assumptions of reality.

My research project might have received the influence of my experience as an instructor of pre-service teachers because of my biases. I have constructed beliefs about what should be taught and how. I also have personal beliefs on what constitutes a good instructor, mostly an inheritance of my mother, who was a teacher for many years and has passed on to me a fierce sense of responsibility in the act of teaching.

Finally, I am a product of my own story. This means that I was shaped by interaction with others: family, friends, colleagues – both in friendly and unfriendly circumstances. My educational opportunities (formal and informal) also brought me to where I am today and I cannot neglect how such privilege resonates in what I produce academically.

Participants

The participants in the study were composed of a purposive sample. This means that a sample that was more likely to offer real, detailed and rich information about the subject of the study was selected among pre-service teachers and their instructors at a Southeastern American university attending its Introduction to Computers for Teachers course. A typical Introduction to Computers for Teachers class receives around 20 students and it is composed mainly by first or second year students from the College of Education, although the course does accept students from other fields such as Social Work, Journalism, Business, and Arts. Student athletes are also commonly found in the course.

The learners were mainly young adults and there was a predominance of female students. The class was culturally and ethnically diverse, with the predominance of Caucasian students. Usually an incoming student in this Introduction to Computers for Teachers has basic knowledge of productivity tools such as word processor and presentation software. Basic Internet skills such as browsing the web, sending and receiving e-mail, and using a search engine are also

common in this population. Working with digital pictures also occurs at a very basic level. However, working with digital video, creating web pages and planning lessons are skills not commonly found among the students.

The majority of the students has access to a newer (less than 3 years old) computer with high-speed internet access and loaded with Microsoft Office software. Only a few students start the course demonstrating knowledge of both Macintosh and Windows platforms. Contact with more advanced technological resources and their application in the learning process occurs with the accomplishment of a number of projects throughout the semester.

Context

The Introduction to Computers for Teachers course has learning as its central point in order to create teaching and learning environments using technology. Students work in various projects to design products for learning environments through numerous activities with different types of technologies. The purpose of the course is to teach pre-service teachers to use and manage technology in educational settings and to communicate means for using technology in educational settings.

The course objectives are:

- Develop an exploratory, experimental approach to technology with a willingness to try new applications
- Define various types of learning styles and strategies and explain how technology can support the needs of diverse learners
- Operate available computer hardware and associated peripherals
- Evaluate resources for their potential for achieving instructional objectives
- Plan instruction that incorporates technology in appropriate ways

- Use technology as a personal productivity tool
- Create learning activities and products with the following software that will enhance instruction and personal productivity:
    - Word processing software
    - Spreadsheet software
    - Presentation software
    - Web development software
    - Graphic design software
    - Graphic organizer software
    - Curriculum-specific software
- Recognize various implications for computer use in K-12 schools and other educational settings
- Reflect on literature related to using technology in educational settings
- Access, evaluate, and utilize online educational resources
- Explain and give concrete examples of how all the technologies learned in this class can be used to enhance instruction and personal productivity

Typical projects in the course are: Productivity Tools (creating an organized and professional work environment); Inspiration and Kidspiration (developing concept maps and brainstorming webs); PowerPoint Games (designing a game for learning); WebQuests (creating an inquiry-based learning activity with online resources); Digital Storytelling (creating an original audiovisual product on an educational topic); Capstone Project (using the ASSURE model to create a learning activity for future students); Final Reflection (students communicate

what they know, what they want to know, and what they have learned); Final Project / Portfolio (students summarize their accomplishments).

The course meets in a large computer lab, offering one computer per student enrolled in the class. Students must comply with all lab procedures and policies. Most computers are PC machines. There are few Macintosh computers. The students seat in four rows, separated in two sections, facing each other. The instructor's station is located in front of the students and the instructor has access to both PC and Macintosh computers. There is also a screen projector.

Classes occur either in the morning or in the afternoon. There are Monday-Wednesday-Friday classes that last 50 minutes each and Tuesday-Thursday classes with 90 minutes each. Attendance is taken and late work is not accept, however students can be given the opportunity to earn a late pass that may be used only one time during the semester.

Data Collection Tools

The primary resources for data collection were interviews with pre-service teachers and the instructor, observations of class activities, surveys, and artifacts analysis - artifacts analysis involved course web portfolios and digital stories developed by the pre-service teachers, as well as any handouts provided by the instructor such as the peer review form. The primary data collection tools used in this study were:

1. Interview protocol
2. Background information form
3. Peer review form
4. Written reflection on the students' web portfolios
5. TPACK survey (Survey of Preservice Teachers' Knowledge of Teaching and Technology)

There was also the intention to use the TPACK matrix (Matrix Organization of the Thinking for Designing a Unit of Instruction) as a data collection tool. It is a dynamic reasoning tool and was developed and used by M. L. Niess in methods courses at Oregon State University (Niess, 2008) to guide pre-service teachers' decision making process in relation to technology and to teaching and student learning (Appendix D). However, during the development of this research, the course instructor preferred not to use it. Instead, the concept mapping tool "Bubbl.us" was used to brainstorm students' story ideas, with questions based on the TPACK framework. Table 1 illustrates the alignment between the research questions and the data collection resources:

Table 1

Alignment of data sources to research questions

	Interview	Observation	Artifacts	Surveys
Q1. What does the process of designing digital stories look like when pre-service teachers use the TPACK framework?	++	+++	+++	+
Q2. What are the pre-service teachers' perceptions of the TPACK framework as it relates to their projects?	+++	++	+	++

Table 1 (continued)

Alignment of data sources to research questions

	Interview	Observation	Artifacts	Surveys
Q3. How do instructors perceive the effectiveness of the TPACK framework in the design of their students' digital stories?	+++	++	N/A	N/A

+++: Major data sources

++: Secondary data sources

+: Supplementary data sources

Interviews.

Interviewing was a fundamental activity in this study. According to Seidman (2006), "To observe a teacher, student, principal, or counselor provides access to their behavior. Interviewing allows us to put behavior in context and provides access to understanding their action." (p. 10) Understanding the meanings of the participants' actions and experiences was, therefore, the central purpose of interviewing.

Interviewees in this study composed a purposeful sample of pre-service teachers (education majors), as well as the instructor of the course. Interviews occurred upon completion of the Digital Storytelling project and obeyed the students' and the instructor's schedules.

The student interviews (Appendix B) lasted no longer than 1 hour and explored the students' impressions about the digital storytelling project, as well as their understanding of the

TPACK framework as it relates to their projects. The instructor interview (Appendix C) explored the instructor's impressions on the effectiveness of the use of the TPACK framework in the digital storytelling project.

Observation.

The researcher was an observer in this study and did not hold the instructor's position. Observations occurred during all sessions involving the digital storytelling project and included all class activities – lectures, tutorials, students' design and development of digital stories, use of the class materials, interactions.

Artifacts.

The artifacts that were considered for this study included students' final digital story product, written reflections posted on their web portfolios, and course handouts (peer review form).

Surveys.

The background information form (Appendix F) was an instrument to collect data on general demographic information about the students, as well as information on the level of knowledge on various technology tools. This form, typically distributed on the first day of class of the semester, had not been filled by the students yet. An electronic version of the form was prepared by the instructor and the students filled it out at the beginning of the digital storytelling project.

The Survey of Preservice Teachers' Knowledge of Teaching and Technology (TPACK Survey - Appendix G), developed and validated through the collaboration between Iowa State and Michigan State universities, is available at http:www.tpack.org to be used as is or modified. It was administered electronically twice: before and upon conclusion of the digital storytelling

project, with pertinent modifications to the demographic section of the form. All pre-service teachers in the Introduction to Computers course were invited to participate.

The purpose of the TPACK survey was meant to be twofold – to raise awareness of the pre-service teachers' level of knowledge of different aspects of TPACK and to detect the any changes on those levels. Although determining the development of TPACK is outside the scope of this research, the survey was used to help determine the usefulness of the use of the TPACK framework in the digital storytelling project. Due to small participation in the two rounds of the survey (54 participants in the first round and 47 in the second one), however, major conclusions could not be drawn from this data source. The surveys were still mentioned in the results chapter when considered pertinent, though.

Data Collection Procedures

The data collection process used activities originally planned for class assignments, such as software tutorial, practice activity, final project development, and so on. The only activity planned to take extra time (outside class activities) was the interview with students. Interviews did not take more than one hour and were scheduled at the student's convenience. These arrangements were made in agreement with the course instructor.

Audio-recording was performed for the purpose of creating transcripts. Aiming at achieving ultimate confidentiality, audio files and transcripts were kept on a separate drive and deleted within twelve months after completion of the data collection procedures.

Digital Storytelling Implementation

When the digital storytelling started, the Introduction to Computers course had already offered knowledge background to the pre-service teachers on a variety of technology tools,

instructional resources and basic educational psychology foundation. Typically the students already know how to use productivity tools and how to work with digital pictures.

The digital storytelling activity proposed in this research added the TPACK element to the instruction. The assignment applied Mayer's "SOI" framework to its instructional design: 1) S: Selecting relevant information to be retained and processed in working memory, 2) O: Organizing incoming information in coherent pictorial and verbal representations, and 3) I: Integrating incoming information with existing knowledge. (Mayer, 1999) Each part of the assignment tried to address this framework. For instance, students selected relevant information in "Planning Your Story." They then organized information in "Identifying, Gathering, and Editing materials". The integration of information occurred in "Development and Implementation."

Furthermore, the design of the activity applied Mayer's principles to an adaptation of the five-phase media production process outlined by Ohler (2008): 1) Planning; 2) Identifying and gathering materials, expertise; 3) Development and implementation; 4) Honing, editing, and finalizing; 5) Sharing with others. This author recognizes, however, that this is "a fairly generic treatment of this process" (Ohler, 2008, p. 136). Because the bulk of Ohler's work occurs in the K-12 setting, Ohler's framework was adapted to fit the characteristics of the students in pre=service teacher technology integration course, resulting in the process outlined in Figure 8.

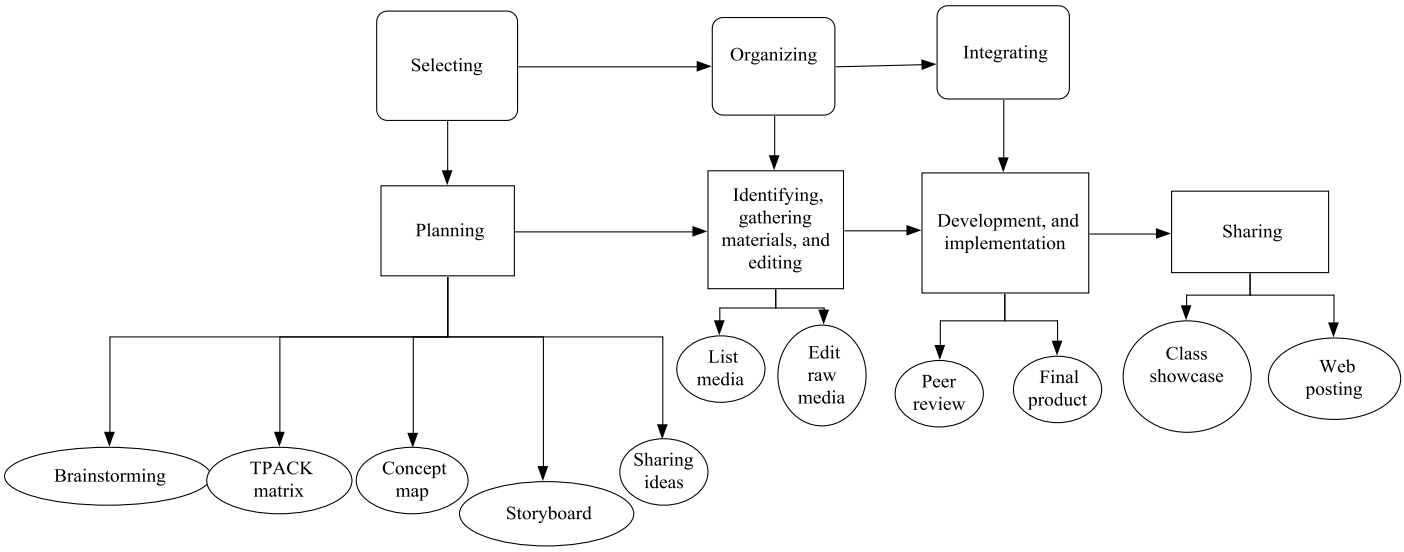

Figure 8. Digital Storytelling assignment process, adapted from Mayer (1999) and Ohler (2008)

The assignment also tried to promote the students' successful performance by integrating motivational strategies into the instructional design, addressing each of the four motivational components of the ARCS (attention, relevance, confidence, and satisfaction) model developed by Keller (Keller, 1983). Motivation, according to Keller, refers to "…the *choices* people make as to what experiences or goals they will approach or avoid, and the *degree of effort* they will exert in that respect. As such, motivation is influenced by myriad internal and external characteristics." (Keller, 1983, p. 389) Motivation deals with the reasons for learning. However, it is usually a neglected side of instruction.

Regarding attention, the novelty of the assignment was already in itself a way to create curiosity. Also, once the students were asked to share their ideas with the rest of class by the end of the class session one (Planning) and they prepared a preliminary version of their story for peer review their level of attention was high in order to perform well those tasks.

Accomplishing a meaningful assignment should contribute to the creation of a sense of personal relevance. Various opportunities to perform meaningful tasks were provided to the

learners, such as expressing their own thoughts, critiquing their own learning process, and giving suggestions to improve the course.

Confidence levels improved once the students started building a personalized product, knowing that there were different ways to finalize it. And finally, creating something that they could show inside and outside the class, building a sense of pride for their achievements provided intrinsic satisfaction to them.

The assignment also satisfied several of the technology integration course objectives. The main ones, however, were: 1) Explain and give concrete examples of how all the technologies learned in this class can be used to enhance instruction and personal productivity; 2) Recognize various implications for computer use in K-12 schools and other educational settings; 3) Reflect on literature related to using technology in educational settings.

The daily planning of the digital storytelling project was as follows:

Class session 1 – fundaments on the TPACK framework and digital storytelling.

This session starts with a primer on the TPACK framework. Lecture and handouts are provided for the class. A class discussion about digital storytelling follows, with the exhibition of instructional examples. The session ends with a discussion of how the TPACK framework can be used to design digital storytelling.

Class session 2 - planning your story.

Students plan their instructional digital stories, according to their chosen subject area/grade. They brainstorm ideas, and use the TPACK matrix. They also construct a concept map, using a tool like "Bubbl.us" (http://bubbl.us/). Next, they create a storyboard, using the story boarding template distributed in class. Once the students are finished, they must be prepared to share their ideas with the class.

Class session 3 - identifying, gathering and editing materials.

Students identify and gather materials and other resources for their stories. They make a list of the elements that they want to show on the screen: pictures, drawings, screen shots, and so forth. Tools and resources for picture editing should have already been discussed in the course. The students can refer to the materials posted on the course blog and also to the handouts for more information on editing tools and methods. In case they finish early, they can move ahead to the development and implementation phase.

Class session 4 - development and implementation.

The students develop their digital stories using Photo Story or another tool of their choice, taking advantage of the software possible features – transitions, titles, music, voice-over, and so forth. Students prepare a preliminary version for peer review. A peer review instrument is distributed to allow students to give feedback on other digital stories. Once they receive feedback from their classmates, they are given some more time to make any changes that they judge appropriate and necessary. Then, the students get their stories ready for the class showcase.

Class session 5 - Sharing the stories.

The students share their stories in the class showcase. They also link their digital stories directly to their web portfolio or they upload the final file (.wmv file) to Google Video or Teacher Tube.

Data Analysis Plan

Data was analyzed inductively, according to the concepts of the underlying theoretical framework. Specifically, triangulation of multiple data sources was used to guarantee the internal validity of the research. All interviews were transcribed using Express Scribe software

and organized with *Microsoft Word*®, a method developed by Dr. Ruona to help analyze data. Ultimately, all interviews were coded and compiled using a master table, making it possible to sort the data in different ways (Ruona, 2005). The TPACK framework was used to develop categories. However, there was flexibility to accommodate different categories that might have risen from the data.

Figure 9 describes the data analysis process for each data source (interviews, portfolio reflections, final digital story products, observations):

Data Analysis Process According to Data Source				
Interviews	***Reflections***	***Digital Stories***	***Observations***	***Surveys***
Transcribed each interview.	Copied all reflections from their original websites.	Got familiar with themes when students build their stories.	Each field note was completed at the end of each class. I kept "headnotes", as mentioned by Emerson, Fretz, and Shaw (1995, p. 19).	Descriptive statistics (Frequency tables).
Read interviews several times to become familiar with content.	Pasted reflections on a *Microsoft Word*® document for easier referencing.	Showcase of students' final products will helped create a broader perspective	Allowed time for reflection and added information to notes.	

		on the themes being explored.		
Used Dr. Ruona's analysis method (Ruona, 2005), coding according to the TPACK framework.	Read through reflections assigning major themes on the side of each passage. This helped locate themes fast.	Watched them again from the students' portfolios to confirm major themes.		
Read through again, listing major themes.				
Compiled major themes.				

Figure 9. Data Analysis Processes According to Data Source

In order to assure the internal validity of the research, some strategies were applied from the very beginning of the research planning. For instance, the purpose of the study, as can be seen in Chapter One, situated the problem in the literature. Another important point is that the significance of the study was well discussed for benefitting pre-service teachers' education and for aligning the digital storytelling activity to the TPACK framework. The qualitative method was the adequate choice for the present case study, because the perceptions and the constructed meanings of the participants were the focus of the investigative process.

Ethically, I made efforts to insure that my research activities in every class session of the digital storytelling project did not influence in any way the students' or the instructor's behavior.

My role during the project was that of an observer. For instance, I sat at the back of the room, discretely. I did not speak unless spoken to.

Despite the fact that "triangulation" is a controversial term (Bogdan & Biklen, 2007), it deals with a concept that was used in this research. According to Merriam and Associates (2002), "In this triangulation strategy, the researcher collects data through a combination of interviews, observations and document analysis" (p.25). The benefit of such strategy resides in the possibility of making a pooled evaluation of data. Indeed, multiple sources of data were used and compared against each other (please refer to Chapter 3 for a complete list of data collection tools, procedures, and the data analysis plan). For instance, the opinions expressed in the interviews regarding the participants' TPACK development were compared to the quality of the content shown in the artifacts produced during the project, that is, the actual digital stories. This strategy proved that the interviewees were sometimes correct in their self judgments and sometimes they were not. There was a tendency to highly regard one's own pedagogical knowledge, for instance, when, in fact, this was not always proven right during the observation of the digital stories.

Another important point is that, although I did not perform member checks, I asked the interviewees if my understanding was correct in several moments during the interviews. Moreover, the interviewing process occurred long enough until saturation of findings was reached, that is, when no new themes or ideas emerged from the data.

Maxwell (1996) stresses the importance of providing "rich data" and to account for discrepant data during the analysis process. I produced verbatim transcripts of every interview that was performed and wrote detailed notes of each class session that I attended - I was present in every class of the four sessions of the course being studied for the present research. Finally,

discrepant data was mentioned in Chapter 4 when it existed and discussed in relation to the other ones that supported major conclusions.

In conclusion, all measures and strategies mentioned above were taken to guarantee that the findings were congruent to reality.

CHAPTER 4

Results

The purpose of this study was to explore the role of the TPACK framework in the design of the pre-service teachers' digital storytelling. Specifically, the guiding research questions were:

7) What is the description of the process of designing digital stories when pre-service teachers use the TPACK framework?
8) What are the pre-service teachers' perceptions of the TPACK framework as it relates to their projects?
9) How do instructors perceive the effectiveness of the TPACK framework in the design of their students' digital stories?

This chapter presents the findings for each question mentioned above.

This research collected data from four sessions of a college course that introduces technology to pre-service teachers and collected data from all the four sessions. Demographic information is reported in the following section.

Participants

Most general demographic data came primarily from the background information form (Student Background Information Sheet), an instrument used by the instructor at the beginning of the semester to collect demographic information about the total group of students (Appendix F). Although typically used in the first day of the semester, it had not been administered yet among students by the time this research was being conducted. The instructor understood, however, that

there was still time to collect useful data through such instrument and the students were asked to fill it out. The instructor also made an update on the form, deleting some questions and adding others. All students enrolled in the course answered the survey.

As mentioned in Chapter Three, the college course here analyzed is very heterogeneous. It not only receives Education majors, but also students from different colleges within the university. The Student Background Information Sheet, then, collected data not only from the pre-service teachers enrolled in the class, but also from the whole population of the course. There was a total 70 respondents in this survey, from the four different course sessions participating in this research: 16 respondents from the 8 a.m. session; 21 from the 9:30 a. m session; 14 from the 11:00 a. m. session and 19 from the 12:30 one.

When asked about what teaching experience they had, the students revealed not having any formal teaching experience at all. Most did have, however, some level of informal or non-certified teaching experience, such as: tutoring after school programs, substitute teaching, teaching Sunday school, working at Summer camps, coaching sport teams. As an example, a student responded: "I have tutored small groups at an underprivileged community center for six months, and that experience is the closest one that I have to real teaching. My mom is a teacher and I have observed her and her colleague's classrooms on many occasions." Another student said: "I currently teach an adult ESOL class. I have taught the class for about 6 months but I received no training. I use the internet and the textbook we are given to learn more about how to teach language learners."

Including the semester in which the study was being conducted, the Introduction to Computers for Teachers course was the first education course for twenty-one of the students enrolled in it. The other students were taking or had taken a number of varied education courses,

ranging from required to not required ones, such as Educational Psychology, Educational Diversity, Marketing Education, Introduction to Special Education etc. One of the students mentioned: "Including this semester, I have taken EDIT 2000 and a freshman seminar called, "So You Think You Want to be a Teacher?". The freshman seminar was for freshmen in college."

When asked how they planned to apply the course information to their major, in case they were not planning to teach in traditional classroom setting, most students could provide some examples of how they can integrate the knowledge built in the course in their professional lives, stating that the subject of the course is pertinent to any profession. Only three students explicitly declared not having any idea on the matter. One of the students, however, explained clearly what could be done in the case of Speech Therapy: "I am a speech major and I plan to specialize with special needs children. I will be able to incorporate technologies such as VoiceThread to help with pronunciation." Another student stated: "Learning about technology is crucial to any field of study. It makes tedious tasks much quicker and learning about something that is constantly evolving is very exciting."

As for technology not located in labs on campus, 95.7% of the students declared having access to a newer (less than three years old) computer with high-speed Internet connection. They also had access to a color printer (91.4% of the respondents) and to Microsoft Office Software - not Works (92.9%).

The students reported as "very good" their skills with certain applications and activities, as follows: sending and receiving e-mail attachments (78.6% of the respondents); Word processing software (68.6%); web search engines (55.7%); presentation software (47.1%). Working with digital photos is an activity that 34.3% reported being very good at and 30%

believe that they are "good" performing it. Using image editing software, however, is a skill that 40% of the class considered "average". Having average skills was also mentioned for working with: digital video (44.3%), concept mapping software (35.7%), and web page creation (45.7%). Their skills working with audio editing software was considered "average" (32.9%) and poor (30%). As for lesson planning, while 38.6% of the students reported having "average" skills with it, 21.4% considered that they were "good" at it and only 11.4% believed that they were "very good" in such activity.

More specific background information that pertains to the pre-service teachers enrolled in the class came from the Survey of Preservice Teachers' Knowledge of Teaching and Technology (Appendix G). It is important to remark that the instructor decided to have all students fill out this survey in order to keep them all focused on the same task, on the day that it was administered. It was necessary, therefore, to filter the answers that pertained only to pre-service teachers. Given the students' responses on the items three and four of the form (major and area of specialization, respectively) - that also allowed them to choose "other" and write the answers-, a certain level of ambiguity existed. Where such ambiguity occurred, I adopted the strategy to refer to the Degree Programs page at The College of Education website in order to filter out the respondents who were not likely to be pre-service teachers. Therefore, certain responses were eliminated from the data set.

The Preservice Teachers' Knowledge of Teaching and Technology survey was administered in two rounds, as explained in Chapter Three. The demographic information reported here was extracted from the first round of the survey, when there was a larger number of pre-service teachers participating in it (54).

There was a balance in the number of pre-service teachers attending the four sessions being studied during this research: 14 at the 8:00 a. m session; 12 at the 9:30 one; 15 at 11:00 a.m., and 13 at 12:30. The majority of the students were female (77.8%) against 22.2% of males. Regarding their year in college, most students were Juniors (35.2%). Also, 90.7% of the students' age ranged from 18 to 22 years old. Varied types of majors were reported, however the largest number of majors represented in class came from Child and Family Development (20.4%), Early Childhood Education (16.7%), and Secondary Education (16.7%). As for the area of specialization, a great diversity of areas were also reported, however, the most represented areas were Early Childhood Education (16.7%), and English and Language Arts (11.1%).

When asked whether they were completing an educational computing minor, 96.3% of the participants answered "no" to that question. The pre-service teachers also informed that 79.6% of them are not currently enrolled or have completed a practicum experience in a PreK-6 classroom.

As for technical skills, 61.1% of the students agreed that they knew how to solve their own technical problems and that they could learn technology easily. However, 50% agree that they keep up with important new technologies. They also answered that they agree that they frequently play around the technology (46.3%), that they know about a lot of different technologies (38.9%), that they have the technical skills they need to use technology (55.6%) and that they have had sufficient opportunities to work with different technologies.

Research Question One: What is the description of the process of designing digital stories when pre-service teachers use the TPACK framework?

This research question used observations and artifacts as major data sources. Interviews were used as secondary data sources. Surveys were supplementary (Please refer to Chapter Three for an explanation of how the surveys were used in this study. Due to low participation in the TPACK surveys, data reported here is merely illustrative when judged appropriate, no major conclusions could be drawn from them).

There was a daily planning of the digital storytelling project. Prior to the start of the project, there were discussions with the course instructor to explain the activities planned for this research, as well as the instructional design of the digital storytelling unit. The instructor was very receptive of the ideas presented and managed to fit the planned activities into her course schedule.

The Digital Storytelling Project – Implementation Plan Development

Class session 1.

The activities planned for class session 1 (Fundaments on the TPACK Framework and Digital Storytelling) occurred according to the implementation plan. Since in Spring 2010 the course was exploring major themes, such as creativity, communication, and innovation, the digital storytelling project was appropriately connected to the creativity theme. Students had been asked to try something creative, or in a different way as a homework assignment right before the first day of the digital storytelling project. Some students reported in class trying to engage in activities, such as pottery, cooking and decoration. After the discussion of these activities, the instructor showed a PowerPoint presentation about TPACK. This presentation respected the level of the students and explored just enough proper information about TPACK.

Much emphasis was given to the TPACK diagram (as shown in Figure 1). The instructor explained that it looks difficult at first and she named the center of the diagram, where the circles intersect, as the "the perfect storm." She also called attention to the needed balance among the different types of knowledge (technological, pedagogical and content). However, she talked about the size of the circles, that they can in reality be smaller or bigger, depending on someone's experience with a certain type of knowledge. The instructor was often careful to ask questions to the students, about their views as to why TPACK would matter to digital storytelling. During these times, only a few students risked raising their hands, and spoke about the importance to align activities such as digital storytelling to students' interests, and also to use such resource to motivate students. During one of the class sessions, the discussion of the concept of pedagogical knowledge led to the meaning of the word "pedagogy." Only one student reported knowing its meaning. Even pronouncing "pedagogy" was difficult for some students.

The instructor showed two examples of instructional digital stories – one about the water cycle being told from the perspective of a water drop and another one about Geometry. This last one was showed as a dull example for being slow paced and very similar to a lecture. She then contrasted the two, raising questions about their intended audience and features, such as narration. Teaching with digital storytelling was then compared to the times when instruction was given through film strips. At this point of the class discussion, the instructor searched on the Internet for a picture of a filmstrip and a projector, since one of the students asked what a filmstrip is.

After the discussion of the digital stories examples and their place in education, especially reinforcing how important it is to encourage students to develop their own digital stories, the

instructor moved back to the TPACK framework, reinforcing its major concepts. In relation to the technological knowledge, for instance, it was stressed that choosing the right tool for the task was important. Some tools for digital storytelling were then briefly mentioned: Storybird (http://storybird.com/), VoiceThread (http://voicethread.com/), PhotoStory, and iMovie. The majority of the students reported in class not knowing about these technological tools. At the end of the class session, the instructor asked the students as a homework assignment to find a curriculum standard in their chosen grade/area that lent itself to digital storytelling.

One of the students, during the interview, commented on the strategy of comparing these two videos in the first day of the project: "I really like that she showed us some examples in the beginning, before we started, kind of gave us a good starting ground, a good idea where we were headed as far as doing our own. I liked that she showed us a bad example, too, so that we know, like, I don't want mine to be like that."

Another student, talking about this first day during the interview, explained how she felt when she was presented with the project: "I felt like when we were presented with the project, (said the name of the instructor) talked about how the digital storytelling it is a new and interesting way to teach topics that are boring and that you could just throw a book at a student and tell him to read it, so that it was good just realizing that there are different ways to go about teaching certain topics. The students go so closed minded this is one way to teaching it, and this is what a good average day in a class would look like, and you think outside of that and use technology in many different aspects."

Class session 2.

Class session two (Planning your story) was to be devoted to brainstorming and storyboarding. Most of the work could be concluded in the first three sessions of the day, even

with classes dismissed early. The last session was canceled, however, due to poor weather conditions. The activities started with a refresher on the TPACK framework. This served to the students as an introduction to one of the surveys taken for this research project. I observed that not all students agreed to participate in the survey. After twenty minutes, once the students had finished the survey, the instructor showed another digital story example, named "We Didn't Start The Fire", with song by Billy Joel. She then went on to explain that she knew the song by heart during her teenage days, listening to cassette tapes, since there was no "lyrics.com" (http://www.lyrics.com/) in that era. The students seemed amused by the story. After sharing her personal experiences about being in school in the 1980s, the instructor explored with the students ways in which they could use that digital story in the classroom. Right after that, the instructor talked about "Bubbl.us" (https://bubbl.us/), an online brainstorming tool, and made a demonstration of it. Such tool was completely new to the students. The instructor commented that she did not want the students to be "caught up" in the technology, but they needed to learn to use it. Also, by brainstorming, each person's digital story was going to result different. She then gave ten minutes to the students to try it, brainstorming their possible digital storytelling projects. The instructor of the course understood that was better to incorporate the questions of the TPACK matrix into the Bubbl.us activity. So, when creating their brainstorm webs, the students would automatically complete the activity from the matrix. After that, she then instructed the students to get in their groups (according to school level – elementary, high school etc) in order to exchange ideas.

Right before class was dismissed due to the snow, the instructor distributed the storyboards and promised to send an e-mail to the students with instructions about the sheets. The fact that classes got dismissed early that day affected somewhat the work with the

storyboards, as well the activity of sharing their initial digital story ideas. Although a few students filled out the storyboard handouts and turned them in, most of the students did not use it and preferred to keep only the brainstorm done through Bubbl.us. A student reported during the interview about the use of the storyboards: "There was a snow day and we ended the class early, and I didn't actually use those and I wish I would have, in hindsight, so…"

However, as for Bubbl.us, the students learned to use it very quickly and found it very useful. A student reported: "I use Bubbl all the time now, for different projects. (…) I used it in the classroom, I've showed it to others students for them to use."

Class session 3.

Class session 3 (Identifying, gathering and editing materials) revisited the activities accomplished by the end of the last class for the first three sessions and tried to consolidate two classes in one for the last session, since it was canceled due to weather conditions. Students were asked to remind their activities with Bubbl.us done during last class and to meet in their grade level groups. They were also asked to share their ideas with the whole class, afterwards.

That was mainly a day, however, to help students choose their digital storytelling tool. As explained by the instructor, Microsoft Photo Story used to be a requirement for the digital storytelling project. However, due to technical issues related to it, other options were be presented and accepted for the project. Photo Story had some compatibility issues with certain Windows versions and the instructor warned the students about trying to install it in Windows Vista and to the fact that it was no longer going to be updated. She then started to present Photo Story in a quick tutorial and also Voice Thread, making the presentation about the most basic features of these tools, and stressing that she did not want to show too much of them to the students. She said: "The best way to learn about technology is using it."

I observed that the students particularly liked the music feature in Photo Story, that lets the user customize a sound track for the digital story. At this point, the instructor made the observation about being careful when introducing such feature to fourth, fifth or sixth graders. She also talked about the advantages and disadvantages of adding video and narration. Students were paying close attention to the demonstration. When the Voice Thread tutorial started, it was presented as a web-based tool with many advantages for educational use, especially for online courses, due to its collaborative features. Using Voice Thread, several authors can create a digital story collaboratively, using telephone, microphone, webcam, text and audio file. "I am not pushing anybody to it, but the more I think about it, the more I like it", said the instructor about Voice Thread. However, I felt that such comment could actually cause the opposite effect on the students, since the instructor appeared to be so enthusiastic about the tool.

Links for the tutorials of other tools were made available at the course blog. Students' options for hardware were also explained, especially talking about the services offered at the Office of Information Technology at the College of Education. Finally, the instructor commented that she wanted the students to tell a good story rather than learning only about the technology. This class was also the last one after Spring Break and students were asked to come to next class with their story ideas and knowing what tool they were going to use.

Class session 4.

The fourth day of the project (Development and implementation) was a work day and occurred after Spring Break. The computer lab had also been rearranged with a different layout during the break and that was a surprise for all students. A pod structure substituted the row arrangement used before. During the first session, students still looked tired and slow paced. When asked about their tool choices, only some already knew that they were going to use Story

Bird, or iMovie, or Photo Story, or Voice Thread. Others did not have any idea yet. Some still needed help, asking the instructor's opinion on the best tool match for their ideas. Another problem was that a few machines were presenting technical problems (logging off suddenly) after the classroom arrangement. The teacher station was offered to students so that they could work. The students were not clearly on the same page, but remained focused on their tasks. All types of activities were being accomplished at that moment – working on portfolios, creating concept maps, browsing the Internet for pictures. It was clearly a mix of two different phases – planning and getting organized – and not a good predictor of following the five-day project implementation plan. At that point, at least another day was going to be necessary in order to end the project. Nevertheless, students were reminded that they should develop a story that was also fun and interesting, and not only a description of things. Using PowerPoint as a tool was discarded by the instructor, who wanted something more technically sophisticated. Class time was also provided for checking out equipment at the Office of Information Technology at the College of Education.

The students' reasons for choosing their digital storytelling tool were varied. The two biggest reasons, however, according to the interviews, were the ease of use (the fact that some tools had tutorials or a wizard feature, for instance) and the availability of the tools in the students' own computers (laptops or desktops). Having a simple tutorial and intuitive interface was the reason why some students made their choice for a particular tool. A student said during an interview, justifying her tool choice: "I think it's because I did go through the choices and that was the one to seem to have the tutorial that was basic, straight forward as possible." However, sometimes the choice was solely based on availability, as this student concluded: "I did

Windows Movie Maker and the main reason I chose Movie Maker is because that's what my computer at home could do."

After choosing the tool, however, some students felt frustrated because they were not satisfied with their choice. A student said: "I didn't know the tools that were being used, they were all new to me and it's hard to first choose a tool and, once I did choose the tool to do my story, I was, I just didn't know how to go about it." And complemented, afterwards: "Well, she [the instructor] went over the StoryBird in class, so that's the one I thought most comfortable using, however, now that I go back I wish I would have done something else, that way I would have learned a new tool that way."

Class session 5.

Class session five was still devoted to development and implementation. It started as another work day for the students. There were many absences, however, in the first two sessions of the course, and this fact irritated the instructor. She then stressed to those present that she expected them to stay. This day was supposed to have the students work on the integration of the elements organized during the previous class session, but the students were still at different stages of their work, performing tasks that were supposed to be finished before this class started, such as getting feedback on their chosen curriculum standards, working on storyboards, searching for pictures, and learning their digital story software tool. This difference in pace affected the peer review activity, planned for this class session.

When the time came to perform the peer review activity, the instructor distributed the handouts and explained what a good feedback is, giving some examples. She also informed the students that she would receive the completed handouts back next class and give the students who returned their peer review forms extra credits. Recognizing that the students were at

different phases of the project, she stated that although they were on different stages, they all had something to share.

The students then began the peer review activity with the students near them, in their pods. First, they showed their stories to one another, exchanging comments verbally, very courteously. Only after this vocalization of their thoughts they would start filling out the peer review form.

The students who chose to work with iMovie were struggling and taking longer than the other ones who chose simpler tools, demanding more technical support from the instructor. Due to this fact, the instructor decided to extend the due date of the project.

When asked about the peer review during the interviews, the students had mixed views about its usefulness. A student mentioned that it was a valid activity for her: "I did the entire project alone, with exception of that one part that, where they had peer review, she gave me some pointers for the project." This student also mentioned feeling comfortable about receiving feedback and that she was looking forward to it. Another student mentioned that the peer review was useful to confirm his expectations about remaining work: "I think that it was helpful. I think it was correct and I think that when I did it she [fellow student] told me everything that I already knew needed to happen so I mean it definitely was helpful and she said the absolute right things."

However, one of the interviewees gave a good explanation about why the peer review was not as useful for her: "No, I didn't feel like it was useful, because we did a peer review, but she [the instructor] said it didn't matter whether you're finished or how much you have accomplished (…) at that point in time, so the other two people that I did peer review with… One was most still confused on what she wanted to do with hers, so she had not started it; the

other one had started it, but she didn't have any pictures or anything done on the computer. (…) I was basically finished at the point when I had mine, and mine was more, I thought it was rather good to go. My peers didn't have much to say about it, it's probably because they didn't have theirs finished."

Other students mentioned not caring so much for the paperwork; therefore they did not finish the peer review activity.

Class session 6.

Class session six of the digital storytelling project was the deadline for submission of the students' finished projects, since it was the showcase. This was the first video practice of the great majority of the students, and they still had many doubts about their technology tools - the instructor stated that she never got so many e-mails before a project was due. Due to this reason, the classes started with the instructor teaching the students how to save and post videos online. She especially addressed how to perform these tasks using different versions of iMovie. Students who had used PhotoStory needed to convert the "raw" PhotoStory file (.wp3) into one for playback on a computer (.wmv file). However, some forgot to do that, as exemplified in the story with the title "Fashion" (Appendix S). The consequence was that the viewer is now required to have the software to watch the story.

The instructor also made a special remark on all four sessions of the course that day about the expectations for the quality of their work, since that was not a video production class. She also talked about how important finishing the first video project is. She praised the students for taking the project seriously, despite the challenges they faced. Therefore, the students should be proud of their final products.

The showcase activity started with students showing their digital stories first in their pods. They enjoyed showing their projects and I observed that this was an opportunity for some of them to socialize with their peers, since I saw several of them introducing themselves. This phase ended with the groups selecting one video to be presented to the whole class.

After a brief introduction of their videos, the students started the showcase to the larger group. The teacher station was presenting a few problems, which was frustrating to the students and to the instructor. Nevertheless, the presentations continued with enthusiasm and the students applauded at the end of each digital story. A student expressed at the homepage of her portfolio how much she enjoyed not only the showcase but also the entire project: "Another thing that I have learned this semester is how to create a digital story. I really enjoyed learning about the multiple different technologies that support the use of digital storytelling. One of my favorite days of the semester was when we got to look at the different stories that everyone created because I feel like it says a lot about someone to learn about the type of story that they created."

The students were very creative to work with technology in unpredictable ways. For instance, a student who chose Voice Thread used her own paper and marker to create the scenes of her story. She then took digital pictures of these drawn scenes and edited them with iPhoto. Finally, she uploaded them to Voice Thread.

Not all students used narration in their stories. Some actually made the choice to make a live "narration" during their projects exhibition. A student made a comment in her portfolio about not adding narration to her digital story named "Founding of Georgia" (Appendix S), which was intended to work as a "movie preview": "I was able to get that 'movie preview' feel by adding music and utilizing the features of Windows MovieMaker. I was hoping to use narration instead of text, but the text worked better with the music. Because some of the words

might be difficult for my second graders, I will most likely narrate as we are watching it." Although adding narration was not a formal requirement of this particular project, several students experimented with microphones and the sound editing features of their technological tools, when possible.

Project Performance and TPACK Developments

The Digital Storytelling Project implementation plan occurred without major discrepancies. It required one extra day due to the dynamics of that particular context, but it provided a supporting structure to the overall project development and showed that skills necessary for its accomplishment could, indeed, be taught in sequence, building upon the skills from previous steps. It was also flexible enough to have the students experience the process in a personalized manner, as, in fact, they did. One of the students expressed the idea that she was too ambitious in the beginning and that she soon realized that she had to adapt her amount of information in order to fit a two to three-minute video. She then decided to use her digital story as an introduction to unit in History. Another student, instead of choosing a standard first, then deciding on a story and finally going to try to find the right pictures, did it the other way around. She first found on Storybird an appealing artist scenario with pictures of fruits and vegetables. She then built her story around a health standard from there.

This was the first time that the students ever built a real digital story. Some students had experimented with slide shows before, but did not try using the same tools to create a story. It was also an opportunity to learn something new and interesting, working with different technological tools. Observations corroborate this idea, since the students seemed to be motivated to carry out the activities planned for the project, even in the early classes and they strived to solve technical or pedagogical issues.

Considering the experience of developing a digital story as a whole, it was a very enjoyable opportunity for the students, according to the opinions expressed in the interviews and also in the students' portfolios. A student said: "I did enjoy it! (…) I like that it was straight forward, just make something that you could use, and I could teach in a classroom setting, and it was fun." The students also felt proud of their finished products.

Another student enjoyed the project as an opportunity for self-expression. When asked what his digital story meant to him, he answered: "I think it means me putting my own words into a visual representation for people to see, kind of what was going through my mind, what I am trying to teach them, something, and I wanted to make it interesting, but you know. I can't always do that with me just standing and talking to people and telling them about things."

Being proud of their final products was a feeling expressed by several students, even when they aware of their limitations. A student said: "Wow, I actually made a little digital story, and, it is something that I am proud even though, like I said, I would do differently, but, still, something… OK, I did that, you know."

As for challenges found along the way while developing their stories, the students mentioned, mostly, technical issues such as integrating music into their projects, figuring how to work with the microphone, and adding narration. Indeed, as it can be verified in some of the digital stories, the integration of sound or narration did not always work perfectly. The digital story "The History of Baseball" (Appendix S), for instance, presents much noise and interference during the narration. Apart from technical issues, deciding which story they were going to tell was also a challenge for some. Other students also reported difficulties finding the appropriate pictures for their stories.

It was interesting to notice that very few students worked in partners. Most students preferred to develop their projects individually. This occurred due to the fact that some did not realize that they could work collaboratively. Although mentioned in the course blog, such option was not enough emphasized in class.

Although it is not possible to precise numbers, there was a preference for the tools VoiceThread and iMovie in the digital storytelling project. The overall technical quality of the projects presented on the showcase day was amateurish (with few exceptions) due to the fact that this was the students' first experience with digital storytelling. Furthermore, depending on their choice of technology tool, the task of constructing a digital story would be more or less complex. Despite these observations, it was noticeable that the students made efforts to show many of the technical skills learned in class, such as incorporating transitions, integrating music, editing pictures etc. For an example of a very successful instructional digital story, please watch "Farmer Bill" (Appendix S). This digital story has the proper amount of instruction and entertainment, demonstrating a very good technical quality. It is intended for a fifth grade Math class and teaches about area of geometric plane figures.

Pedagogically, in comparison with previous digital story experiences developed in the course, there was a gain in pedagogical quality, because there was a raise in the level of the themes being explored and the stories were more focused on instructional objectives. When asked in their reflections what they wanted their students to achieve through their digital stories, the pre-service teachers answered: "I want students to be able to write creatively and comprehend what they are writing", or: "I want students to be able to use technology to create their own literature." For instance, the digital stories "Beowulf" and "Hatshepsut: Queen of The Nile?" (Appendix S) present the stories of their respective protagonists mixed with popular

culture, in a creative way. This strategy is intended to make a correlation with what the students already know and catch their attention. Another creative way was to tell a story in rhymes, as in "Kindergarten Class Routines". This story is well suited for kindergarteners. The digital story "Where in The World is Stanley?" presents a guessing game while telling a story, in "Where in The World is Carmen San Diego?" style. "The History Baseball" presents a more traditional way of teaching with visuals – as support of a lecture. These examples (found in Appendix S) show how much differentiated effort the pre-service teachers have put in preparing their stories with a pedagogical view that deviates from a more traditional one.

Project instructional decisions.

The students rated positively their experience in their teacher education program. In both rounds of the Survey of Preservice Teachers' Knowledge of Teaching and Technology, the students highly believed that their program has caused them to think more deeply about how technology could influence the teaching approaches they use in the classroom (50% in the first round and 55.3% of the students in the second round). All the interviewed students agreed with the instructional decisions that were made in order to teach the digital storytelling project. They pointed out some strengths and weaknesses of those decisions. For instance, starting the unit by showing some examples (good and bad), the link to the creativity theme, and the use of visual aids were perceived as fortunate instructional decisions. As for disadvantages, some students reported feeling lost at the beginning about choosing their own digital story themes. One of the students mentioned that instructions were sometimes confusing and another one felt that there was not much accountability for the activities performed during the project. Suggestions for future digital storytelling projects included: extending the length of the project, have students spend more time with the technological tools, let the students have the opportunity to create a

mini-digital story as practice before the actual one, narrowing the choices of digital storytelling tools, making sure students are on the same page during the project, and promoting more sharing time among students along the project.

Technological pedagogical content knowledge (TPACK) developments.

Knowledge of the TPACK framework in the context of the digital storytelling project is translated through the understanding the technical demands of a digital storytelling activity, the applicability of digital storytelling for the teaching and learning process, as well as through the understanding of what can be taught through digital stories, and the applicable teaching techniques in a particular context. The artifact (digital story) should translate the understanding of the aforementioned elements.

Technological knowledge (TK).

Technological knowledge is, perhaps, the most visible or evident form of knowledge since it is materialized in the actual artifact (digital story) developed by the students.

Most students who were interviewed felt comfortable with the technological tools used during the project and were apt to spend the time to learn them. Only one of the students openly manifested how overwhelmed and nervous she felt at the beginning of the project in relation to learning a new tool – iMovie, in her case.

Overall, the students learned a plethora of hardware and software skills, building on previous knowledge (e.g. dealing with digital pictures, searching and downloading content from the Internet). As a summary, for instance, the students were able not only to learn about the existence of certain features built in their own computers (e.g. microphones, speakers), but they also really learned how to use them. Among the software skills, the students learned their choice

of digital storytelling tool and also some type of photo or music editing software (e.g. Garage Band). They also learned how to apply music to their stories and to manage their timing.

However, evidence from the digital stories created by the pre-service teachers shows that there were different levels of technological knowledge development. For instance, the digital stories "Where in The World Am I From?", and "Farmer Bill" (Appendix S) reveal good mastery of the features present in iMovie. The digital story "Lilly and Larry's Dancing Adventure" makes proper use of typed comments, taking advantage of what VoiceThread has to offer. Not all users of VoiceThread in the digital storytelling project did that. Overall, however, the students demonstrated good use of the technological knowledge that they develop during the project.

The TPACK surveys have shown a slight change related to technological knowledge - items five and six, respectively (Appendix G): The second round of the TPACK survey shows that 51.1% of the students believed that they know a lot of different technologies, in contrast to 38.9% in the first round (this actually meant a difference of three more people from one round to another). Also, 70.2% of the students in the second round agreed that they had the technical skills they needed to use technology, contrasting with 55.6% in the first round (again, representing a difference of only three people). Please refer to Appendices Q and R for the frequency tables of the two rounds of the TPACK surveys.

During the interviews, the relationship between technology and pedagogy (TPK) was also discussed. When asked if her experience in the digital storytelling project had enhanced her knowledge of technology, a student was able to express her opinion in comparison to her previous school experience: "Yeah, it really did. Because I remember seeing all the different choices we could do - we could use the PhotoStory, the VoiceThread and it's something that I

don't think I ever would have considered before. I think, going back to my schooling, too, when a teacher teached something like Econonomics in third grade - portion of it, you do learn. It would have been just something like a poster board. They had what was the definition, something showed on the board and we would all copy down. So it was a good way to realize that there is different ways you can teach things that are more interesting for everyone."

Pedagogical knowledge (PK).

Despite the fact that the percentage of pre-service teachers who believed that they could use a wide range of teaching approaches in a classroom setting has decreased (64.8% in the first round of the TPACK Survey in item 24, compared to 57.4% in the second round), it is still high the agreement among students that they can use different methodologies. During the interviews, however, when asked how they would use digital storytelling in a classroom, the students could not mention any specific teaching strategies by name. Instead, they were able to describe the way or the situation in which they would use digital storytelling with their future students, revealing a low technological pedagogical knowledge at the same time. For instance, a student cited the following example: "I was thinking with the interactive aspect of it, you could introduce a subject, I am pretty sure with PhotoStory or something like that, (…) but then make it into a jeopardy game and then the kids (…) can break apart in teams and it would be like review questions, something like that."

Another student revealed knowledge of learning theories, but did not provide practical examples in the digital storytelling context: "I know that you need to keep the basic structure of what, things that you learn, things that required to be learned in there, you get that tied in with something that's age appropriate, like something that's close to real life, combining knowledge that you need to know with things that they already do know and things they are interested in,

because students have different interests and sometimes if you apply that to something that they have general interest in their early life and they'll probably connect to it a little bit better."

The majority of the digital stories reveal, however, a tendency to prioritize the lecture model through slideshows. There were exceptions, nevertheless. The stories "Doug and His Favorites", and "Kindergarten Class Routines" (Appendix S) made an effort to be creative, teaching through rhymes. "The Adventures of Little Orange" teach about colors in a fun and simple way for kindergarteners. And "Farmer Bill" brings a pedagogical approach that is very different from the traditional one. It made efficient use of visuals to teach Math, connecting its content to humor and cultural interest.

As detected in the TPACK surveys, however, the pre-service teachers reveal a high regard for their teaching skills, despite the fact that they have very little teaching experience. For instance, more than 50% of the respondents in both rounds of the survey have said that they agree that they can adapt their teaching based upon what students currently understand or do not understand (item 21): 59.3% in the first round and 51.1% in the second round.

The assessment of student performance is also a highly estimated skill among pre-service teachers, as detected on the TPACK surveys. It was high the agreement (despite a slight change) that they know how to assess student performance in the classroom and that they can assess student learning in multiple ways (item 23): 57.4% in the first round and 48.9% in the second one. However, the interviews revealed that the students had difficulty relating to how they could asses using digital storytelling. Also, the idea of assessment is strongly connected to the idea of grading. A student commented on his difficulty with this matter: "I am having trouble, I think with something like digital, or with PhotoStory at a certain age they could use PhotoStory to create something that I would grade."

Pedagogical ideas related to digital storytelling were expressed in many ways. During the interviews, the students correlated digital storytelling to "more enjoyable", "more interesting", or "more memorable" ways of teaching, translating a certain measure of technological pedagogical knowledge (TPK). It was also referred to as a more engaging way to use technology in the classroom, resulting in more student interest to learn a particular topic (TCK). Digital storytelling was also cited as a way to accommodate visual learners and to bring a change of pace in the class routine, as students engage in something that is out of the ordinary.

Digital storytelling was also considered for situations that should be less frightening or intimidating for students. As stated by a student: "(…) this is another way to express yourself that's relatively low risk, it's not asking the student to get up there and perform something, it's asking the student to perform a technological task, and so you can have more student participation that way."

The idea of instruction connected to entertainment was also revealed in the interviews: "I think it's a way to get kids interested in the topic, but at the same time teaching them something, and it might stick with them a little bit better than watching a documentary or just a lecture." Some digital stories made an effort to be connected to such ideas. For instance, "The Skeleton Man" (Appendix S) made good use of suspense, as a way to keep the audience's interest in the story. Mixing the stories to elements of popular culture was present in "Beowulf", and "Hatshepsut: Queen of The Nile?" According to the authors, this was an attempt to translate a more dense content into something more comprehensible.

There is also the notion that digital stories are a "personalized lesson", something specially made to address a particular group of students. A student mentioned: "I think it just provides something out of the ordinary, so the students would be like, excited, almost about it,

because it's not the typical textbook or, whatever you're looking at, it's a different thing, and your teacher made it specifically for you, so it's almost a personalized lesson."

Ultimately, digital storytelling was mentioned as a way to motivate students to be creative and develop their own stories to teach each other. "(…) They learn better if they are doing themselves", said one student. And another one said the she would: "(…) get them to come up with their own to try to teach their peers about a topic." This last statement is clearly related to pedagogical content knowledge (PCK). Another student provided an idea for how to align pedagogy and content: "Say, there is just this big, broad topic, like Civil War, and each of the kids get in groups and have their own PhotoStory, like they're about the North, they're about the South, I think things like that are interesting." Later, the student completed the idea: "And then everyone presents it to the class, each group becomes really well informed on that one topic, but then they still get to get the information on all the topics. And grade something like that, like grading their own PhotoStory."

All the interviewees declared the intention to use digital storytelling with their own students when they become a teacher. One of the students, however, was very realistic about how often he would use digital storytelling: "Yeah, I definitely think I would[use digital storytelling], I don't know how often, probably just have to come up with one or two a year, to continue on using because it does take some time to do."

Content knowledge (CK).

Having enough knowledge in a content area was expressed by one of the students during the interviews. She was pretty confident that she had enough knowledge in History. The TPACK survey has detected a slight change in the confidence level of the students whose area is Social Studies. The second round of the TPACK survey (item 11) has shown that 42.6% of the

respondents agree that they have sufficient knowledge about Social Studies, compared to 31.5% in the first round. Among the other areas researched in the TPACK survey (Math, Science and Literacy), Math and Literacy have presented some increase in the percentages of the questions asked relating to content expertise. Science, on the other hand, has slightly presented changes.

Among the students who were interviewed, four of them chose to create a digital story related to Social Studies standards. Two of them chose Science and the others preferred Health, Language Arts, British Literature and Fashion Marketing.

Overall, the digital stories reveal that the pre-service teachers have dealt efficiently with the topics chosen and achieved a good balance between the amount of content and the time used to teach it. As examples, please refer to the Social Studies stories "Founding of Georgia", "Harriet Tubman", and "The Story of Thurgood Marshall" (Appendix S).

As for what can be taught through digital storytelling in their content areas, revealing the alignment of content and technology (TCK), the students were very secure citing specific topics in History, Literature, and also in Science. For instance, a Science pre-service teacher, who designed a digital story on the phases of the moon, mentioned about his story: "The general story is the sun and the moon and trying to explain their cycles. I have the cartoon characters playing a game of hide and seek, it's… The moon goes around the Earth to hide from the sun, but I had to, it seemed pretty straight forward, but I had to think of a lot of effects."

Despite the fact that one of the students stated that any subject can be taught through digital storytelling - it only depends on how you present the content, the other students were more cautious. They mentioned that maybe not all topics would work well with digital storytelling, translating the idea that there are subjects that lend themselves more naturally to it. Such notion had been reinforced in class by the instructor. A Science student said digital

storytelling would better cover "something like when there's cycles, for learning cycles, visually showing the different ways the moon moves and putting it without all the filler, it presented there in an educational informational way would be the best way to present that topic. Maybe not all topics would work that well, but…"

Similarly, the notion that there are some contents that are better understood when expressed visually was present in the interviews. One of the students summarized her understanding as this: "Sometimes you need to represent something visually, you can't just tell them, and it's a little harder for students to understand when they're reading out of a textbook or something how things are done. It's also good to have a little change of pace sometimes and do something a little different because it addresses all kinds of different learners."

Technological content knowledge (TCK) was further explored by the pre-service teachers. Teaching with digital storytelling, as mentioned by the interviewees, is an effective method to introduce a new topic to the students or to review one. It can also be used to simplify topics. Above all, it was regarded as a powerful way to stimulate creativity and expression while teaching certain content. A student commented: "I think the use of digital storytelling for instruction is to be able to express something to your students in a more creative and different way, you know, it's not just someone standing up lecturing you the whole time or even just doing repetitive group work activities."

When asked how they could make the learning process of their subject areas with digital storytelling more interesting, a student mentioned that she would encourage her students to develop digital stories of historical facts from the perspective of historical figures. She explained what that she would do: "Try to get it that way, put my students in somebody else's shoes, to make them see from a different stand point." Later, she added: "So they should learn when

looking at their classmates' stories also, I also think they can work in groups and make the story and I would probably even make it more detailed also." Such comment reveals technological pedagogical content knowledge (TPACK).

Making the learning process more interesting in British Literature through the use of digital storytelling was also discussed by another student in the interviews. She related the characters of a novel to those of comic books as an introduction to a reading activity. She stated: "I was gearing it towards seniors and I did a combination of Beowulf and trying to introduce the topic a little less intimidating, because the minute students see Beowulf and see the literature they're just, they're completely overwhelmed. At least I was when I was in High School, so I did it to where it was a comparison to comic books, to bring a more modern idea, I guess, and to break down the wall also of the two."

As for how much content can be conveyed through digital storytelling, since the students had been asked to develop a two to three-minute video, they felt that they could not deal with too much content. However, two students expressed that, in case they changed anything in their digital stories, they would change the content, trying to add more to it.

Research Question Two: What are the pre-service teachers' perceptions of the TPACK framework as it relates to their projects?

This research question used interviews as major data sources. Observations and surveys were used as secondary ones – again, data from the TPACK surveys were merely illustrative. Artifacts were supplementary.

Volunteers for the interviews came from the four sessions of the course where this research was conducted. Primarily, twelve students volunteered to be interviewed. Since two of them were Speech Therapy Majors, however, ten students were considered for data analysis.

During the interview, most students could relate to the TPACK framework. Nevertheless, one of the students declared being still confused about it even though she remembers receiving instruction about the framework. Also, a student wrote in her portfolio that TPACK was the curriculum standard that she had chosen for her digital story, clearly showing confusion between the Georgia Performance Standards and TPACK. Among all interviewees, only one student stated not remembering it at all because, according to her, it was not emphasized enough in class. It was her perception that the activity called "TLAT" (Think Like a Teacher) was the emphasis more than TPACK. As a matter of fact, this was true, since the TPACK framework was only introduced in the course for the Digital Storytelling project.

Students' impressions of TPACK framework is that it was well connected to the creativity portion of the course and to the digital storytelling project. It served as a "general guideline" working to "put everything in perspective" during the development of their stories, as they mentioned in the interviews. While doing their work, the students regarded the framework as a "planning method" to use technology in order to convey a concept or content. Also, according to

the students, such planning method was not hard to follow and they performed their tasks in a natural manner with it.

The students also mentioned that the framework is a good way to match content and technology together. Since nowadays students have more contact with different types of technological tools, using a framework that combines well content with technology will not only catch those students' attention but will also lead to more critical thinking skills - hopefully.

The value of the framework was mostly connected, then, to the notion that it was a guiding and organizing element to keep the use of technology "appropriate" in the classroom. One of the students stated: "The framework basically just keeps us from straying off too far, to making sure to keep it educational and keep it informational, and not basically give kids a laser show without reason." Another student expressed her thoughts about the usefulness of the framework this way: "I think that this [the framework] helps pull the focus into why are you using technology in the classroom. I can show a movie or a slide show all day long but if it's not focusing on what they need to be learning for that grade level on that semester or what they need to take away from it, then it's useless."

Students pointed out, however, that the value of the framework also resides in its connection to the creativity in integrating the technological element: "We have to keep up with nowadays students and figure out what they are interested in and how we're going to be able to get them interested in whatever we're teaching. So, I think that creativity is a huge part of many different technology applications, (…) it makes it a more fun way and exciting way to learn about something that might not necessarily be as exciting if technology didn't play in a role."

Another student mentioned that the framework is valuable for the way it helps novices while integrating technology in the classroom: "I think it's important to keep in mind, it gives a

good framework of how to set things up, and get started with things like that, to make sure you have all the necessary elements of it." Another student complemented such idea with the notion that good instruction on the framework is needed to be able to get started with it.

During the interviews, a student mentioned that the TPACK framework was almost common knowledge to her, but in conversations with her peers, she discovered that they used the framework more for pedagogical guidance.

All the materials related to TPACK used in the digital story project were considered to be good and efficient in showing how the different types of knowledge correlate to each other, however the students generally pointed out that the most useful materials were the TPACK diagram (Venn diagram) and the "Bubbl.us" brainstorming tool. Two of the students mentioned that, despite the fact that the idea of the framework is "common knowledge" to them, the Venn diagram served as a "refresher" or "reminder" of the things that should be considered when one wants to "make an educational point".

The diagram was also considered to be a good way to condense visually all the information contained in the TPACK framework, especially in contrast to the instructor's PowerPoint presentation about the different types of knowledge in the beginning of the unit. As mentioned by a student: "The circle graph helped a lot, because the PowerPoint was just lengthy, it just looked like you're just getting this crazy amount of information at once and it's hard to piece it out together, but then you saw the diagram it really allowed you to see how it all needed to relate and the different parts together, that really helped a lot. " This student's opinion about the PowerPoint was contrasting with my observation of the presentation, since I had considered that the presentation had much humor embedded into it and I considered that the amount of information respected the level of the students.

Some students manifested the idea that they followed the framework unconsciously while developing their digital stories, which is, in reality, a reflex of the work done during the planning phase with "Bubbl.us", since the students had to answer questions based on the framework while brainstorming their story ideas. A student stated: "I probably went by the framework without knowing it. I did not intentionally plan out, did think about the framework. But looking back at it, my thought process went with the framework. But I did not acknowledge that at that time."

When asked about advantages and disadvantages of the framework while developing their products, the students could not relate to any specific limitations of the framework per se. They could, however, manifest that they did not feel limited by it and that their story ideas went along well with the framework.

All interviewees consider that they learned to develop a meaningful product that they can use in their future classrooms, having the TPACK as a guide. They are aware, however, that they may need to make some modifications in order to enhance it. As a student affirmed: "(…) I may need to edit something, and make it a little better before I would show it to students or show it in a more advanced setting, but I think it was a good start, I have the knowledge now to be able to create something again." Another student firmly stated: "(…) I think that what I did could be integrated into a classroom to teach students."

Students also mentioned that learning to develop a product having the TPACK as a guideline was an important asset that they can carry on to their future professional lives as teachers – even to teach other teachers. A student affirmed: "If our principal asked: 'Hey, I need you to do a presentation for the other teachers, like a workshop, discussing technology.' I could do that." Such notion of leadership is also prevalent among the surveyed pre-service teachers, even though the percentage has dropped a little in the second round of the TPACK survey

(46.8% against 59.3% in the first round). Most students agree that they can help others to coordinate the use of content, technologies and teaching approaches at their school and/or district (item 46).

As for modifications on their digital stories that they would like to make based on the TPACK framework, some students mentioned the desire to add more content or more technological features, such as narration.

When asked about what the relevance of the TPACK framework for other projects developed in the EDIT 2000 course would be, the students mentioned that the framework is connected to everything they do in the classroom, and, if used more times, it would become very familiar to them: “I think that if it keeps being reintegrated or reintroduced in all the projects that we do, it would become second nature.” Another student said: “I think no matter what lesson you’re planning, if you have looked at this model it could help you and aid you in figuring out a lesson plan for your students or whatever project you’re accomplishing.”

Research Question Three: How do instructors perceive the effectiveness of the TPACK framework in the design of their students' digital stories?

This research question used the interview as major source for data collection. Observations served as secondary data sources.

Due to the fact that, by the time this research was conducted, all other sessions of the Introduction to Computers for Teachers course had already had their digital storytelling project except one, it was only possible to investigate the sessions being taught by one instructor in particular. However, in order to provide strength to this part of the research, all four sessions being taught at that time by that instructor were investigated.

The instructor being investigated had eight years of experience in the Introduction to Computers for Teachers course at the time she was interviewed, teaching it since Fall of 2002. Her pedagogical approach is project-based, and she explained that she tried "to develop a course for the students to become independent learners, so they are able to select tools that support (…) the goals of their curriculum." She also explained that a project-based approach is, according to her, the best way to convey the type of information covered in the course to her group of students.

The instructor's experience in the digital storytelling project this time was considered to be very good, compared to previous experiences. Less focus on technology and more on content set this experience apart from prior ones. According to her, in other semesters this is how she worked: "I would let them write a story, kind of about anything, so they're really comfortable learning the tool, they don't have to worry about the content, they just worry about the tool. And so what happens is the actual end project is not very good." However, she understands that introducing the TPACK framework to the students that semester has brought positive change to

the course. She explained: "Using that I think gave more structure to what has been a project that did not have the structure that it needed. So, I think that their stories are more much like stories this time, they are much more focused on content, or curriculum, that they have been in the past. They were better just in general, but I think they really took the hard parts of the TPACK model (…). Because I would say, well, the students did a good job."

However, the instructor was skeptical about attracting the students' attention to the importance of the TPACK framework in the beginning of the project. Although she was interested in the idea of the use of the framework and thought that students should know the educational fundaments of the activities performed in class, she did not expect students to be interested in the TPACK. Nevertheless, the instructor's expectations in relation to this issue changed right at the beginning of the project activities and she felt the interest of integrating the TPACK framework in other class activities. She reported: "But after the first day - I guess it was the first day of the storytelling project where we went over TPACK with them and explained what it meant, showed them the graphic and all that - I think for them it really clicked, and it's something I've been using since with their other lesson plans, writing activities, so… It's something that I wanna make sure I use more throughout this semester and not just for this digital storytelling project."

The instructor is also aware of the constraints of using the TPACK framework with her heterogeneous group of students. She said: "(…) my class is a 2000 level class and the students come from all different backgrounds and experiences and I am talking only about the Education majors. For some, ideas about pedagogy and content… They're coming to me with that. Others, they never heard the word pedagogy, it's the first time they heard about curriculum and

curriculum standards, and so it's not a disadvantage of the model, but a disadvantage when using the model with my particular population of Education majors.

Having the students free to choose their digital storytelling tool created some challenges to the instructor. However, the biggest one devised by her was going to be the grading process aligned to each students' choice of technological tool. Taking into account the complexities, possibilities and constraints of each tool and the end result of each students' work, she concluded: "…it doesn't all have to be equal to be fair." Due to this fact, she was considering making changes in the grading process in the future: "Everybody doesn't have to have the same complexity in their task, but making sure there is a balance when I am grading because of the differences in complexity (…) do I change the requirements based on the tool they chose, or don't make them choose a tool? So, gotta figure that out."

Another challenge faced in her class, according to the instructor, was to work with students from different Majors. For instance, working with Speech Therapy Majors intending to develop a career in the K-12 setting was challenging, since it is a struggle "for them to come up with something to use with their students", she said. Most of them chose Storybird as a digital storytelling tool and it was still difficult for them "finding a legitimate use of that tool."

The instructor had a strong opinion about why developing a digital story is beneficial for her students. She links the project to the opportunity of being creative and extending this ability to the pre-service teachers' future students: "(…) We cover creativity and innovation, and digital storytelling is a great way for them to be creative at all, so let's see how the students can be creative in any subject not just Language Arts, or Art." She also added that the main purpose of the project is for the students: "(…) to see how simple it can be to provide opportunities for children to be creative, because if you can do Voice Thread, then a fifth grader can do a

VoiceThread and it's free and it's quick and it's easy, and it doesn't require you to have a nice camera and they will have to do real editing footage."

Among other gains, the instructor could also point out:

As students have the real opportunity to create an artifact, and, above all, engage in something new to them, there is motivation to learn different technological tools, overcoming any challenges that they may face along the way. For instance, the students in the Introduction to Computers for Teachers course learned several technical abilities: they learned about a digital storytelling tool, about file storage and file conversion sites, about music file conversion. The students especially learned how to find answers on their own, becoming independent learners. According to the instructor's opinion: : "It's really the first project in this semester where they are able to completely immerse themselves in a tool, even though I really always wanna have them focusing on content, it's nice for them in a technology class that meets in a lab to, for a week or two, just to come in and work in the technology, because they learn so many other things that I anticipate like, several of them were learning screen shots, because they wanted to use things that they couldn't get other way. Some [were] learning how to edit those images and insert them and just microphones and they learn about OIT, because they had to down and check out computers and microphones."

It was very interesting to the instructor to note that several students, instead of using a scanner to convert a physical picture into a digital one, preferred to take pictures of those images, adding comments with markers, and uploading them to the online digital story tools. The instructor views this as "(…) the shortest route to getting something done" and something really clever. This solution can be particularly observed in the digital story "The Adventures of Little Orange" (Appendix S).

As for the technological training of the tools, the instructor was thinking of a different idea: instead of using class time to show the students how to use any of them, she would provide tutorials and previous student examples, and use more time on story ideas.

According to the instructor, creating a digital story is a positive way to enhance the students' idea of technology integration. She said: "I think it's one of the main opportunities we have in this semester for them to really see that connection between content and technology." Furthermore, she mentioned that technology, in this context, can be seen as "an alternative way that has some enhancements that is very different from what they might be able to do in a traditional way."

Still related to the challenges related to the fact that the students chose an array of technological tools in order to accomplish the project, the instructor pondered about the quality of the work achieved with different tools. Her first thought was that the work developed by someone using iMovie, for instance, could not be paired with someone else's done with Storybird. However, reflecting on her own words, she concluded that it does not have to be equal to be fair, as she said. She cited the example of a students'work with Storybird: "…one student that did Storybird that was rhyming and something, you would take right into a Kindergarten class, it was about colors, I think, and it was fantastic." The instructor was referring to the digital story "The Adventures of Little Orange", aimed at second grade Art students (Appendix S).

The fact that students needed little assistance with the technological tools that they were using called the instructor's attention, especially because they were learning different ones at the same time. This led to more focus on other types of knowledge. The instructor commented: "So, technically-wise, as far as technical skill, I was surprised at how little they needed

assistance, I feel I answered more questions about content: “Would it be okay to do a video about this topic”, “would this make sense”, “would this be appropriate for grade level”, which is what I would rather be doing anyway, that’s much more enjoyable for me, which is surprising, because you would think: since we didn’t do any direct teaching of the tool, that would be all their questions, and really until they were finished, they didn’t really have questions of technical nature, it was more of core content: “I am not sure what to do”, “that’s what I thought of”, “which one should I choose”, “I think this is too easy”, “I think this is too hard”, you know, they were really having to think, so that was good.”

Asked as to whether she thought that her students learned to develop a product that could be used meaningfully in their future classrooms, the instructor responded that some certainly did: “Some of the ones that I’ve seen they could use tomorrow in a classroom.” At this point, the instructor mentioned the digital story “Famer Bill” (Appendix S): “I think that one can be used immediately in a class today.” However, the instructor made an important distinction on the level of maturity of the work developed by different students in her class: “I think some students learned how to create a video, whether it’s one they can use in a classroom or not. And I think those students who learned how to technically create a digital story are students who are early in their Education program or they’re not Education majors at all. But I do think the students who have much more in class experience did create [meaningful stories], (…) they were the ones with the content questions. It’s really hard to create something and use again if you never met the people you’re gonna use it with.”

Due to the fact cited above, it is the instructor’s perception that some adjustments would be necessary to the digital stories created by the students with less pedagogical knowledge: “(…) Generally they would have to have some modification about how good, how appropriate it

was, because they don't know their students, even though we try to have them consider their class roles we give them in the beginning and all that." However, there is not enough time in the course program to work with the improvements, despite the fact that creating another digital story would be ideal: "We just don't have time to create another one. The most of them, their next one would be the best one, because now they know how to do it."

Thinking of improvements to the digital story project that she can do in the future, the instructor was planning to construct a chart containing the advantages and disadvantages of each digital storytelling tool, with student examples - something that she now has. This improvement would help students decide earlier which tool to use and also the possibilities and constraints of each one.

Another change would come with the peer review process. The instructor had the perception it was a good activity, but evaluating her own performance she said: I am not good doing peer reviews. (…) Pushing close to the end of the project, I am watching the time. And so I think the peer was helpful for those who did it. I could have done a better job of making sure everyone did it and discuss the feedback, make this part of the evaluation or something like that, then I think that would be better, but I think as much as we used it, it was helpful." This view is compatible to a students' perception of the peer review, mentioning the absence of accountability during this task, which led to a lack of motivation by some students in the class to finish the activity. It is also true, however, that the weather conditions that day had an impact on the activity, as reported earlier.

Nevertheless, according to the instructor, the fact the students are at different stages of the process happens anytime a peer review is performed. Also, attaching the peer review to the grade came as a possibility to her. It would be a solution to "(…) link that peer review,

unfortunately, link it to grading, so it is taken seriously. And have a place, maybe in their reflection, where they document any change or modifications they make based on the peer review, which I really didn't do for this."

Strengthening the instruction about TPACK would be another possible change to the course. It was her perception that it would be better placed at the beginning of the course: "I think it would be good to talk about the TPACK in the beginning of the year, just an overall context for the course."

Finally, having in mind some practical limitations that she faces, the instructor mentioned a change that she wishes she could make in her course, taking into account the TPACK framework. She said: "I always wanna go back and focus more on content, and pedagogy. I never feel we do a bad job about the technology part, I feel like that goes okay. But there is always a gap. But then, part of that is because of their different backgrounds and so I couldn't spend… So that would be a change - is longer discussion about how videos are used in classrooms, what makes one appropriate for particular age, or content area, what are the best features of a Science digital story, or Language Arts, but in four or five days I don't know we have time to do that."

Chapter Summary

The purpose of this study was to explore the role of the TPACK framework in the design of the pre-service teachers' digital storytelling. The guiding research questions were: 1) What is the description of the process of designing digital stories when pre-service teachers use the TPACK framework?; 2) What are the pre-service teachers' perceptions of the TPACK framework as it relates to their projects?; 3) How do instructors perceive the effectiveness of the TPACK framework in the design of their students' digital stories?

Research data came from four sessions of a college course that introduces technology to pre-service teachers. According to the answers in the Student Background Information Sheet (Appendix F), the students revealed not having any formal teaching experience at all, only some level of informal or non-certified teaching experience. The majority of the students had access to: a newer (less than three years old) computer with high-speed Internet connection; a color printer; and Microsoft Office Software - not Works. Most students also had experience with sending and receiving e-mail attachments, Word processing software, and web search engines.

The implementation of the Digital Storytelling project occurred mostly as planned, only one more day was necessary to conclude the activities. The students could choose their digital storytelling tool: Storybird (http://storybird.com/), VoiceThread (http://voicethread.com/), PhotoStory, or iMovie. The tools mostly used were VoiceThread and iMovie. Working with storyboards was not the preference among students. They preferred to build concept maps with the tool Bubbl. us (https://bubbl.us/) to brainstorm ideas for their projects. The fact that the students were not all at the same page affected the peer review process. Also, most students did not realize that they could have done the project in teams. Nevertheless, the students were very creative to work with technology in unpredictable ways and enjoyed developing their projects. Most students agreed with the instructional decisions taken to conduct the project.

Due to the fact that this was the students' first experience with digital storytelling, the quality of the majority of the digital stories was amateurish. However, the students showed gains in their technical skills and were more focused on instructional objectives. Also, the students dealt efficiently with the topics chosen and achieved a good balance between the amount of content and the time used to teach it.

The students considered the TPACK framework used in the Digital Storytelling project as a good general guideline and saw how it could be integrated in other projects throughout the course. The framework was also considered valuable for the way it helps novices while integrating technology in the classroom. All interviewed students consider that they learned to develop a meaningful product that they can use in their future classrooms, having the TPACK as a guide.

The instructor of the course considered that she had a very good experience in the digital storytelling project this time, compared to previous experiences. Less focus on technology and more on content set this experience apart from prior ones. Using the TPACK framework has also brought positive change to the course, because it gave more structure to the project. However, working with students from different majors and also letting the students free to choose their digital storytelling tool brought challenges to the instructor. Nevertheless, the digital storytelling project was considered an opportunity for being creative and for extending this ability to the pre-service teachers' future students. Above all, the instructor considered that creating a digital story is a positive way to enhance the students' idea of technology integration.

CHAPTER 5

Discussion

This study explored the role that the TPACK (Technological, Pedagogical, Content Knowledge) framework has on digital storytelling, a design-based learning opportunity for teachers taking a pre-service technology integration course. The results contradicted some findings of studies in the area of pre-service teachers' education, technological pedagogical content knowledge, and digital storytelling, and corroborated others in those same areas.

Teacher Education

Byrum and Cashman (1993), and Pierson and McLachlan (2004) have concluded that prospective teachers were not being exposed to good technology integration modeling, due to the fact that most of the instruction was teacher-centered and focused on the technological element rather than on pedagogical practices. This study, however, has detected a different perspective on this matter, because the participants revealed feeling secure and motivated to implement digital storytelling practices in their future classrooms, and, furthermore, even expressed the desire to extend their knowledge to future peers in their professional circle. The TPACK framework, aligned to the learning-by-design instructional design approach, has offered a more holistic view to their education in which not only the technological element is prevalent, but works consonant with pedagogy and content.

The results of the designed instructional intervention (see Digital Storytelling Implementation, p. 43) have shown that it was successful. Pre-service teachers who participated in the digital storytelling project reported gains in all aspects of the technological pedagogical

content knowledge framework and learned how to design and develop meaningful digital storytelling activities, expressing motivation to implement such activities with their future students. The implementation plan proved to be flexible and fit well into the daily schedule of a technology integration course, despite natural unforeseen circumstances. The replication of the aforementioned intervention may not be applicable to other groups of pre-service teachers; however, because this was a case study.

Because results show the importance and efficacy of the implementation of design-based learning, the present research brings immediate practical consequences to pre-service teacher's technology integration education. Learning how to integrate technology requires well-modeled hands-on experiences. Combined with the TPACK framework, such experiences offer a more complete view of the types of knowledge that teachers need to work with technology. Teacher education institutions should consider, therefore, the adoption of design-based projects based on the TPACK framework.

The confidence expressed by the pre-service teachers in the present study corroborate a certain aspect in the research conducted by Pierson and McLachlan (2004), in which they reveal that pre-service teachers do intend to use technology in their future classrooms as a result of the growth in confidence in the technology integration courses. Pierson and McLachlan (2004) identified their students, therefore, as agents of change. The present study has also detected that the pre-service teachers have a strong belief that they will be able to implement meaningful digital storytelling projects with their future students.

Ertmer, Conklin, Lewandowski, and Osika (2003) have also called attention to the absence of self-confidence that pre-service teachers express in relation to technology integration as a result of a technology-centered education tradition. Because technical skill training is

considered to be insufficient to solve such situation, specific ideas on how to best perform technology integration are needed during pre-service teachers' college years. This study has resulted in the development of a specific idea related to technology integration and has, therefore, detected a level of reported self-confidence as a result of such planned effort. The pre-service teachers have pointed to the TPACK framework as a guide and they approved the instructional materials developed for the digital storytelling unit, expressing that they are able to develop digital stories independently from now on.

The understanding of how pre-service teachers foresee the use of technology in their own classrooms and their ability to identify content-based technology uses for their future professional lives figure as the two main objectives in the research of Doering, Hugues, and Huffman (2003). They investigated a group of pre-service teachers taking a teacher preparation program focusing on innovative technology. Similar to some of their findings, this research has also detected that students, upon instruction, had several ideas of how to integrate technology in their classrooms and viewed technology as a tool for assisting learning. Another similar finding was that pre-service teachers realized that it was important to put technology in their future students' hands.

Technological Pedagogical Content Knowledge

More specifically about technological pedagogical content knowledge (TPACK), as suggested in the initial results of the research conducted by Russell et al. (2003), the introductory technology course can serve as a useful context for introducing TPACK to students, regarding the fact that it provides a general frame for course material and for studying the interplay of technology, pedagogy and content. Schmidt et al. (2009) present similar finding in their research that examines pre-service teachers' development of technological pedagogical content knowledge

in an introductory instructional technology course. The present study has also detected from the students' and the instructor's opinions that an introductory course, such as the Introduction to Computers for Teachers, can use the TPACK framework throughout the activities and projects developed during the semester. Such integration would only benefit the culture of TPACK among students, raising it to the level of "second nature," as students mentioned. Despite the fact that TPACK was also identified as "common knowledge", the idea that was prevalent in the interviews was that having more familiarity with the framework is very beneficial to teacher education.

Mishra and Koehler (2006) have stated that learning how to use technology per se does not guarantee the knowledge of teaching with technology. Furthermore, Mishra and Koehler (2006) demonstrated that teacher education must go beyond skill instruction to reveal the interconnections of technology, pedagogy and content knowledge. The present research has also detected that knowing how to use a particular technology tool does not necessarily mean knowing how to develop educational opportunities with it. The pre-service teachers who participated in this research knew some of the technology that is also used for digital storytelling. Creating a story that teaches educational content, however, involved a process that went far beyond merely learning how to use the technological tools. Despite the fact that there were very successful digital stories developed by the pre-service teachers, it was possible to detect that there was a range in the pedagogical quality of the final artifacts. As an illustration of this fact, the artifact "Fitness" (Appendix S) can be mentioned for being very similar to a slide show with lecture. It can be barely categorized as digital storytelling. On the other hand, "Farmer Bill" is a very effective educational digital storytelling.

The pre-service teachers' interviews have showed that they were able to articulate examples of digital storytelling that take into account not only their choice of technological tool, but also the other elements of TPACK, in their respective areas of study. This was a result, however, of participation in a structured learning process that involved brainstorming, organization, craftsmanship and interaction with their peers and with the course instructor.

The recognition of the interplay of the elements of the TPACK framework is also another result that is congruent to the work presented by Koehler and Mishra (2005). The pre-service teachers in this research were able to realize that creating an educational artifact involves different elements and, above all, those elements should be considered in correlation to each other. Despite the fact that they were in the early stages of their teacher education and may not have been able to correlate the elements so efficiently, they could understand the importance of having technology, pedagogy, and content together.

Koehler and Mishra (2005) also concluded that, as a result of the learning-by-design approach used in their research, the participants found the learning process not only challenging, but also fun. This result is corroborated in the present study, since the pre-service teachers have manifested that they enjoyed the process of developing their digital stories. The word "fun" also appeared a few times during the interviews, as a way to describe the process during the development of the project. Although being fun was not the fundamental objective of the digital storytelling project, it played an important role in having the participants motivated to engage in the activities.

Related to the exploration to TPACK in practice and to the use of specific instructional materials, Hofer and Swan's case study (2006) of moviemaking in the classroom has called for a revision in the way storyboards are used among students. One of Hofer and Swan's questions

was: “What are the necessary components of the storyboard?” Being also an example of the examination of the TPACK framework in real contexts, the present study has revealed, taking into account the differences in the characteristics of the participants in both studies, that the storyboard was not the favorite tool for the specific group of students involved in this research. Rather, they preferred to use the concept mapping tool with guiding questions based on the TPACK framework. This method proved to be very efficient leading to better structured stories.

The development of technological, pedagogical, and content knowledge in the preparation of pre-service teachers to teach with technology was investigated by Niess (2005). Unlike Niess’ findings regarding pre-service teacher’s difficulty to recognize the interplay of content (Science) and technology, the present research found that Science pre-service teachers were comfortable making such connections. Two of the interviewed students developed digital stories related to Science content. As an example of a Science digital story, please refer to “A Red Blood Cell’s Journey” (Appendix S). The students were able to use the technology to structure their stories, and could cite number of different topics in Science that could benefit from the use of digital storytelling in the classroom. Niess reported that not being comfortable with technology is probably a factor that explains such difficulty. Since this was not the case with the participants of the present study – they reported being comfortable around technological tools, this might explain why they could recognize how content and technology can work together in their fields.

Özgün-Koca, Meagher, and Edwards (2010) explored the emergence of technological pedagogical content knowledge among Math pre-service teachers during a technology-rich methods class. First, they concluded, that “participants’ understanding of technology shifted from viewing technology as a tool for reinforcement into viewing technology as a tool for

developing student understanding" (p. 1). Despite the fact that shifts in views were not particularly detected in the present research, and that some Math digital stories were creative – for instance, "Farmer Bill, and Pete's Pizza Shop" (Appendix S) - it has also observed that the idea of using technology (digital storytelling) in the classroom for content reinforcement is still present among pre-service teachers. Nevertheless, the awareness of how important it is to have their students in mind (as target audience) when designing digital stories also existed. Pre-service teachers have also mentioned the importance of having their future students create their own stories, developing them in groups collaboratively and sharing knowledge for better content understanding.

Having the students in mind is an issue connected to the second conclusion drawn by Özgün-Koca, Meagher, and Edwards (2010) in their context: there was a "change in participants' relationship to technology as they shifted their identity from being a learner of mathematics to being a teacher of mathematics" (p. 13). Those authors stress the importance of such development, since the methods course was the participants' first opportunity to reflect on the use of technology for teaching and learning. Similar to their case, the college course that introduces technology to pre-service teachers studied in the present research was the first opportunity for prospective teachers to learn about digital storytelling and how it can be used in education. They were also stimulated to think as teachers while developing their digital stories, planning appropriate stories for classroom instruction.

More detailed analysis of the TPACK developments is presented by Özgün-Koca, Meagher, and Edwards (2010). They concluded that the pre-service teachers, upon participation in the methods course, were able to mention various technologies and technical skills that would be useful for their future teaching. In line with such finding, this research has also detected that

pre-service teachers manifested knowledge of different technological tools that aided the digital storytelling process and could devise how they could such tools meaningfully in their future classrooms.

Content knowledge as a basis for the development of pedagogical content knowledge was another finding in Özgün-Koca, Meagher, and Edwards' research (2010), as their participants start to create lesson plans and transition from Math students to Math teachers: "Preservice teachers started thinking about pedagogical issues together with content" (p. 16). Equally in the present research, while pre-service teachers designed their digital stories, having the TPACK framework as a base, they were stimulated to think about the correlation of content and pedagogy upon the discovery of which curricular content they wanted to address. This was the prevalent trend among the students, as reported in the interviews.

Although in Özgün-Koca, Meagher, and Edwards' study (2010) the students are able to articulate ideas about pedagogical knowledge, they do not make explicit connections between technology and pedagogical knowledge (TPK). In the present research, however, such connections were clearer and the pre-service teachers could articulate several pedagogical ideas for using digital storytelling in the classroom.

As for the interactions among content and technology, while in the present research the students could point that not all topics lend themselves to digital storytelling, revealing refinement in technology content knowledge (TCK), it was not clear among the participants in Özgün-Koca, Meagher, and Edwards' study (2010) how content influences technology, despite the fact that they knew that there are appropriate uses for technology. They were more confident discussing the influences of technology on content, reversely. In the present study, the participants were also aware of the limitations that digital storytelling creates to the content they

want to teach, especially regarding amount of content. They were also aware that creating digital stories requires time and planning, leading also to a limitation in its use with their future students.

Özgün-Koca, Meagher, and Edward (2010) finally remark that technological pedagogical knowledge was discussed by pre-service teachers as they saw technology as a pedagogical tool, not focusing merely on technical skills. Aligned with such finding, this study has also concluded that prospective teachers, upon their participation in the digital storytelling project, have developed a better notion of how digital stories can enhance the learning process. Despite the fact that acquiring or refining their technology knowledge absorbed a great part of their project time, the pre-service teachers learned far more than merely technical skills. The participants in the digital storytelling project have demonstrated gains in all areas of TPACK.

Digital Storytelling

Specifically about digital storytelling, it is considered a powerful tool to enhance the learning process (Barret, 2006; Sadik, 2008; Robin, 2008; Heo, 2011). However, more structured research in the field of storytelling had been requested by Ganske (2007), and, especially regarding digital storytelling, by different researchers (Barret, 2006; Robin, 2006; Dogan & Robin, 2008). Sadik (2008) conducted a study in Egypt to help teachers integrate technology in their classroom through the use of digital storytelling and there are several points of similitude between Sadik's conclusions and those presented here. First, it is a common finding that the participants are willing to adopt digital storytelling practices in their classrooms. The present research, despite the fact that it has studied prospective teachers, has found that the pre-service teachers involved in the study feel motivated and have expressed the willingness to implement digital storytelling practices in their future classrooms. Furthermore, both studies

have detected that the participants felt pride in the accomplishment of their projects and that they acquired a number of new digital and technological skills. The participants in both studies have also met pedagogical requirements of educational digital storytelling. Despite the amateurish level of the work produced by the participants in both studies, the students involved demonstrated enjoyment in the use of different pieces of technology to translate their ideas into a storyline.

Sadik (2008) has also concluded that the teachers involved in his research believe that digital stories increase students' understanding of curricular content and that they were willing to transform their pedagogy and curriculum to include digital storytelling. The prospective teachers investigated in this study have also expressed their willingness to adopt digital storytelling in their future classrooms (even if at a certain extent) and were aware of the demands of such practice. They also believe that digital storytelling can be an efficient way to work curricular content with students, in a more memorable and fun way, meeting the learning needs of different student groups.

Heo's research (Heo, 2009), a quasi-experimental study on the impact of digital storytelling on pre-service teachers' self-efficacy and dispositions towards educational technology, has shown in the results that there was an improvement in the participants' technology competency and openness to change towards educational technology, as a consequence of their digital storytelling experience. Heo (2009) concluded that it is important not only to teach pre-service teachers about educational technology and classroom technology integration, but also to transfer the technology knowledge and skills that they already possess into the learning environment. Similarly, the present study has found that the pre-service teachers have acquired several technological skills through their active participation in the digital

storytelling project, building upon previous knowledge – working with digital pictures, for instance. Furthermore, they have become independent learners, troubleshooting their own technological challenges. This fact is corroborated in the instructor's opinion about the pre-service teachers' behavior. Resistance towards technology was not a prevalent theme in the present research, however. The pre-service teachers already welcomed technology and, despite being overwhelmed sometimes with the project technological demands, they managed to find solutions satisfactorily and to keep a positive attitude towards technology integration.

As for technological knowledge transfer and application in the learning environment, the digital storytelling project implemented for this research has demonstrated that learning about technology integration produces better results when it is contextualized in a meaningful learning opportunity, based on design. By their participation in the project, pre-service teachers had hands-on practice that went beyond mere theory, providing them with experience and ideas for real technology integration in their future classrooms. They have also built critical knowledge about the process of digital storytelling implementation, as they mentioned the possible adaptations that they would need to make based on the characteristics of their future circumstances.

Heo's second quasi-experimental study (Heo, 2011) corroborated the key findings in the first research (Heo, 2009) and provided more in-depth analysis about the pre-service teachers' self-efficacy and dispositions toward change with regard to new technological approaches. It was again detected that self-efficacy and openness towards technology improved as a consequence of the digital storytelling activity. Digital storytelling was identified as an efficient tool to promote constructive and authentic learning experiences.

Heo (2011) specifically concluded that the participants in her research showed significant improvement in pedagogical-related issues, even at the early stages of their Education programs. Such improvement was higher than that related to the participants' familiarity with technology per se. The present research has detected improvements in pre-service teachers' knowledge of the elements of the TPACK framework as a whole. Although there was not the intent to quantify and measure which of the three types of knowledge has improved more, it was possible to observe gains of the technological, pedagogical, and content knowledge as a consequence of the digital storytelling project. Because this research was not based on practice teaching per se, it is possible to argument that pedagogical knowledge might be the one that requires more proof. Nevertheless, the pre-service teachers were able to articulate ideas for the pedagogical use of digital storytelling, and felt motivated to integrate them into their future teaching. Because they are in the beginning of their teacher education program, they will have other opportunities to enhance their pedagogical knowledge. It was significant, however, to raise their awareness about the importance to connect technology with content and pedagogy at this early stage of their education.

Heo (2011) also detected that

> "while participants perceive themselves as highly competent in major processes of creating digital stories, they were not equivalently confident in infusing digital storytelling into their class. That is, although participants are rather comfortable using digital storytelling for their personal lives, integrating it into education settings takes more training than a week of experience." (p. 20)

As a matter of fact, the present research concluded that a carefully designed instructional intervention is necessary in order to make such transition happen – from personal to educational

use. A mere tutorial on the pertinent software, for instance, does not guarantee that pre-service teachers will be able to at least produce ideas on the pedagogical uses of digital storytelling. The integration of the TPACK framework into the process of developing educational digital stories is a necessary element to produce successful experiences.

Figg and McCartney (2010), who have conducted a longitudinal research to study the integration of writing, digital video stories and diversity, focusing on the development of technological, pedagogical, and content knowledge in teacher candidates, have indicated the gains in the understanding of new techniques and different instructional strategies among the key findings of their research. For instance, the participants in their research have built the understanding of facilitation as an instructional strategy that opposes more traditional teacher-centered practices. They have also identified by name several strategies that support facilitation. Despite the fact that the present research has not occurred in a practice teaching setting, that the prospective teachers are still in the beginning of their teacher education programs, and, therefore, have incipient pedagogical knowledge, some comparisons can still be drawn between both studies.

In this study, the insertion of the digital storytelling project in the creativity portion of the course has allowed the pre-service teachers the opportunity to reflect on several new ideas about teaching with digital storytelling. The level of their pedagogical competence did not allow them to cite any instructional techniques by name when the research was conducted; however, they have expressed different ways in which they would like to teach with technology. For instance, they have mentioned that they would like to stimulate their students to develop their own digital stories for group learning. The idea of having their future students develop digital stories from somebody else's perspective was also expressed in the interviews. Such ideas do translate the

notion that they would like to oppose more traditional approaches to teaching with digital storytelling.

The participants in Figg and McCartney's research (Figg & McCartney, 2010) have also gained new understanding about the process of teaching with technology as a whole, being able to foresee implementation issues in their own classrooms, for instance. The same has been detected in the present research, when the participants manifested that they were aware of the modifications they would need to make in their digital stories in the case that they used them with their future students - adapting the story to their learners' characteristics, adding more content. They were also aware that implementing digital storytelling practices is time consuming and mentioned that they would need to plan accordingly during the school year in order to fit the project in their schedules.

Regarding the agentive self, this is a concept that Hull and Katz (2006) have explored in the research with young adults and their experiences with digital storytelling. They state:

> "The enactment of an agentive self is pivotal for learning and motivation; the opportunity to be successful as learner and doer can foster a view of self as agent; multimedia and multimodality is powerful form of communication and means to represent social world." (pp. 71-72).

It is important to stress that the participants involved Hull and Katz's research are not pre-service teachers. There are aspects of their research, nevertheless, that intersect with those from the present research, when it comes to analyzing the communicational potential of digital storytelling and how it allows self-expression. When the pre-service teachers created their stories, even if they pertained to the educational story category and were connected to curricular standards, the participants developed them with so much creativity and freedom that they

expressed elements of their culture and the values of their age-group. The TPACK framework (figure 1) places the elements of teacher knowledge in a larger dotted circle, called "context". This is a part of the framework that might go unnoticed for several people. It is, however, a very important part of the framework and should be better highlighted in the visual element (Fig. 1). Teacher knowledge, therefore, is connected to the characteristics, affordances and constraints of the context in which it takes place. Such knowledge is also embedded in personal, cultural, and historical circumstances. When pre-service teachers use a medium such as digital storytelling, they empower their self-expression. They use the communicational potential visual, sonorous and textual signs in a complementary way in order to convey their ideas. This represents an enriched way of communication.

By being able to be "doers", as mentioned by Hull and Katz (2006), the pre-service teachers became motivated to implement digital storytelling in their professional and personal life situations. Some of them expressed the desire to teach other teachers in their school units about digital storytelling. From that perspective, it can also be considered that they started to exercise their agentive selves.

Concluding, the present research presented findings that pertain to three interconnected areas: teacher education, technological pedagogical content knowledge (TPACK) and digital storytelling. It has shown the benefits of adopting multimedia projects in a pre-service technology integration course. There were immediate gains to pre-service teachers' authoring skills as they engaged in a design-based activity. They became more independent and motivated to create other artifacts.

The findings are also important as they reveal the particular benefits of digital storytelling for teacher education. Digital storytelling represents an opportunity that comprises multiple

types of learning experiences, as participants exercise their self-expression to tell stories that are intended to educate. Such learning experiences range from manipulation of hardware and software to the creation of a storyline that carries an educational narrative.

Ultimately, the integration of the TPACK theoretical framework to a practical activity such as digital storytelling produces the utmost benefit to pre-service teachers, as they gain a holistic view of teaching with technology.

Limitations

Some limitations in the present research should be considered. First, this research was an attempt to align the learning-by-designing approach to the TPCK theoretical framework in the context of digital storytelling developed by pre-service teachers. Because the majority of the participants are prospective teachers in the beginning years of their college life, they possess very incipient level of pedagogical knowledge. Such incipient knowledge has an impact, obviously, in the educational materials that they develop and how they are able articulate their thoughts in relation to the use of digital storytelling for instruction, for instance. Despite the fact that I consider, however, that studying TPACK among pre-service teachers is still a valid scenario because they are not a "tabula rasa" and they do have some notion of pedagogical practices, even if it is fragile – from their historical experience as students, observing their masters, for example - this issue was addressed through instruction on the TPACK framework that was provided by the course instructor at the beginning of the digital storytelling unit and practiced throughout the project.

Second, while I was recruiting volunteers to participate in the research, I stressed that their evaluation grades would not be affected in any way by the opinions expressed during the interviews. The instructor of the course, who also helped me with such recruitment, made the

same claims among her students. Furthermore, I still stressed this point while being face to face with the students for the interviews. It is still possible, however, that some of the interviewees avoided making certain comments that they judged that could have had a negative impact on their course grades. This could be especially possible during the questions regarding the instructor's performance or the quality of the materials used during the digital storytelling project.

Next, this research was conducted with the students from the same instructor. This happened because the other instructors had already had their digital storytelling projects by the time this research was implemented. In order to address this issue, four sessions of the same instructor were studied, in an attempt to diminish any possible bias and to give more diversity to the population being investigated. Generalizations of the results of this study are not possible, therefore.

Finally, as a consequence of the four sessions being studied in this research, the amount of data was very considerable, multiplying the natural complexity in the analysis of information. I have tried to refer to the literature on TPACK and digital storytelling regularly in order to avoid misinterpretations and to keep the trustworthiness of the process.

Implications for Future Research

The alignment of the TPACK framework with digital storytelling practices is somewhat unique and needs more structured studies in order to prove its efficacy. The present research was an attempt to provide empirical evidence on this matter, however, since pre-service teachers are still strengthening their knowledge in many areas of the educational field and lack real formal teaching experience, it is important to study the alignment mentioned above when they start their practice real classrooms situations. Also, it is important to study their students' performance in

order to diagnose the effectiveness of their real classroom practices. These types of study would verify the effectiveness of the instruction given to them during their college education.

Because implications of TPACK for digital storytelling in general were considered in this study, not detailing how these implications would benefit specific areas of knowledge, such as Math, Language Arts, Science, Social Studies and so on, it would be a considerable contribution to carry on research that relates TPACK, digital storytelling and specific areas of knowledge. Also the particular investigation of student assessment in the content areas mentioned above would greatly benefit from such studies, for instance.

Further study of the interactions between pre-service teachers, TPACK and digital storytelling will help improve not only the research, but also the practice in those areas, ultimately benefiting technology integration. The specific research questions listed below are worthy of future study, based on this research study:

1. How and to what extent do teachers' actual digital storytelling practices compare with those modeled during their teacher education in college?
2. How does evidence of student performance reflect the effectiveness of their teachers' digital storytelling practices?
3. How does the alignment of the TPACK framework and digital storytelling impact pre-service teachers' understanding of specific content areas?
4. How does the alignment of the TPACK framework and digital storytelling impact pre-service teachers' understanding of student assessment practices in specific content areas?

Conclusion

The results of this research indicated that there were gains in the technological, pedagogical, and content knowledge of the pre-service teachers involved in this research as a consequence of their participation in the designed digital storytelling project.

The instructional design used in the digital storytelling project was effective and the integration of the TPACK framework figured as a secure guide, providing confidence to the pre-service teachers. The instructor who participated in the research saw the importance of using TPACK not only in one project, but throughout the entire course.

The use of the TPACK framework during the development of digital storytelling impacted positively the development of the projects created by prospective teachers, benefitting their college teacher education.

Chapter Summary

Due to the alignment of the TPACK framework with a learning-by-design instructional design approach, the participants in the present research revealed feeling secure and motivated to implement digital storytelling practices in their future classrooms. A level of reported self-confidence was detected. The pre-service teachers also expressed the desire to extend their knowledge to future peers in their professional circle. This brings immediate practical consequences to pre-service teacher's technology integration education: teacher education institutions should consider, therefore, the adoption of design-based projects based on the TPACK framework.

Although being fun was not the fundamental objective of the digital storytelling project, it played an important role in having the participants motivated to engage in the activities. The students felt that they could express themselves and be creative. As for instructional materials, the use of storyboards was not a common choice among the pre-service teachers and they

preferred to use the concept mapping tool with guiding questions based on the TPACK framework.

The participants have demonstrated gains in all aspects of the TPACK framework, despite the fact that there were different levels of TPACK development among them, as shown in their artifacts. This research has also detected that pre-service teachers, upon instruction, had several ideas of how to integrate technology in their classrooms and viewed technology as a tool for assisting learning. Above all, they realized that it was important to put technology in their future students' hands. Therefore, the introductory technology course can serve as a useful context for introducing TPACK.

Being comfortable with technological tools is the base for connecting a specific content area, such as Science, and technology. The Science pre-service teachers in this research were able to use the technology to structure their stories. They could also cite a number of different topics in Science that could benefit from the use of digital storytelling in the classroom.

Although the idea of using technology in the classroom for content reinforcement is still present among the pre-service teachers' final artifacts (digital stories), there was also awareness of how important it is to have their students in mind as target audience when designing digital stories. The pre-service teachers, starting to think as teachers, have also mentioned the importance of having their future students create their own stories, developing them in groups collaboratively and sharing knowledge for better content understanding.

Upon their participation in the Digital Storytelling project, pre-service teachers became more independent learners, acquired a set of technological skills and felt proud of their final artifacts. As a result, they felt motivated to implement digital storytelling practices in their future classrooms. They also believe that digital storytelling can be an efficient way to work

curricular content with students, in a more memorable and fun way, meeting the learning needs of different student groups.

Some limitations in this research existed: the participants' incipient level of pedagogical knowledge; the participants' possible fear of a negative impact on their course grades as a consequence of making comments about the digital storytelling experience; the impossibility of the generalization of the results of this research because students from four sessions of the same instructor were studied; the large amount of data, which multiplied the complexity of data analysis.

There are four implications for future research: the first is to compare an in-service teachers' digital storytelling experience with that from his/her pre-service time. The second is to detect the impact of teachers' digital storytelling practices on their students' performance. The third is to study how the alignment of the TPACK framework and digital storytelling impacts pre-service teachers' understanding of specific content areas. The fourth is to examine how the alignment of the TPACK framework and digital storytelling impacts pre-service teachers' understanding of student assessment practices in specific content areas.

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Appendices

Appendix A: IRB Approval Letter

PROJECT NUMBER: 2010-10562-0
TITLE OF STUDY: The Impact of TPACK and Digital Storytelling as a Learning Experience for Pre-Service Teachers in a Learning-by-Designing Project
PRINCIPAL INVESTIGATOR: Dr. Robert Maribe Branch

Dear Dr. Branch,

The University of Georgia Institutional Review Board (IRB) has reviewed and approved your above-titled proposal through the exempt (administrative) review procedure authorized by 45 CFR 46.101(b)(2) - Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, /unless:/(i). the information obtained is recorded in such a manner that human participants can be identified, directly or through identifiers linked to the participants; /and/(ii). any disclosure of the human participants' responses outside the research could reasonably place the participants at risk of criminal or civil liability or be damaging to the participants' financial standing, employability, or reputation.

You may now begin your study. Your approval packet will be sent by mail.

Please remember that no change in this research proposal can be initiated without prior review. Any adverse events or unanticipated problems must be reported to the IRB immediately. The principal investigator is also responsible for maintaining all applicable protocol records (regardless of media type) for at least three (3) years after completion of the study (i.e., copy of approved protocol, raw data, amendments, correspondence, and other pertinent documents). You are requested to notify the Human Subjects Office if your study is completed or terminated.

Good luck with your study, and please feel free to contact us if you have any questions. Please use the IRB number and title in all communications regarding this study.

Thank you,

Kim Fowler, CIP
Human Subjects Office
627A Boyd Graduate Studies Research Center
University of Georgia
Athens, GA 30602-7411
kfowler@uga.edu
Telephone: 706-542-5318
Fax: 706-542-3360
https://www.ovpr.uga.edu/compliance/hso/

Appendix B: Student Interview Protocol

Interview Protocol – Pre-Service Teachers

Interview Questions:

1) Tell me about your experience in the Digital Storytelling project.
Possible probes:

- ✓ Have you ever done a digital story before?
- ✓ What were your impressions in relation to the project?
- ✓ Were you alone or with a partner?
- ✓ Tell me about your experience with your project partner.
- ✓ What grade and content area does your digital story relate to?
- ✓ What was your digital story about?

2) Tell me about how your digital storytelling project progressed.
Possible probes:

- ✓ How was the process of developing your story?
- ✓ Were there challenges? If so, tell me about them.
- ✓ Do you feel interest in doing other digital stories? If so, tell me what you would like to do.
- ✓ Could you do another one completely on your own?

3) How comfortable were you with the technological tools used in this course?
Possible probes:

- ✓ Did you find any challenges with the hardware and/or software? Examples?
- ✓ If you found any challenges, did you overcome them? How?
- ✓ Did your experience in this project enhance your knowledge of technology?
- ✓ Have you acquired any new technical skills?
- ✓ Please cite some examples of what you learned to do during the project.

4) Tell me more about your digital story.
Possible probes:

- ✓ What does your digital story mean to you?
- ✓ What types of images did you choose?
- ✓ Why did you make that particular selection of images?
- ✓ Why did you arrange the images/text in the way that you did?
- ✓ What is like for you to watch your stories?

5) Tell me what you think about the TPACK framework in the digital storytelling project.
Possible probes:

- ✓ What are your impressions of the use of the TPACK framework in the digital storytelling project?
- ✓ What do you believe is the value of the TPACK framework for the digital storytelling project?
- ✓ What did you think about the TPACK materials used in this project?
- ✓ What are the advantages and disadvantages of this framework in your opinion?
- ✓ Did the TPACK framework help you?
- ✓ Tell me whether you think that you learned how to develop a product to be used meaningfully in your future classroom having the TPACK as a guide.
- ✓ What would be the relevance for the TPACK framework for other projects that you develop in this course?
- ✓ Would you change anything?

6) How would you explain the applicability of digital storytelling for the teaching and learning process?
Possible probes:

- ✓ What is the usefulness of digital storytelling for instruction?
- ✓ Do you intend to use digital storytelling with your own students when you become a teacher? If so, Please cite some examples of how you intend to use digital storytelling with your own students.
- ✓ What are the ways that you could use digital storytelling to teach your content?
- ✓ What topics in your area of study could be covered using digital storytelling?

7) How could you teach using digital storytelling?
Possible probes:

- ✓ What techniques could you apply when using digital storytelling?
- ✓ How could digital storytelling make the learning process related to certain contents more interesting?
- ✓ How could digital storytelling motivate your students?
- ✓ What pedagogical approaches could you use while teaching with digital storytelling?
- ✓ How could you manage the classroom while teaching with digital storytelling?
- ✓ How could digital storytelling be used for student assessment in your content area?

8) What can be taught through digital storytelling in your content area (having your students in mind)?
Possible probes:

- ✓ What specific contents could benefit from the use of digital storytelling? Why?

- ✓ What contents could become more interesting using digital storytelling?

9) How can digital storytelling be used to enhance the understanding of your subject area?
Possible probes:

- ✓ What activities could be accomplished with digital storytelling?
- ✓ How can digital storytelling be used to teach a lesson in your area?

10) Tell me about examples of lessons that combine your content area, digital storytelling and teaching methods.
Possible probes:

- ✓ Tell me about what you would do to combine content, digital storytelling and how.
- ✓ Please give me a complete example of the use of digital storytelling to teach your content area and the teachings methods that you would choose.

11) Tell me about your views in relation to the instructional decisions made by the instructor in this project.
Possible probes:

- ✓ What are the pros and cons of the strategies chosen by the instructor in order to carry out this project?
- ✓ Did you find the materials (e.g.: handouts) useful?
- ✓ Do you have suggestions for future projects? If so, what are they?

12) Is there anything else that you would like to add?

Other possible probes:

- ✓ You mentioned_____, please tell me more about that.
- ✓ You mentioned_____, how do you feel about that?
- ✓ You said_____, could you please elaborate more on that?

Appendix C: Instructor Interview Protocol

Interview Protocol – Instructor

Interview Questions:

1) Tell me about your teaching experience in this course.
Possible probes:

- ✓ How long have you taught this course?
- ✓ What is your pedagogical approach?

2) Tell me about your experience with the Digital Storytelling project.
Possible probes:

- ✓ How long have you taught digital storytelling in this course?
- ✓ What are your impressions in relation to the project?
- ✓ Are there challenges? If so, tell me about them?
- ✓ How much time do you believe is enough for this project?
- ✓ What are your impressions in relation to the materials used in this course?
- ✓ Do you have suggestions for future projects? If so, what are they?

3) What is the value of the digital storytelling project for your students?
Possible probes:

- ✓ Why do you teach digital storytelling in your course?
- ✓ How have your students progressed in the project?
- ✓ What instructional purposes do you want to achieve through this project?
- ✓ What are your perceptions about the work being developed in groups?

4) What are the technical skills that your students learn through this project?
Possible probes:

- ✓ What do your students learn to do with technology through the development of a digital story?

5) Tell me what you think about the TPACK framework in the digital storytelling project.
Possible probes:

- ✓ What are your impressions of the use of the TPACK framework in the digital storytelling project?
- ✓ What do you believe is the value of the TPACK framework for the digital storytelling project?
- ✓ What are the advantages and disadvantages of this framework for your students' learning process?
- ✓ How would you assess the use of the TPACK framework in this course?
- ✓ Tell me about whether you think students learned how to develop a product that could be used meaningfully in future classrooms.
- ✓ When you think about your teaching, how would you evaluate the relevance of TPACK for the other projects in the course?
- ✓ Would you change anything?
- ✓ Would you develop other projects (with different technological tools) using the TPACK framework?

6) How can digital storytelling be used to enhance the understanding of technology integration?

Possible probes:

- ✓ How can digital storytelling be used to enhance the teaching of a lesson in your course?

7) What are possible pedagogical approaches in the use digital storytelling to teach technology integration?

8) Is there anything else that you would like to add?

Other possible probes:

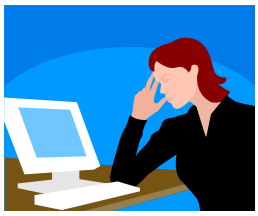
- ✓ You mentioned_____, please tell me more about that.
- ✓ You mentioned_____, how do you feel about that?
- ✓ You said_____, could you please elaborate more on that?

Appendix D: Matrix Organization of the Thinking for Designing a Unit of Instruction

Knowledge Dimension	Content	Teaching & Student Learning	Technology
Declarative			
Procedural			
Schematic			
Strategic			

Source: Niess (2008).

Appendix E: Peer Review Form



Comment Sheet for Digital Storytelling

Name of Designer: _____ (Write the digital story designer's name here)

Write down at least one good thing about this digital story.

Write down at least one thing that you think this story needs in order to be improved or revised.

If you have other suggestions, please write them here. You can also use the back of this sheet if necessary.

Appendix F: Student Background Information Sheet

EDIT 2000 Student Information

https://spreadsheets.google.com/viewform?hl=en&formkey=dHRteDBtTm5venV3MHRTblFUWmVMNUE6MA#gid=0

Thank you for taking time to complete this survey. Please answer each question to the best of your knowledge. Your thoughtfulness and candid responses will be greatly appreciated. Your individual name or identification number will not at any time be associated with your responses. Your responses will be kept completely confidential and will not influence your course grade.

---

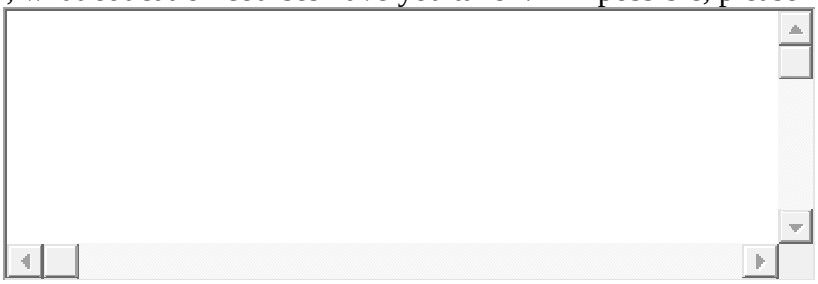
* Required

1. Your session: *

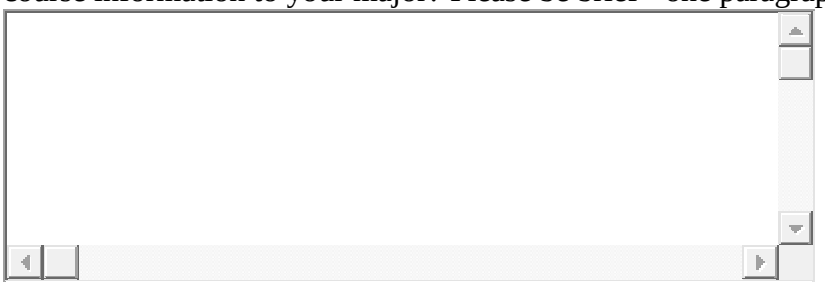
- 8:00
- 9:30
- 11:00
- 12:30

2. What teaching experience do you have? * Please be brief - one paragraph is enough.

3. Including this semester, what education courses have you taken? * If possible, please describe course codes.



4. If you are not planning to teach in traditional classroom setting, how do you plan to apply the course information to your major? Please be brief - one paragraph is enough.



Other than in labs on campus, do you have access to:

5. A newer (less than 3 years old) computer with high-speed internet access? *

- Yes
- No

6. A color printer? *

- Yes
- No

7. Microsoft Office software (not Works)? *

- Yes
- No

Please indicate your skills with the following applications and activities:

8. Sending and receiving email attachments *

- N/A
- Very Poor
- Poor

- Average
- Good
- Very Good

9. Word processing software. *

- N/A
- Very Poor
- Poor
- Average
- Good
- Very Good

10. Presentation software. *

- N/A
- Very Poor
- Poor
- Average
- Good
- Very Good

11. Web search engines *

- N/A
- Very Poor
- Poor
- Average
- Good
- Very Good

12. Working with digital photos *

- N/A
- Very Poor
- Poor
- Average
- Good
- Very Good

13. Working with digital video *

- N/A
- Very Poor
- Poor
- Average
- Good
- Very Good

14. Concept mapping software *

- N/A
- Very Poor
- Poor
- Average
- Good
- Very Good

15. Creating web pages *

- N/A
- Very Poor
- Poor
- Average
- Good

- Very Good

16. Image editing software *

- N/A
- Very Poor
- Poor
- Average
- Good
- Very Good

17. Audio editing software *

- N/A
- Very Poor
- Poor
- Average
- Good
- Very Good

18. Lesson Planning *

- N/A
- Very Poor
- Poor
- Average
- Good
- Very Good

Submit

Appendix G: Survey of Preservice Teachers' Knowledge of Teaching and Technology

Survey of Preservice Teachers' Knowledge of Teaching and Technology

https://spreadsheets.google.com/viewform?hl=en&formkey=dENCZThXaTBHMUZOWExZTEY5aU5fTFE6MA#gid=0

Thank you for taking time to complete this questionnaire. Please answer each question to the best of your knowledge. Your thoughtfulness and candid responses will be greatly appreciated. Your individual name or identification number will not at any time be associated with your responses. Your responses will be kept completely confidential and will not influence your course grade.

---

* Required

1. Your session *

- 8:00
- 9:30
- 11:00
- 12:30

2. Gender *

- Female
- Male

2.1. Age Range *

- 18-22
- 23-26
- 27-32
- 32+

3. Major *

- Early Childhood Education

- Middle School Education
- Secondary Education
- Speech
- Special Education
- Non-Ed
- Other:

4. Area of Specialization *

- Art
- Early Childhood Education
- English and Language Arts
- Foreign Language
- Health
- History
- Mathematics
- Music
- Science
- Social Science
- Speech
- Other:

5. Year in College *

- Freshman
- Sophomore
- Junior
- Senior

6. Are you completing an educational computing minor? *

- Yes

- No

7. Are you currently enrolled or have you completed a practicum experience in a PreK-6 classroom? *

- Yes
- No

Technology

Technology is a broad concept that can mean a lot of different things. For the purpose of this questionnaire, technology is referring to digital technology/technologies. That is, the digital tools we use such as computers, laptops, iPods, handhelds, interactive whiteboards, software programs, etc. Please answer all of the questions and if you are uncertain of or neutral about your response you may always select "Neither Agree or Disagree"

TK (Technology Knowledge)

1. I know how to solve my own technical problems. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

2. I can learn technology easily. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agre
- Strongly Agree

3. I Keep up with important new technologies. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agre
- Strongly Agree

4. I frequently play around the technology. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agre
- Strongly Agree

5. I know about a lot of different technologies. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agre
- Strongly Agree

6. I have the technical skills I need to use technology. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agre
- Strongly Agree

7. I have had sufficient opportunities to work with different technologies. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agre
- Strongly Agree

CK (content Knowledge)

Please choose the area that applies to you.

Mathematics

8. I have sufficient knowledge about mathematics.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

9. I can use a mathematical way of thinking.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

10. I have various ways and strategies of developing my understanding of mathematics.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

Social Studies

11. I have sufficient knowledge about social studies.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

12. I can use a historical way of thinking.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

13. I have various ways and strategies of developing my understanding of social studies.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

Science

14. I have sufficient knowledge about science.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

15. I can use a scientific way of thinking.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

16. I have various ways and strategies of developing my understanding of science.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

Literacy

17. I have sufficient knowledge about literacy.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

18. I can use a literary way of thinking.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

19. I have various ways and strategies of developing my understanding of literacy.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

PK (Pedagogical Knowledge)

20. I know how to assess student performance in a classroom. *

- Strongly Disagre
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

21. I can adapt my teaching based-upon what students currently understand or do not understand. *

- Strongly Disagre
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

22. I can adapt my teaching style to different learners. *

- Strongly Disagre
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

23. I can assess student learning in multiple ways. *

- Strongly Disagre
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

24. I can use a wide range of teaching approaches in a classroom setting(collaborative learning, direct instruction, inquiry learning, problem/project based learning etc.). *

- Strongly Disagre
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

25. I am familiar with common student understandings and misconceptions. *

- Strongly Disagre
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

26. I know how to organize and maintain classroom management. *

- Strongly Disagre
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

PCK (Pedagogical Content Knowledge)

27. I know how to select effective teaching approaches to guide student thinking and learning in mathematics.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

28. I know how to select effective teaching approaches to guide student thinking and learning in literacy.

- Strongly Disagree

- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

29. I know how to select effective teaching approaches to guide student thinking and learning in science.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

30. I know how to select effective teaching approaches to guide student thinking and learning in social studies.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

TCK (Technological Content Knowledge)

31. I know about technologies that I can use for understanding and doing mathematics.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree

- Strongly Agree

32. I know about technologies that I can use for understanding and doing literacy.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

33. I know about technologies that I can use for understanding and doing science.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

34. I know about technologies that I can use for understanding and doing social studies.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

TPK (Technological Pedagogical Knowledge)

35. I can choose technologies that enhance the teaching approaches for a lesson. *

- Strongly Disagree

- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

36. I can choose technologies that enhance students' learning for a lesson. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

37. My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

38. I am thinking critically about how to use technology in my classroom. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

39. I can adapt the use of the technologies that I am learning about to different teaching activities. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

TPACK (Technology Pedagogy and Content Knowledge)

40. I can teach lessons that appropriately combine mathematics, technologies and teaching approaches.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

41. I can teach lessons that appropriately combine literacy, technologies and teaching approaches.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

42. I can teach lessons that appropriately combine science, technologies and teaching approaches.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree

- Agree
- Strongly Agree

43. I can teach lessons that appropriately combine social studies, technologies and teaching approaches.

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

44. I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

45. I can use strategies that combine content, technologies and teaching approaches that I learned about in my coursework in my classroom. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

46. I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my school and/or district. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

47. I can choose technologies that enhance the content for a lesson. *

- Strongly Disagree
- Disagree
- Neither Agree or Disagree
- Agree
- Strongly Agree

Submit

Appendix H: Sample Interview Analysis

C o d e #	ID	Q#	Turn#	Data	Notes
5 0 0 0	St1	5	64.	S: I mean, I guess it is just helps you keep everything in perspective, make sure, this so I can use technology, like this is to convey a concept or content, help you remember, I guess.	
5000	St2	5	59.	S: I think I, it almost just happened in a natural way, I wasn't making sure I had all the things, but at the same time I kind consciously was aware that this was the technology for me, this is the…	Reflex of the Bubbl.us activity
5000	St3	5	72.	S It seemed basically like a general guideline for me to get the things that I need to do and it wasn't too hard to follow, what I did, naturally went along with it so… Yeah… Pretty much. (laughter)	
5000	St4	5	74.	S: I feel like going… content and technology together and I just think it's a good thing, overall, it will be good for, I feel it catches students' interest, doing those kinds of things, incorporating the two because they're always looking for something they can relate to, and now they use the iPhones or the iPods and computers, all that kind of stuff, so, I think it can teach something that, I am thinking, oh, man, this is cool, maybe relating that to content will get people's attention, hopefully make them think critically and do their own work and engage in things. So, that project made me do all of those things.	
5000	St5	5	81.	S: I'd say so, because it's almost like a, almost a planning method, a way to organize your thoughts, and what you want to teach, it's just, I don't know, it's like, you have all these parts, it's almost simple, something could be technically more challenging, so it would be like, ok, content, do I have content?, yes, and then you're like, do I have technology, ok, the technology and the content, now I need to know how I am gonna, perform this task or teach this material, so it's almost like a check list, so, ok, if you have all of them, or if you're missing some, or how you need to even out to incorporate all three pieces to get that middle section.	

Appendix I: Student Background Information Sheet Demographic Information

Table 2
Student Survey Demographic Information

Item	*Freq*	*Pct*
1.Session		
8:00	16	22.9
9:30	21	30
11:00	14	20
12:30	19	27.1
5.Acess to a newer computer		
Yes	67	95.7
No	3	4.3
6.A color printer		
Yes	64	91.4
No	6	8.6
7.Microsoft Office		
Yes	65	92.9
No	5	7.1
8.Sending and receiving e-mail attachments		
N/A	0	0
Very Poor	0	0
Poor	0	0
Average	1	1.4
Good	14	20
Very Good	55	78.6
9.Word processing software		
N/A	0	0
Very Poor	0	0
Poor	0	0
Average	5	7.1
Good	17	24.3
Very Good	48	68.6
10.Presentation software		
N/A	0	0
Very Poor	0	0
Poor	1	1.4
Average	9	12.9
Good	27	38.6
Very Good	33	47.1

Table 2 (Cont.)
Student Survey Demographic Information

Item	*Freq*	*Pct*
11.Web search engines		
N/A	12	17.1
Very Poor	3	4.3
Poor	17	24.3
Average	25	35.7
Good	10	14.3
Very Good	3	4.3
12.Working with digital photos		
N/A	1	1.4
Very Poor		
Poor	1	1.4
Average	23	32.9
Good	21	30
Very Good	24	34.3
13. Working with digital video		
N/A	5	7.1
Very Poor	2	2.9
Poor	13	18.6
Average	31	44.3
Good	12	17.1
Very Good	7	10
14. Concept mapping software		
N/A	12	17.1
Very Poor	3	4.3
Poor	17	24.3
Average	25	35.7
Good	10	14.3
Very Good	3	4.3
15.Creating web pages		
N/A	2	2.9
Very Poor	2	2.9
Poor	14	20
Average	32	45.7
Good	14	20
Very Good	6	8.6

Table 2 (Cont.)
Student Survey Demographic Information

Item	*Freq*	*Pct*
16.Image editing software		
N/A	3	4.3
Very Poor	1	1.4
Poor	13	18.6
Average	28	40
Good	16	22.9
Very Good	9	12.9
17.Audio editing software		
N/A	7	10
Very Poor	10	14.3
Poor	21	30
Average	23	32.9
Good	7	10
Very Good	2	2.9
18.Lesson planning		
N/A	4	5.7
Very Poor	3	4.3
Poor	13	18.6
Average	27	38.6
Good	15	21.4
Very Good	8	11.4

Appendix J: Results of Question 2 - Student Background Information Sheet

Q2. What Teaching Experience do You Have?

None

No formal teaching outside of some tutoring.

No formal teaching experience (not an education major)

I am a junior in the college of education. so I have much experience observing and teaching.

I have 100+ hours interacting and observing in both high school and middle school settings. I have taught grammar lessons, and I have had numerous courses on how to teach. I was in the Secondary English Education program last semester, so I have plenty of experience with standards, lessons, pedagogy, and engaging students.

I really don't have any teaching experience, I have done some tutoring in the past but that is it.

I have done over 20 hours of observations in various K-12 classroom settings. Also, I have completed my 6week practicum experience in middle and high school grades.

I don't have any teaching experience.

I have been a volunteer at Down Syndrome of Louisville. I help them with different activities related and non-related to academics. I was a volunteer as a tutor at a school for children with special needs. I am an Oasis tutor here in Georgia.

Not much teaching experience. I have never taught an individual class before. However, I do coach football and some of my other professors here at UGA have said that coaching will help me out a lot in the classroom and will provide me some experience.

I teach a Sunday School class of 5-12 yearolds and have done field experiences with High School honors and at-risk students.

In high school, I was apart of a Teaching Academy (a 3 year college prep program). First year (sophomore year) was an overview of the teaching profession (1 class dedicated to this). Second year (Junior Year) I observed a mentor teacher once a week and the other 4 days were geared to educational psych, and the final year (senior year) I interned the first semester at an 8th grade feeder school and the second semester with a 1st grade class to get an idea of what age level I would prefer. Also, we had to create lesson plans and teach a total of 6 lessons throughout the year to the students. In college, I did not complete my certification, but I did teach lessons for the school district I was in regarding Theatre workshops and I have had tutoring opportunities as well.

I do not have much teaching experience. I have helped kids out in the way of teachign them about sports like football and track but that is it.

I have no classroom teaching experience. A few sports related practice/camp teaching is it.

I'm an after-school teacher at Timothy Road Elementary School.

I have observed in classrooms and volunteered as a tutor.

The only teaching experience I have is when I am a teacher over the summer at a childrens' day camp. I teach for 5 weeks and come up with themes for each week that have crafts everday and a mini-lesson.

zero, none, nada

I have tutored small groups at an underpriviledged community center for six months, and that experience is the closest one that I have to real teaching. My mom is a teacher and I have observed her and her colleague's classrooms on many occassions.

None whatsoever.

I have been in the classroom since my freshman year in college. I've team taught and individually taught through my freshman sophomore and junior years. Last semester I student taught for 17 weeks and I am now a sub teacher in the county I student taught in.

Taught preschoolers ballet and jazz dance when I was in hs. I help lead a small group of 1st graders at my my church. I've tutored before as well.

I have observed an AP English classroom, I tutored students daily this summer, and I tutor at the Performance Learning Center once a week.

I don't really have "real" teaching experience, but I have been an assistant coach before to the girls from my high school and taught them the importance of having a bond on a team and having "team" come first and then yourself second. I have taught them how to do relay exchanges and they were successful in the end. I used to babysit my cousins and next door neighbors children and we used to do alot of fun activities. I wasn't a boring babysitter. I used to have a time when they would just practice writing their names over and over, then a time to watch any movie of their choice and then we would play with flashcards to spell.

Very little - I am a communication sciences and disorders major, so most of my experience will come when I enter grad school.

In high school we ran a preschool with the the Early Childhood Education class. I was a student teacher for 3 years and my senior year I was one of the student directors of the preschool. In the

class we had to create lesson plan and do the activity with children ages 2 to 5 with different levels of development.

I do not have any teaching experience.

I took a freshman seminar on teaching and worked in a first grade class for one semester. I have not taken any other education classes.

I have helped teach at an after school program at Gaines Elementary School, I do Young Life where I hang out with and teach high school students, and I have worked in different settings at church where I have taught elementary age students to high school students.

I teach a Sunday School lesson at a church on Sundays to two and three year olds. Besides that, I tutor third graders on Tuesday and Thursday. I don't teach a specific subject, just whatever their homework is dealing with and a few things that they'll need to know for the CRCT.

None. I'm not in a teaching based education program.

None but I plan on gaining some very soon.

Worked as a Teacher's Assistant in Kindergarten classroom for a semester, volunteered in pre-k class setting, work at Boy's and Girl's club--have helped those kids k-5 with homework.

I volunteered in a first-grade classroom for my entire senior year of high school, and have completed 50 hours of volunteer tutoring with a mentor teacher since being at school.

None aside from working camps and teaching kids in day-care type situations.

Mentoring, Teacher's assistant.

Have completed one practicum and have had experience substitute teaching and many observations.

I participated in Project Focus last semester where I taught science to an inclusive special ed class.

I have interned and observed a couple Speech Therapists and Special Education teachers. I have also helped teach a 4th grade class. This year I have been tutoring at Oasis Catolico and help the students complete their homework and use English regularly. In high school I worked with the After School Program and tutored elementary students after their classes.

I have been a camp activities counselor. I was also a preschool teacher at my high school for a year.

None

None.

Helping teach english in the dominican republic.

Very brief and simple ones like vacation bible school or volunteering at boys and girls club.

None

I work at a summer camp and the staff members may teach various classes.

My mom is a Special Education teacher (my major) and I have been a substitute teacher for the past 4 years. I do A LOT of volunteer work at the school (yearbook, pep club, after-school learning program, etc.)

I have visited and observed in several classrooms. I have also worked at a summer camps for the past two summers and for ten weeks each. I was a camp counselor.

I have been a counselor at a sleep away camp, as well as a supervisor and I have taught informational education to children between the ages of 9-14. I also work at an after school elementary program.

Tutoring experience from Pinewoods Library in Athens, (September 2009- Present), Assistant Instructor for Choi Kwang Do Martial Arts (January 2006-June 2009), Junior Assistant Senior Patrol Leader for Boy Scouts of America (est. 1998- January 2006).

I worked in as a paraprofessional in a pre-k classroom last summer (EarlyReading First summer program).

I volunteer with a summer science research program, during the year I volunteer in a 2nd grade classroom, and in the summer I also teach swim lessons.

Just in sports, track and field.

I currently teach an adult ESOL class. I have taught the class for about 6 months but I received no training. I use the internet and the textbook we are given to learn more about how to teach language learners.

I don't have a lot of actual teaching experience. I tutor pre-K children now and have worked with children in different types of settings, but never actually in the classroom.

I have taught/helped out with a first grade class one school year. I have also taught cheerleading lessons and tutored children.

I have observed several different times for first grade and second grade classrooms. I also give the ACT, SAT, and Praxis at Parkview high school, thats about the most experience teaching that I have had.

None

I really don't have any teaching experience. The closest that I can think of is that I worked at a camp two summers ago. This was a sleepaway camp that lasted a month, and I was a bunk councelor for 8 year old girls. Also, during the camp day, I was the co-director of theatre. We lead drama classes for the kids, and even directed them in the play ANNIE.

I was an instructor one summer at Cybercamps Academy. It is a computer camp hosted at various colleges for children aged 10-17 year olds. I taught Adobe Photoshop, Flash and C++.

I have experience with tutoring from high school and now in college. I do not have experience in schools, but I have experience teaching and tutoring in after school programs.

I have worked at a summer daycare camp with children, but have not actually taught them as a teacher- it was more of being a leader and teaching them artwork, etc.

I don't really have any teaching experience, but I have worked with students one on one with their reading.

I have no previous teaching experience.

The only teaching experience i have is that i have been a tutor to several different ages of kids and i have observed a speech teacher at an elementary school.

Not much more than coaching.

Observation at Cedar Shoals High School 2008.

Appendix K: Results of Question 3 - Student Background Information Sheet

Q3. Including this semester, what education courses have you taken?

this is the only one

EDIT 2000 (Instructional Technology)

None

ALL required EDMS, EMAT x2, ESOC x2, MATH x2 (teaching math), SPED. Basically all the classes I have taken are education oriented.

Educational Psychology. EFND. SPED 2000. 5 English Education courses that ranged from teaching students how to read to knowing what students read. I had a standards class, a young adult literature class, a reading in the classroom class, a writing class, and a seminar that would cover miscellaneous topics.

Educational Psychology, EPSY 2130

Block one, educational psychology

EPSY 2130, SPED 2000, MATH 5001, EDIT 2000

EFND 2110, SPED 2000, EDIT 2000

Workforce Education, Intro to Teaching US History

EPSY 2130- Ed Psych, EFND 2110- Critical issues in education, EFND 2120- Classroom Diversity

Prior to UGA: I have taken Ed Psych, Literacy: teaching adolescents

At UGA: SPED 2000, EFND 2120, EPSY 4060, EDIT 2000, LLED 4260 (online class that has me tutor at Garnet Ridge Boys and Girls Club.

Investigating Critical and Contemporary Issues in Education

Exploring teaching and learning

Survey of Special Education

Introduction to Computers for Teachers

Educating Young Adolescents

Educating Young Adolescents Lab

Children Literature and Oral Language, Grades 4-8

Teaching Social Studies in the Middle Grades

Content Area Literacy for Middle School

This is the only teaching course i have taken.

EDIT 2000 is the only education class that I have taken.

EDIT 2000, EPSY 2130--Educational Psychology

EPSY 2130- Educational Psychology, EDIT 2000, EFND 2110- Critical Issues in Education

SPED 2000- Special Education

EFND 2110 and EPSY 2130

I transferred from Vanderbilt University and I took an introduction to education there.

this is first and last

I have not taken any other education courses.

This class and EPSY 2100.

EFND, ESPY, Cirrculium planning, Program Planning, Agriscience for teachers,

Horticulture for teachers, Ag Mech for teachers, EDIT 4150, and at least 2 more that I

cannot remember!

educational psychology, EdIT 2000

Educational Psychology and Social Foundations in Education

None.

EPSY - overview of educational psychology and behavior management

EFND - overview of the foundations of education

SPED - overview of special education

EDIT - technology for teachers

Just Edit 2000

This is the only education course I have taken unless you count ECHD

Including this semester, I have taken EDIT 2000 and a freshman seminar called, "So You Think You Want to be a Teacher?". The freshman seminar was for freshmen in college considering being a teacher. We worked with an elementary school and learned different things about being a teacher.

I have taken education psychology and the Intro to art education class.

This is my first education course -- EDIT 2000.

EDIT 2000.

EDIT 2000

CHFD2000, CHFD2980, CHFD2100, EFDN2110, MATH5001, MATH5002, EDIT2000, KINS2420, SPED2000, ??

I have taken Math 5001 and Math 5002 (two of the math education classes), EFND 2110 and EFND 2120 (foundations in education classes), EPSY 2130 (education pyscology).

just this one

SPED, EFND2110, EPSY

Education Psychology, Educational Diversity, Computing for Teaching, Marketing Education, Work Based Learning Education, Workforce Education, Internship for Marketing Education, and Business Education.

EFND, EPSY, and SPED 2000

EDIT 2000, EFND 2110, EPSY

I have not taken any educational classes.

none

Two-this technology in the classroom class and parent education and child guidance

edit2000

Intro to education and EDIT

SPED 2000

I haven't taken any specific education course. However, I am enrolled in various CHFD courses.

All the education class needed: EDUC 2110 (Investigating Critical and Contemporary Issues in Education), EDUC 2120 (Exploring Socio-Cultural Perspectives on Diversity), and EDUC 2130 (Educational Psychology/Exploring Learning and Teaching). EDUC 2460 (Educational Experiences in Classroom and Community), SPED 2000 (Survey of Special Education), EPSY 4060 (Prevention and Intervention with School-Age Youth), and EPSY 4310 (Prevention and Remediation of Classroom Behavior Problems).

I took a standard like history on education course at my previous college. I have taken Educational Psychology, Workforce Education for Special Needs, some diversity type class, and this class.

None

EFND 2130, EPSY 2120, EDUC 2110, EDIT 2000, SPED 2000.

EFND 2110, MATH 5001, MATH 5002, EDIT 2000, SPED 2000

ESPY, ENFD 2010, 2020, CMSD 3000

edit 2000

This is my first education class.

EFND 2110- critical issues in education, SPED 2000- intro to special education

This is the first education course that I have taken.

CHFD 2100 and 2950 , and I forget the classes I took at Gainesville related to education, so I would say about 4 or 5 classes.

Just this one

EDIT 2000

Just Edit2000.

Just EDIT 2000. I took CMSD 3120, Language Development, which had some focus for education.

EDIT 2000, EFND 2110 foundations in education, SPED 2000 special education , EPSY 2130, education psychology

EDIT 2000

Educational Psychology, Foundations in Education, EDIT 2000, SPED 2000

I have only taken CHFD classes. No education classes.

EFND 2110- critical issues in education, ESPY- educational psychology

Workforce education, Intro to teaching US History

ESOC 4350, ESOC 4360, ESOC 4360 Lab = observation at schools

Appendix L: Results of Question 4 - Student Background Information Sheet

Q4. If you are not planning to teach in traditional classroom setting, how do you plan to apply the course information to your major?

It can help me make a website

I hope to get a MAT degree after finishing my undergraduate Business degree in Risk Management & Insurance. With that, I hope to apply the course information to the classroom setting, though my ultimate goal is administration.

I am a Pre-Nursing student, so after I am certified I may have the opportunity to lead conferences and teach new information.

I do not plan on teaching anytime soon.

If I do not work in a school, I may want to work from my home or by going to the homes of my students.

I am currently a Recreation and Leisure Studies major. I really have no idea how i will be able to use this class in the future. Hopefully most of my education will focus on getting students away from technology.

I plan on working in speech therapy. I plan to use different technologies to enhance student learning and motivation.

I am looking forward to including a lot of information from this course towards my class. Especially utilyzing a website for my students so they can interact and stay up to date from home.

n/a

Learning how to teach is always something good to have. Some day aftr i retire i may want to be a high school coach and teach p.e. or maybe to make some extra money to be a tutor.

There are many things you could do to apply this.

Many of the things we learn in this class can be applied to speech therapy

I plan on incorporating technology techniques into my speech therapy classroom.

I plan on doing private practice work as a speech pathologist and I plan on incorporating a lot of the teaching techniques into my lessons. For example, I know now how to adequately use technology to enhance lessons.

It was a requirement I assume because it is possible for me to work to children.

Learning about technology is crucial to any field of study. It makes tedious tasks much quicker and learning about something that is constantly evolving is very exciting.

I plan to use the information I've learned her to make my private Speech Therapy practice more interesting for the children who are doing it.

I could use them to teach dance to students in a private school or studio setting

Collaboration and Communication is something you do in everyday life and with everyone in every field, so I feel like I can definitely apply this is my course.

I plan to use various computer programs in the treatment of my students' communication disorders. I also plan on incorporating some of the cooperative/collaboration tools we have learned about into my therapy programs.

Technology tools can be adapted to any other jobs as well as if I have children in the future, I know of some tools that they can use for educational learning online as well as where I can find the curriculum standards.

This class helps e improve y techology skills. I have learned about different helpfyl tools and sites to help me with projects or talking to professors.

I am a Child and Family Development Major, and I really don't know what I am going to do

after college yet, so I do not know how I will use this course information yet.

I do plan to teach in an art classroom one day.

Knowing how to inform the parents of my children is very helpful -- Google Sites. I'm not sure exactly how I'll be able to apply the information I'm learning until actually getting into my classroom.

Everyone has to use technology, so if there is a tool that I think could apply to adults as well I would use it.

I am CMSD so it won't necessarily be traditional, but I will definitely apply all the knowledge from my courses, especially EPSY and SPED.

I am a speech major and I plan to specialize with special needs children. I will be able to incorporate technologies such as voicethread to help with pronunciation.

I am a Speech major, but technology will play an important part in providing interest and other methods of helping the Speech students improve. I can use Voicethread, Storybird, Imovie, etc.

I want to use information from this course in a church teaching environment.

no

Using technology and teaching it to the elderly.

the use of technology is important in our world today and for our future and the great understanding of all its uses will be usefull for me in any future career.

Whatever I decide to do with my major it will be important for me to understand technology and help the students do the same as well.

I do not plan on teaching, although after this class, who knows!!

I am planning to teach in traditional classrooms.

I still have to teach my students how to speak so I will be using technology that helps them communicate, whether in a classroom or not.

i learned a lot more about technology

I think there are several tools available on the internet and through the use of software that can help my ESL students learn English.

I am doing speech, so I will not be in the general education classroom, but there are different technologies that are good to use with students who need help with speech. I will also be able to use programs that are designed specifically for speech, and even though we don't address those in this class, learning how to use technology in the classroom will help with my overall knowledge.

I would like to teach in a traditional classroom one day, but if not I know I will use the information that I have learned in the class while working with kids in the future.

Well I want to eventually want to teach but for now I just want a job with kids in that area. And I feel that I can apply any of the course information to everyday life, In whatever I do.

By applying my knowledge and understanding of technology to help communicate and work with other employees

The tools and technology used in class could also be used to teach small seminars and use to work with individual students in an intimate setting.

I am planning to work as a speech therapist and I hope to use the technology one-on-one with the kids.

If I pursue graduate school, I think this class would be beneficial at the college level when teaching classes there.

Because speech therapists can work in schools, most of the information I have learned in my

education classes is still applicable for me. Understanding about schools, the psychology for teaching and students, and learning about special education will be very useful.

I plan to apply this course information by using teaching combined will technology skills when I work with children in the future.

I'm not sure yet. I might use it for teaching.

The course information is useful for any major really. It is applicable to life to tech savvy.

i am trying to interpret the information i am learning in the class into speech and language lessons. one way to do this is to make a video of the right articulation of a specific sound using imovie. the video would incorporate both the annunciation of the sound and the correct place and manner of articulation.

I am planning on teaching with powerpoint and some other information from class. I am looking forward to using different types of interactive tools with my students such as the survey I am filling out right now to figure out student needs. I will design lesson plans based off the feedback I receive from my students on these forms.

I plan to do this by using various technologies that are geared towards my students and there style of learning. I feel that I can adapt to all students and their preferences in learning.

Appendix M: TPACK Survey – 1st Round – Demographic Information

Table 3
TPACK 1st Round Demographic Information

Item	*Freq*	*Pct*
1.Session		
8:00	14	25.9
9:30	12	22.2
11:00	15	27.8
12:30	13	24.1
2.Gender		
Male	12	22.2
Female	42	77.8
3.Age Range		
18-22	49	90.7
23-26	5	9.3
27-32	0	0
32+	0	0
4.Major		
Early Childhood Education	9	16.7
Middle School Education	3	5.6
Secondary Education	9	16.7
Special Education	2	3.7
Other	31	57.4
5.Area of Specialization		
Art	1	1.9
Early Childhood Education	9	16.7
English and Language Arts	7	13
Foreign Language	0	0
Health	4	7.4
History	1	1.9
Mathematics	4	7.4
Music	2	3.7
Science	3	5.6
Social Science	3	5.6
Other	20	37

Table 3 (Cont.)
TPACK 1st Round Demographic Information

Item	*Freq*	*Pct*
6.Year in College		
Freshman	8	14.8
Sophomore	17	31.5
Junior	19	35.2
Senior	10	18.5
7.Completing a computing minor		
Yes	2	3.7
No	52	96.3
8.Enrolled or completed a practicum in PreK-6classroom		
Yes	11	20.4
No	43	79.6

Appendix N: TPACK Survey – 2nd Round – Demographic Information

Table 4
TPACK 2nd Round Demographic Information

Item	*Freq*	*Pct*
1.Session		
8:00	12	25.5
9:30	10	21.3
11:00	10	21.3
12:30	15	31.9
2.Gender		
Male	9	19.1
Female	38	80.9
3.Age Range		
18-22	42	89.4
23-26	5	10.6
27-32	0	0
32+	0	0
4.Major		
Early Childhood Education	5	10.6
Middle School Education	3	6.4
Secondary Education	7	14.9
Special Education	1	2.1
Other	31	66
5.Area of Specialization		
Art	0	0
Early Childhood Education	8	17
English and Language Arts	7	14.9
Foreign Language	0	0
Health	3	6.4
History	0	0
Mathematics	1	2.1
Music	1	2.1
Science	3	6.4
Social Science	5	10.6
Other	19	40.4

Table 4 (Cont.)
TPACK 2nd Round Demographic Information

Item	*Freq*	*Pct*
6.Year in College		
Freshman	5	10.6
Sophomore	15	31.9
Junior	18	38.3
Senior	9	19.1
7.Completing a computing minor		
Yes	1	2.1
No	46	97.9
8.Enrolled or completed a practicum in PreK-6classroom		
Yes	11	23.4
No	36	76.6

Appendix O: TPACK Survey – 1st Round – Descriptive Statistics

Table 5
TPACK Survey 1st Round Descriptive Statistics, TPACK portion, items 1-47

Item	*n*	*Mean*	*SD*	*Min**	*Max**
1	54	3.61	.76	2	5
2	54	4.15	.76	1	5
3	54	3.46	.90	1	5
4	54	3.65	.93	2	5
5	54	3.41	.88	2	5
6	54	3.87	.87	1	5
7	54	3.83	.86	1	5
8	33	3.45	1.20	1	5
9	34	3.24	1.26	1	5
10	33	3.18	1.29	1	5
11	34	3.62	.98	1	5
12	34	3.56	.99	1	5
13	33	3.52	.91	2	5
14	31	3.42	.99	2	5
15	31	3.42	.99	2	5
16	31	3.39	.99	2	5
17	37	4.14	.95	1	5
18	37	3.95	1.05	1	5
19	37	3.86	1.08	1	5
20	54	3.56	.84	1	5
21	54	3.87	.78	1	5
22	54	3.98	.79	2	5
23	54	3.87	.73	2	5

Table 5 (Cont.)
TPACK Survey 1st Round Descriptive Statistics, items 1-47

Item	*n*	*Mean*	*SD*	*Min**	*Max**
24	54	3.91	.71	1	5
25	54	3.57	.79	2	5
26	54	3.57	.92	1	5
27	38	3.26	1.00	1	5
28	41	3.41	.89	1	5
29	37	3.08	1.09	1	5
30	40	3.38	1.00	1	5
31	37	3.24	1.04	1	5
32	41	3.54	.9	1	5
33	37	3.24	1.06	1	5
34	40	3.40	.93	2	5
35	54	3.85	.74	1	5
36	54	3.80	.63	2	5
37	54	3.93	.82	2	5
38	54	4.11	.69	2	5
39	54	4.06	.56	3	5
40	38	3.24	.82	1	5
41	42	3.60	.86	1	5
42	37	3.16	1.01	1	5
43	39	3.62	.75	2	5
44	54	3.93	.61	2	5
45	54	3.98	.53	3	5
46	54	3.78	.69	2	5
47	54	4.02	.6	2	5

*Values based on a Likert scale: 1(strongly disagree); 2(disagree); 3(neither agree or disagree); 4(agree); 5(strongly agree).

Appendix P: TPACK Survey – 2nd Round – Descriptive Statistics

Table 6
TPACK Survey 2nd Round Descriptive Statistics, TPACK portion, items 1-47

Item	*n*	*Mean*	*SD*	*Min**	*Max**
1	47	3.77	.67	2	5
2	47	4.09	.62	2	5
3	47	3.70	.80	2	5
4	47	3.66	.94	2	5
5	47	3.62	.82	2	5
6	47	4	.66	2	5
7	47	3.91	.75	2	5
8	28	3.71	.85	2	5
9	29	3.59	.91	2	5
10	29	3.52	.87	2	5
11	29	3.86	.79	2	5
12	29	3.72	.84	2	5
13	29	3.72	.84	2	5
14	28	3.54	.96	2	5
15	28	3.57	.88	2	5
16	28	3.43	.92	2	5
17	32	3.91	.69	3	5
18	33	3.79	.82	2	5
19	33	3.70	.85	2	5
20	47	3.77	.73	2	5
21	47	3.96	.83	2	5
22	47	3.87	.74	2	5
23	47	3.77	.81	2	5

Table 6 (Cont.)
TPACK Survey 2nd Round Descriptive Statistics, items 1-47

Item	*n*	*Mean*	*SD*	*Min**	*Max**
24	47	3.79	.81	2	5
25	47	3.53	.78	2	5
26	47	3.85	.75	2	5
27	41	3.32	.76	2	4
28	42	3.62	.76	2	5
29	39	3.28	.92	2	5
30	39	3.46	.76	2	5
31	37	3.49	.84	2	5
32	39	3.72	.83	2	5
33	36	3.42	.73	2	5
34	37	3.59	.69	2	5
35	47	3.94	.64	2	5
36	47	3.89	.73	2	5
37	47	4	.72	2	5
38	47	3.96	.75	2	5
39	47	4.06	.57	3	5
40	36	3.56	.84	2	5
41	37	3.81	.81	2	5
42	35	3.57	.88	2	5
43	36	3.56	.88	2	5
44	47	3.94	.67	2	5
45	47	4	.63	2	5
46	47	3.79	.83	2	5
47	47	4.13	.54	3	5

*Values based on a Likert scale: 1(strongly disagree); 2(disagree); 3(neither agree or disagree); 4(agree); 5(strongly agree).

Appendix Q: TPACK Survey – 1st Round – Frequencies

Table 7

Answers in the 1st round of the TPACK Survey, items 1-47

Item	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree	
	freq	pct	freq	pct	freq	pct	freq	pct	freq	pct
1.	0	0	6	11.1	12	22.2	33	61.1	3	5.6
2.	16	29.6	1	1.9	3	5.6	33	61.1	1	1.9
3.	1	1.9	8	14.8	14	25.9	27	50	4	7.4
4.	9	16.7	8	14.8	12	22.2	25	46.3	0	0
5.	0	0	9	16.7	19	35.2	21	38.9	5	9.3
6.	1	1.9	3	5.6	9	16.7	30	55.6	11	20.4
7.	1	1.9	3	5.6	10	18.5	30	55.6	10	18.5
8.	3	5.6	4	7.4	7	13	13	24.1	6	11.1
9. .	4	7.4	6	11.1	7	13	12	22.2	5	9.3
10.	4	7.4	7	13	6	11.1	11	20.4	5	9.3
11.	1	1.9	4	7.4	7	13	17	31.5	5	9.3
12.	5	9.3	4	7.4	9	16.7	15	27.8	1	1.9
13. .	0	0	5	9.3	10	18.5	14	25.9	4	7.4
14.	0	0	7	13	8	14.8	12	22.2	4	7.4
15.	0	0	7	13	8	14.8	12	22.2	4	7.4
16.	0	0	7	13	9	16.7	11	20.4	4	7.4
17.	1	1.9	1	1.9	5	9.3	15	27.8	15	27.8
18.	1	1.9	2	3.7	9	16.7	11	20.4	14	25.9
19.	1	1.9	4	7.4	6	11.1	14	25.9	12	22.2
20.	1	1.9	5	9.3	15	27.8	29	53.7	4	7.4
21.	1	1.9	1	1.9	11	20.4	32	59.3	9	16.7
22.	0	0	2	3.7	11	20.4	27	50	14	25.9
23.	0	0	2	3.7	12	22.2	31	57.4	9	16.7

Table 7 (Cont.)
Answers in the 1st round of the TPACK Survey, items 1-47

Item	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree	
	freq	pct	freq	pct	freq	pct	freq	pct	freq	pct
24.	1	1.9	0	0	10	18.5	35	64.8	8	14.8
25.	0	0	7	13	12	22.2	32	59.3	3	5.6
26.	1	1.9	7	13	12	22.2	28	51.9	6	11.1
27.	1	1.9	8	14.8	13	24.1	12	22.2	4	7.4
28.	1	1.9	5	9.3	14	25.9	18	33.3	3	5.6
29.	2	3.7	10	18.5	12	22.2	9	16.7	4	7.4
30.	2	3.7	4	7.4	16	29.6	13	24.1	5	9.3
31.	2	3.7	7	13	11	20.4	14	25.9	3	5.6
32.	1	1.9	5	9.3	9	16.7	23	42.6	3	5.6
33.	2	3.7	9	16.7	6	11.1	18	33.3	2	3.7
34.	0	0	7	13	15	27.8	13	24.1	5	9.3
35.	1	1.9	1	1.9	10	18.5	35	64.8	7	13
36.	0	0	2	3.7	11	20.4	37	68.5	4	7.4
37.	0	0	3	5.6	11	20.4	27	50	13	24.1
38.	0	0	1	1.9	7	13	31	57.4	15	27.8
39.	0	0	0	0	7	13	37	68.5	10	18.5
40.	1	1.9	5	9.3	17	31.5	14	25.9	1	1.9
41.	1	1.9	3	5.6	12	22.2	22	40.7	4	7.4
42.	2	3.7	7	13	14	25.9	11	20.4	3	5.6
43.	0	0	2	3.7	15	27.8	18	33.3	4	7.4
44.	0	0	1	1.9	9	16.7	37	68.5	7	13
45.	0	0	0	0	8	14.8	39	72.2	7	13
46.	0	0	2	3.7	14	25.9	32	59.3	6	11.1
47.	0	0	1	1.9	6	11.1	38	70.4	9	16.7

Obs.: n is 54, except when it is: 33 for item 8; 34 for item 9; 37 for items 18, 19, 29, 31, 37, and 42; 38 for items 27, and 40; 39 for item 43; 40 for items 30, 34; 41 for items 28, and 32; 42 for item 41

Appendix R: TPACK Survey – 2nd Round – Frequencies

Table 8

Answers in the 2nd round of the TPACK Survey, items 1-47

Item	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree	
	freq	pct	freq	pct	freq	pct	freq	pct	freq	pct
1.	0	0	2	4.3	11	23.4	30	63.8	4	8.5
2.	0	0	1	2.1	4	8.5	32	68.1	10	21.3
3.	0	0	5	10.6	9	19.1	28	59.6	5	10.6
4.	0	0	7	14.9	10	21.3	32	46.8	8	17
5.	0	0	5	10.6	13	27.7	24	51.1	5	10.6
6.	0	0	2	4.3	4	8.5	33	70.2	8	17
7.	0	0	2	4.3	9	19.1	27	57.4	9	19.1
8.	0	0	3	6.4	6	12.8	15	31.9	4	8.5
9.	1	2.1	5	10.6	5	10.6	16	34	2	4.3
10.	0	0	5	10.6	6	12.8	16	34	2	4.3
11.	0	0	3	6.4	2	4.3	20	42.6	4	8.5
12.	0	0	3	6.4	6	12.8	16	34	4	8.5
13.	0	0	3	6.4	6	12.8	16	34	4	8.5
14.	1	2.1	4	8.5	10	21.3	9	19.1	4	8.5
15.	1	2.1	3	6.4	10	21.3	11	23.4	3	6.4
16.	0	0	4	8.5	12	25.5	8	17	4	8.5
17.	0	0	0	0	9	19.1	17	36.2	6	12.8
18.	0	0	2	4.3	9	19.1	16	34	6	12.8
19.	0	0	2	4.3	12	25.5	13	27.7	6	12.8
20.	0	0	2	4.3	13	27.7	26	55.3	6	12.8
21.	0	0	3	6.4	8	17	24	51.1	12	25.5
22.	0	0	2	4.3	10	21.3	27	57.4	8	17
23.	0		3	6.4	13	27.7	23	48.9	8	17

Table 8 (Cont.)

Answers in the 2nd round of the TPACK Survey, items 1-47

Item	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree	
	freq	pct	freq	pct	freq	pct	freq	pct	freq	pct
24.	0	0	4	8.5	9	19.1	27	57.4	7	14.9
25.	0	0	5	10.6	15	31.9	24	51.1	3	6.4
26.	0	0	2	4.3	11	23.4	26	55.3	8	17
27.	0	0	7	14.9	14	29.8	20	42.6	0	0
28.	0	0	3	6.4	14	29.8	21	44.7	4	8.5
29.	1	2.1	9	19.1	13	27.7	14	29.8	2	4.3
30.	0	0	5	10.6	12	25.5	21	44.7	1	2.1
31.	1	2.1	5	10.6	12	25.5	17	36.3	2	4.3
32.	0	0	4	8.4	8	17	22	46.8	5	10.6
33.	0	0	3	6.4	17	36.2	14	29.8	2	4.3
34.	0	0	2	4.3	13	27.7	20	42.6	2	4.3
35.	0	0	2	4.3	5	10.6	34	72.3	6	12.8
36.	0	0	4	8.5	3	6.4	34	72.3	6	12.8
37.	0	0	1	2.1	9	19.1	26	55.3	11	23.4
38.	0	0	2	4.3	8	17	27	57.4	10	21.3
39.	0	0	0	0	6	12.8	32	68.1	9	19.1
40.	0	0	5	10.6	9	19.1	19	40.4	3	6.4
41.	0	0	3	6.4	7	14.9	21	44.7	6	12.8
42.	1	2.1	4	8.5	12	25.5	14	29.8	4	8.5
43.	0	0	5	10.6	10	21.3	17	36.2	4	8.5
44.	0	0	1	2.1	9	19.1	29	61.7	8	17
45.	0	0	1	2.1	6	12.8	32	68.1	8	17
46.	0	0	3	6.4	13	27.7	22	46.8	9	19.1
47.	0	0	0	0	4	8.5	33	70.2	10	21.3

Obs.: n is 47, except when it is: 28 for items 8, 14, 15, and 16; 29 for items 9, 10, 11, 12, and 13; 32 for item 17; 33 for items 18, and 19; 35 for item 42; 36 for items 33, 40, and 43; 37 for items 31, 34, and 41; 39for items 29, 30, and 32; 41 for item 27; 42 for item 28.

Appendix S: Digital Storytelling Inventory

The digital stories mentioned here are the ones still published at the date of the creation of this inventory (June/2011). They also correspond to the Education majors' work during the Digital Storytelling project and address specific Georgia Performance Standards (GPA).

Title	Cultural Experience
Subject Matter/Grade	English/9th grade
GPA addressed	ELA9LSV2
Tool	VoiceThread
Features	narration, still pictures, text
Description	The author describes a family trip to the Caymans, exploring how this experience has left marks on her life. The author wants her students to realize that "even the most commonplace occurrence can impact their lives."
Link to item	http://voicethread.com/#q.b897426.i5113788

Title	Beowulf
Subject Matter/Grade	British Literature/12th grade
GPA addressed	ELABLRC2/ ELABLRC4
Tool	iMovie
Features	Still pictures, music, text
Description	The author describes the characters in Beowulf, comparing this literature piece to comic books in order to make a complex text into something more understandable.
Link to item	https://sites.google.com/site/jeindest/digital-storytelling (for download at the end of page)

Title	Fitness
Subject Matter/Grade	Not informed
GPA addressed	Not informed
Tool	VoiceThread
Features	narration, still pictures, text
Description	The authors explain the importance of "eating the right way, staying active, and in shape."
Link to item	http://voicethread.com/?#u837842.b1018335

Title	The Skeleton Man
Subject Matter/Grade	Language Arts/8th grade
GPA addressed	ELA8LSV2

Tool	iMovie
Features	Narration, music/visual effects, still pictures
Description	The author makes a summary of the "The Skeleton Man" story, presenting her point of view in relation to it as she uses suspense.
Link to item	http://www.youtube.com/watch?v=dot89VBfbJY

Title	Where in The World is Stanley?
Subject Matter/Grade	Social Studies/6th grade
GPA addressed	SS6G8
Tool	VoiceThread
Features	narration, still pictures, text
Description	The author engages the audience's minds in a guessing game while describing the European travels of a boy named Stanley. While seeing pictures and listening to key information, the viewer is invited to discover where Stanley is.
Link to item	http://voicethread.com/#q.b1004683

Title	Interviewing Successfully
Subject Matter/Grade	Career, Business Ed./HighSchool
GPA addressed	BCS-BP-4
Tool	iMovie
Features	Still pictures, narration, text
Description	The author offers advice on how to behave/dress properly for a successful interview.
Link to item	http://www.youtube.com/watch?v=cv-QJ4fHnxA

Title	Hatshepsut: Queen of The Nile?
Subject Matter/Grade	World History/High School
GPA addressed	SSWH1
Tool	Not informed, but probably iMovie
Features	Still pictures, text, sound/music track
Description	The struggles of Hatshepsut, queen of Egypt, are described with a mix of pop culture.
Link to item	http://sites.google.com/site/knichols89/digital-storytelling (for download at the end of page)

Title	The Care and Keeping of Your Baby
Subject Matter/Grade	Nutrition/HighSchool
GPA addressed	FCS-FNL-4
Tool	Not informed, but probably iMovie
Features	Still pictures, text, narration
Description	The author gives advice on how to properly feed a new born (showing two different ways) to insure that the child grows strong and healthy.

Link to item	http://www.youtube.com/watch?v=jTJGhabld6c

Title	A Tour Through The Cell
Subject Matter/Grade	Biology/HighSchool
GPA addressed	SB1
Tool	PhotoStory
Features	Still pictures, narration, text
Description	The functions/structures of cells are explained while making connections with real world places and objects.
Link to item	http://sites.google.com/site/vickeryedit2000/digital-storytelling (for download at the end of page)

Title	Pete's Pizza Shop
Subject Matter/Grade	Math/5th grade
GPA addressed	M3N4
Tool	Windows Movie Maker
Features	Still pictures, narration, text, music
Description	The author teaches how to divide or simplify fractions through the story of Pete, who is going to receive guests for pizza.
Link to item	http://www.youtube.com/watch?v=haduKmxOoqY&feature=player_embedded#at=47

Title	GoldiNaut and The Three Aliens
Subject Matter/Grade	Literature/2nd-3rd grades
GPA addressed	Objective #9, Annual Goal #3, Content Strand of Literature
Tool	Voice Thread
Features	Still pictures, narration
Description	Recreation the story of Goldy Locks and the Three Bears as Science fiction.
Link to item	http://voicethread.com/?#q.b959804.i5289360

Title	Not assigned
Subject Matter/Grade	Social Studies/3rd grade
GPA addressed	SS3E1
Tool	PhotoStory
Features	Still pictures, text
Description	The story of a girl who goes exploring in her hometown to find examples of all four productive resources, connecting her Social Studies homework to real life examples.
Link to item	http://sites.google.com/site/bridgetsedit2000portfolio/digital-storytelling (for download at the end of page, needs PhotoStory)

Title	Kindergarten Class Routines
Subject Matter/Grade	Math/Kindergarten

GPA addressed	Students will understand time as it relates to a daily schedule
Tool	VoiceThread
Features	Still pictures, narration
Description	The teacher of a Kindergarten class instructs incoming students about their daily routines, using rhymes.
Link to item	http://voicethread.com/#q.b1008676

Title	The Real World
Subject Matter/Grade	Social Studies/7th grade
GPA addressed	Not specified
Tool	iMovie
Features	Video, still picture, text, narration
Description	Three girls discuss the diversity of religions between Persians, Arabs and Kurds in the Middle East.
Link to item	http://blip.tv/alexandra-finder/episode-3442244

Title	Lilly and Larry's Dancing Adventure
Subject Matter/Grade	Dance/1st grade
GPA addressed	DKCR.1/DKCR.2
Tool	VoiceThread
Features	Still pictures, narration, typed commentary
Description	The dancing story of two frogs as an invitation for students to explore dancing in new ways.
Link to item	http://voicethread.com/#q.b997852.i5320092

Title	The Revealing Truth to The 3 Little Pigs: Justice has been Served
Subject Matter/Grade	Language Arts/2nd grade
GPA addressed	Students apply existing knowledge to generate new ideas, products, or processes.
Tool	Storybird
Features	Still pictures, text
Description	A new version of the 3 Little Pigs story, where the wolf is no longer the culprit.
Link to item	http://storybird.com/books/the-revealing-truth-to-the-3-little-pigs-justice-h/?token=45mwq4

Title	The History of Baseball
Subject Matter/Grade	Physical education/HighSchool
GPA addressed	PEHS.1
Tool	Voice Thread
Features	Still pictures, narration, text
Description	The author narrates the history of baseball.
Link to item	http://voicethread.com/#q.b1016044.i5430412

Title	Doug and His Favorites

Subject Matter/Grade	Rhyming/Kindergarten
GPA addressed	ELAKR2
Tool	Storybird
Features	Still pictures, text
Description	A book of rhymes about a little boy's favorite activities.
Link to item	http://storybird.com/books/doug-and-his-favorites/

Title	The Adventures of Little Orange
Subject Matter/Grade	Art/2nd grade
GPA addressed	VA2PR.2/VA2PR.3
Tool	VoiceThread
Features	Still pictures, text, narration
Description	Little orange is in search of his real parents while he learns what colors mix together to make other colors.
Link to item	http://voicethread.com/#q.b1013259.i5405686

Title	The Adventures of Tom Sawyer in 5 Minutes
Subject Matter/Grade	English/9th grade
GPA addressed	ELA9RL1
Tool	VoiceThread
Features	Video, still pictures, text, narration
Description	The essence of the story of Tom Sawyer is told through pictures and video.
Link to item	http://voicethread.com/#q.b992399.i5290853

Title	How to make an Amendment to the Constitution – I'm Just a Bill
Subject Matter/Grade	Social Studies/5th grade
GPA addressed	How to make an Amendment to the US Constitution
Tool	iMovie
Features	Music, still pictures, text
Description	The Bill tells the story of how it can be made.
Link to item	http://www.youtube.com/watch?v=qHyU1ObIIhg&feature=player_embedded

Title	Suzy and Tim Learning about Money
Subject Matter/Grade	Math/1st grade
GPA addressed	M1P4/ M1N1/ M1N3
Tool	VoiceThread
Features	Still pictures, typed comments, narration
Description	The story of two siblings who earn money to buy toys. The audience is invited to identify the names and values of each coin, add coins together up to one dollar.
Link to item	http://voicethread.com/#q.b1009024

Title	The Story of Thurgood Marshall
Subject Matter/Grade	Social Studies/2nd grade
GPA addressed	SS2H1
Tool	PhotoStory
Features	Narration, music, still pictures, text
Description	The author describes the several accomplishments of historical figure Thurgood Marshall.
Link to item	http://sites.google.com/site/ilovemsquanda/digital-storytelling (for download at the end of page)

Title	Yellow is The Greatest Color Ever
Subject Matter/Grade	Language Arts/1st grade
GPA addressed	ELA1W2
Tool	PhotoStory
Features	Text, narration, still pictures, music
Description	The author explains why yellow is her favorite color and the emotions that it provokes.
Link to item	http://sites.google.com/site/rkanzoportfolio2010/digital-storytelling (for download at the end of page)

Title	I'm a Senior – True Life
Subject Matter/Grade	Guidance/HighSchool
GPA addressed	Describe healthy ways to deal with stress.
Tool	Not mentioned, but probably PhotoStory
Features	Music, text, narration, still pictures
Description	The author gives tips on how to deal with stress.
Link to item	http://sites.google.com/site/shaylasportfolio2010/digital-storytelling (for download at the end of page).

Title	Fashion
Subject Matter/Grade	Marketing/HighSchool
GPA addressed	MKT-FM-3
Tool	PhotoStory
Features	Still pictures, text
Description	The story shows the different clothing and unique styles of today's fashion designers and it distinguishes them from one another.
Link to item	http://sites.google.com/site/morgannspage/digital-storytelling (for download at the end of page, PhotoStory required)

Title	Harriet Tubman
Subject Matter/Grade	Social Studies/1st grade
GPA addressed	The student will read about and describe the life of historical figures in American history.
Tool	VoiceThread
Features	Text, still pictures

Description	The story depicts the life of American icon Harriet Tubman and all that she went through when helping slaves run away
Link to item	http://voicethread.com/#q.b994538

Title	Coming Together & Being Apart
Subject Matter/Grade	Math/Kindergarten
GPA addressed	MKN2
Tool	VoiceThread
Features	Text, still pictures
Description	Fairy tale characters get together or split apart to represent addition/subtraction.
Link to item	http://voicethread.com/#u820932.b992878.i5294301

Title	Founding of Georgia
Subject Matter/Grade	Social Studies/Second grade
GPA addressed	SS2H1
Tool	Windows MovieMaker
Features	Music, video, text, still pictures
Description	The story introduces the unit on the founding of Georgia, focusing on several important historical figures in Georgia history.
Link to item	http://www.youtube.com/watch?v=7U1Bd-Jv_og&feature=player_embedded

Title	The Vietnam War
Subject Matter/Grade	U. S. History/11th grade
GPA addressed	Not mentioned
Tool	Windows Movie Maker
Features	Text, still pictures
Description	A look at positive and negative aspects of the Vietnam War. Some images may be disturbing.
Link to item	http://sites.google.com/site/coachbellshomepage/digital-story (for download at the end of page)

Title	The Pledge of Allegiance
Subject Matter/Grade	History/Kindergarten
GPA addressed	Not informed
Tool	Not informed, but probably iMovie.
Features	Video, still pictures, text, music, narration
Description	Instructional video that teaches The Pledge of Allegiance, inviting the audience to repeat the words.
Link to item	http://sites.google.com/site/norrisclaysportfolio/home/digital-storytelling (for download at the end of page)

Title	A Red Blood Cell's Journey
Subject Matter/Grade	Biology/9-12th grades
GPA addressed	SAP4

Tool	iMovie
Features	Video, still pictures, narration, music, text
Description	An instructional video about how blood flows through the body.
Link to item	http://www.youtube.com/watch?v=eCBf8pUMMy0&feature=player_embedded#at=90

Title	Playing Hide-and-Seek with The Sun & The Moon
Subject Matter/Grade	Science/4th grade
GPA addressed	S4E2
Tool	VoiceThread
Features	Still pictures, text
Description	A story of hide-and-seek, describing the phases of the moon.
Link to item	http://voicethread.com/#q.b999841

Title	Where in The World Am I From?
Subject Matter/Grade	ESL/5th grade
GPA addressed	4th level WIDA
Tool	iMovie
Features	Video, still pictures, narration, music
Description	The description of a girl's favorite places in Colorado.
Link to item	http://www.youtube.com/watch?v=ztv6XyKMqgw&feature=player_embedded#at=126

Title	Months and Holidays
Subject Matter/Grade	Language Arts/1st grade
GPA addressed	ELA1LSV1
Tool	iMovie
Features	Still pictures, music, narration, text
Description	The author instructs about the months and main holidays of the year. The audience is invited to respond to questions concerning the US holidays.
Link to item	http://www.youtube.com/watch?v=YzbZlSS9g2A&feature=player_embedded#at=76

Title	Farmer Bill
Subject Matter/Grade	Math/5th grade
GPA addressed	Students will extend their understanding of area of geometric plane figures, and derive the formula for the area of a parallelogram.
Tool	iMovie
Features	Still pictures, text, narration, music
Description	The story of a farmer who measured his field to plant corn. The video instructs about how to calculate the area of squares and rectangles.
Link to item	http://www.youtube.com/watch?v=Lqlx-Ri9t-

	4&feature=player_embedded

Title	Welcome to Fairyland
Subject Matter/Grade	English/Writing/2nd grade
GPA addressed	ELA2W2
Tool	Storybird
Features	Still pictures, text
Description	The story about a little girl who has a dream and meets new friends. They all help her into finding her way home.
Link to item	http://storybird.com/books/welcome-to-fairyland/?token=fds7x8