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Abstract: This case study examined the context of one social studies methods course and its use of technology in instruction. The purpose was to determine to what extent pre-service teacher views and practice transformed to embrace technology use in their own teaching. The lens of Transformative Learning Theory (Mezirow, 2012) was used to analyze and describe the results of this embedded single case study. Results suggest that some transformation of beliefs occurred among participants, but that more sustained exposure and experience is needed for practice to change.

Keywords: *technology integration, belief transformation, teacher preparation*

Introduction

In an era in which modern technology is broadly used in education, teacher preparation programs have the responsibility to prepare pre-service teachers to adequately use technology in their educational practices (ISTE 2012; Kaufman, 2015). However, according to Dawson (2008), technology is still under used in many teacher preparation programs. As a result, a great number of pre-service teachers do not feel confident in using technology for instructional purposes (Stokes-Beverly & Simony, 2016). This creates a challenge for the school districts that hire these new teachers, because every year, the districts have to spend money in training teachers with the skills and knowledge they should already possess. To face this challenge, Texas, where this research takes place, now requires teacher preparation programs to incorporate the International Society for Technology in Education Standards (ISTE, 2012) into their curriculum (TX SB1839). This task, however, is a complex one. Not only do teacher educators need to adequately use technology in their classrooms for modeling and practicing, they also need to change the frame of references of teacher candidates.

According to Han, Shin, and Ko (2017), pre-service teachers' perceptions of their competency in the use of instructional technology play a key role in their willingness to use it. Some might not feel comfortable because they bring their own frames of reference about teaching. These tend to be shaped by their own experiences as students with teachers who use traditional methods that do not include technology. However, more recent studies have also explored the notion that these students' perceptions change more willingly and purposefully when teacher educators intentionally and deliberately use technology as a model for students (Vasinda, Ryter, Hathcock, and Wang, 2017).

This changes their frame of reference. Mezirow (2012) describes frames of reference as beliefs and values that are shaped by experience and cultural context, many times without our own realization that this is occurring.

Therefore, this study is examining the current need in teacher preparation programs to undergo fundamental changes for both the instructors and the students. The purpose of this study is twofold: to determine what effect the instructor's use of technology has on preservice teachers' willingness to use it in their own practice, and to determine how well preservice teachers transform their beliefs about the use of technology in teaching.

Literature Review

For the past 20 to 25 years computers have been in the schoolhouse either in a lab or in classrooms. Their use, however, has been limited to specific programs that catered to specific content area needs and were not used for creating, researching or even for simple word processing. Despite its long-term availability, technology has not been widely integrated into the learning experience. A survey of more than 1,000 high school teachers, IT staff and students show that only 8 percent of teachers fully integrate technology into the classroom (Moeller & Reitzes, 2011. p.5).

Teacher beliefs and attitudes are significant determinants of computer integration (Cullen & Greene, 2011; Cviko, McKenney, & Voogt, 2012; Kim, Kim, Lee, Spector, & DeMeester, 2013; Mueller, Wood, Willoughby, Ross, & Specht, 2008). These findings support the idea that many teachers lack confidence in their technology skills. Reitzes and Moeller (2011) stated that only 23% of teachers surveyed by a National Center for Education Statistics study felt prepared to integrate technology into their instruction. When they do use technology, they primarily use it to present information, rather than engage students in hands on activities. Others avoided the time investment for preparation due to fear of equipment failure. Additionally, teachers do not integrate technology due to their perceived low level skills, as well as high anxiety levels of using technology to teach (Rohaan, Taconis, & Jochems, 2012; Wachira & Keengwe, 2011). To this point, teacher's attitudes appear to be the pivotal variable and the most important factor influencing integration and teachers' success (Cullen & Greene, 2011; Cviko et al., 2012; Kim, Kim, Lee, Spector, & DeMeester, 2013; Mueller et al., 2008). Therefore, new technology may pose a challenge to students and possibly more so for new teacher preparation students who will need to use technology, teach with it, and teach children how to use it to create and develop student outcomes. Technology poses both a challenge and the potential to transform education and the classroom (Wartella & Jennings, 2000).

Ideas and suggestions for effective technology integration in teacher preparation programs abound. Most programs teach these skills through an introductory technology course. Instead, some suggest that technology skills be integrated into content areas and authentic teaching experiences and focus on how to use it for teaching and learning (Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010). To accomplish this, Polly, Mims, Shepherd, & Inan, (2010) suggest that education programs need to consider technology as a program component. Tondeur et al. (2011) also suggest change be institutional and systematic.

Another problem that persists is pre-service teachers' perception of technology and its use for instructional implementation rather than for student-centered activities. Herold (2015) indicates that teachers have been "painfully slow to transform the ways they teach, despite that massive influx of new technology into their classrooms" (p. 1). Furthermore, he explains that the "student-centered, hands-on, personalized instruction envisioned by ed-tech proponents remains the exception to the rule" (p.1). Wang & Torrisi-Steele (2015) agree and add:

> While many educators in higher education are using technologies in their teaching, their use of technology is generally restricted to meeting purposes of convenience and efficiency. Rarely are the affordances of technology being exploited by educators in higher education in order to develop teaching strategies that truly engage students, and help students develop self-regulation and the ability to work collaboratively – both of which are important capacities in the information age. (p. 1)

Various surveys confirm that teachers are not as inclined to use technology for student centered instruction, but to present instructional materials (Herold, 2015). Although most pre-service teachers can be considered

technology natives, they have grown up witnessing the use of technology as teacher tools rather than students' empowering tools. Herold (2015) quotes an interview with Leslie A. Wilson, the chief executive officer of the One-to-One Institute, a nonprofit that has consulted with hundreds of schools and districts across the country and world, stating: "there's nothing transformative about every kid having an iPad unless you're able to reach higher-order teaching and learning" (p. 1). She then continued later in the interview: "If schools take all this technology, and use it like a textbook, or just have teachers show PowerPoint [presentations] or use drill-and-kill software, they might as well not even have it" (p. 1).

It is necessary to take a comprehensive look at knowledge, confidence and belief systems, along with school culture to change the ways in which teachers integrate technology in their classrooms. Transformative Learning Theory brings into play teacher social and value changes and their perceptions about technology as a tool for students. Indeed, Wang & Torrisi-Steele (2015) contend that a theory that allows teachers to self-examine beliefs and roles may lead to changes in practice that could yield far reaching benefits. Only by transforming pre-service teachers' perception on technology implementation, future teachers will reach the "student-centered, hands-on, personalized instruction envisioned by ed-tech proponents" mentioned by Wang & Torrisi-Steele (2015, p. 1).

A Theoretical Framework for Transformation

Transformative Learning Theory contends that adult learners seek autonomy and practical thinking. Transformative learning, therefore, utilizes different methods and practices than those of children (Mezirow, 1997). Additionally, an adult's predisposition for transformative learning is connected to his/her notion of what is valuable, as determined by their currently held frames of reference. Mezirow (1997) says that learning activities for adult learners must include experiences that use creative problem solving, interactive, group deliberations, instructional materials relevant to real life experiences, role playing and simulation of authentic experiences, and active reflection involving "thought, feelings, and dispositions" (p. 11). Meldrum (2016) frames these types of activities within a technology-oriented framework and suggests that learning should include how to adequately navigate the 4 C's: consumption, curation, creation, and connection using technology. Thus, faculty researchers focused on activities and technology tools that target these types of learning experiences for pre-service teachers.

In his earlier work, Mezirow (1997) talked about a disorienting dilemma being the catalyst for potential change. In the more current research, the disorienting dilemma is described as an experience that causes the individual to question their current frames of reference (Tisdell, 2012). In adult learning, a disorienting dilemma is needed for transformational learning to occur. In this study, the participants underwent an experience very much like a disorienting dilemma by being challenged to use technology in a more systematic way. For most participants, this level of technology usage was far above any they had ever experienced, so even if they live in a technological world, and are likely savvy with their mobile devices, using technology for learning and teaching was an alarming proposition: a disorienting dilemma.

Methods

This qualitative study employed case study methods for data collection and analysis, and Yin's (2009) description of an embedded single case study design best suits this study. The research study examined one case of the course experience, and the embedded components were the participants to support and better define individual transformational profiles. This was due to the two-fold purpose of the study: the effect of instruction to the class and the description of possible individual transformation of belief system. The case study was appropriate due to its ability to describe and help shed light on a potentially complex situation. In this case study, the Transformative Learning Theory (Mezirow, 2012) contributed to the analytic lens shown on data, and which are further described below.

This study took place in an undergraduate social studies methods course for the elementary teacher preparation program. The course was designed with technology integration using mobile technologies for in-class tasks, as well as experimentation with applications and other technology tools for use with planning instruction and student engagement. The proposition was that pre-service teachers enrolled in this course would undergo a disorienting dilemma (Mezirow, 1997), which would either trigger a transformation in their belief system or

entrench them more deeply. The instructor used technology in her own teaching as a model to students, and then provided samples with which they could practice and determine how to use them with social studies instruction. Fifteen agreed to participate in the study, but only eight completed the data for the study.

Data Collection

In following with the case study tradition, multiple sources of evidence were collected from participants to establish construct validity and create a convergence in patterns or explanations during analysis (Yin, 2009). The data, therefore, totaled sixteen lesson plans and sixteen reflections, for eight participants, enrolled in a social studies methods course. As part of the course, students were required to complete five social studies lessons that integrated technology, but only the first and last were utilized in this study. All the lessons followed the same inquiry-based lesson plan format, which required an approach to planning that moved students from the low to the higher levels of thinking in Bloom's Taxonomy, while integrating technology to support learning (teacher-led) and to engage in learning (students' collaboration, creation, problem solving, etc.). After completing each lesson, students wrote a reflection where they self-assessed how they integrated technology into their social studies lesson plans. More specifically, the participants were asked to explain what the major areas of concern regarding technology integration were; how comfortable they felt about integrating technology into their teaching; and what they learned about themselves in relationship to the use of technology. Figure 1 below illustrates how the chain of evidence was established. This order is deliberate, to determine if transformation of beliefs occurred.

Figure 1: Chain of Evidence

Data Analysis

Because the artifacts gathered as data from each participant fit two different categories, the research team used two different analytical processes to determine to what extent transformation occurred. The lesson plans were analyzed with a rubric with criteria that describe levels of technology integration, and the reflections utilized a qualitative language analysis that Yin (2009) describes as explanation building, which is an iterative process of both data reduction and pattern matching. The two analytical processes are outlined in more detail below.

Lesson Plans SAMR Analysis. A rubric was designed to reflect the SAMR model. The Substitution, Augmentation, Modification, and Redefinition (SAMR) model is a four-level, taxonomy-based approach for selecting, using, and evaluating technology in K-12 settings (Puentedura, 2014). The SAMR Model consisted of four categories that assess the use of technology for learning activities:

- **Substitution**: the technology acts as a direct tool substitute with no functional change.
- **Augmentation**: the technology acts as a direct tool substitute with functional improvement.
- **Modification**: the technology allows for significant task redesign.
- **Redefinition**: the technology allows for the creation of new tasks that could not have been done without the use of the technology.

This instrument was used to indicate the presence or absence of technology integration in the following class task activities: (a) note taking; (b) presentation; (c) content distribution; (d) researching; and (e) assessment; and to what extend these class tasks extended learning. Each lesson plan was analyzed in respect to each of the class tasks. For each of the class tasks, the researchers looked for evidence of their presence or absence; then, they rated each class task activity using the categories of the SAMR rubric. The instrument was used not only to assess the learning activities planned for the students but also the learning tools used by the pre-service teacher. Two researchers analyzed each lesson plan separately; then, all researchers came together to discuss each of the lesson plans. Discrepancies between the raters were discussed and agreed amongst all of the researchers in order to minimize subjectivity and establish inter-rater reliability.

Reflections and Explanation Building Analysis. For the reflections from the participants, Yin's (2009) iterative method of explanation building was utilized to reduce qualitative data into a distinct transformation profile for each participant. Each reflection underwent this iterative analysis using the following process:

1. First data reduction, which isolated language from each reflection that indicated transformation of opinions, resistance to transformation, value or skepticism of technology integration.
2. The second iteration reduced explanations into patterns associated with the theory to determine the degree of transformation, the types of resistance and the influences of experience and participant insights.
3. The third iteration established themed patterns that described a transformation profile for each participants.

To better trace this reduction process, an Excel spreadsheet was used to visualize patterns emerging across several cells of data. These also helped to categorize reduced language into groups that fit descriptive elements of the theory. Table 1 is an example of how the third iteration built toward a transformation profile.

N	Past Influences	Trends to Change	Degree of Transformation	Types of Resistance	Self-Insight	Transformation Profile
113	lacks knowledge on technology because was never exposed to it in school	observed that some games can be used to facilitate learning and make it fun	*NO TRANS-FORMATION LANGUAGE USED*	uncertain about own technology knowledge	*NO SELF-INSIGHTS MENTIONED*	Participant has not undergone a transformation, although he/she observed that some games used could be fun and facilitate learning. There is still hesitancy because he/she is still uncertain about own technology knowledge and finds it difficult to include it when accountability tests overshadow instruction in the schools.

Table 1: Third analysis iteration for one participant

Findings

Findings for this study are presented first for the lesson plans, second, for the reflections, and finally, in combination to describe the larger case.

The eight lessons designed at the beginning of the course and the other eight at the end of the course were compared to determine if transformation occurred in practice. The results are shown in Figure 2.

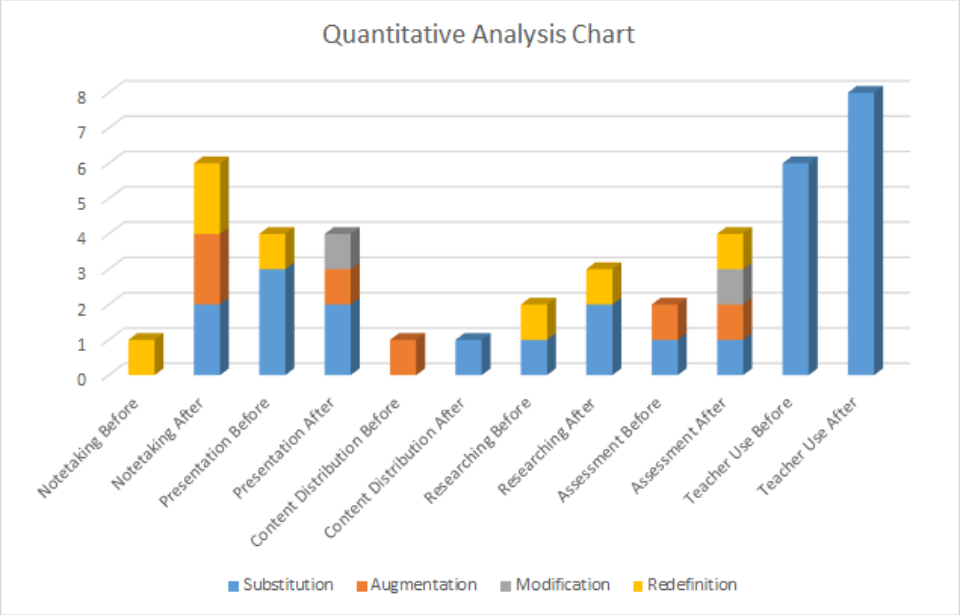

Figure 2. Quantitative Analysis Chart

The findings, based on the use of the SAMR rubric, show consistent increases at different levels of implementation from the first to the last lesson plan created, though the teacher-centered use of technology remains prominent both in the first and the last lesson, as it was explained in the literature review. However, some improvement in the areas of notetaking, research, and assessment are evident in the number of participants implementing technology at the highest level of the SAMR student-centered approach: redefinition.

Findings for the reflections indicate that on participant's reflections did not provide enough language to determine transformation, so that results were inconclusive. One participant did not truly transform belief systems despite some hesitant, yet positive language used. For six participants, evidence of some transformation of belief system was found, with one of them being hesitant, and five using strong and enthusiastic language to indicate how they overcame initial resistance. In four of the six cases who did express transformation, the change did not occur immediately but over time, with language used indicated more resistance at the first reflection. Figure 3 breaks down the findings from the reflection analysis by participant.

Figure 3: Transformed Beliefs Findings per Participant

In combining the findings from these two data sets per participants, transformation may be described in Table 2.

N	Lesson Plan 1	Lesson Plan 2	Reflection 1	Reflection 2
101	Redefinition Substitution	Redefinition Substitution	Inconclusive	Transformed
103		Augmentation Substitution	Hesitant Transformation	Strong Transformation
108	Substitution	Substitution	Transformation	Transformation
113		Modification	No Transformation	No Transformation
118	Substitution	Substitution	No Transformation	Transformation
123		Augmentation Substitution	Hesitant Transformation	Hesitant Transformation
126		Substitution	Transformation	Transformation
133	Redefinition Augmentation	Redefinition Substitution	Transformation	Strong Transformation

Table 2: Summative Data Results for all Data Analyzed

While most participants expressed transformed beliefs in the use of technology, their use of it in their instructional planning did not always fully support a full transformation where beliefs influence action. Of the six students that indicated transformed beliefs, half of them used technology at the substitution level, with two participants demonstrating redefinition practices, which are the more transformed uses of technology, indicative of pedagogical change. Three participants showed promise with the mixture of modification and augmentation, while the participant that did not indicate transformed beliefs reached the modification level of planning in only one of the instructional artifacts.

Implications and Conclusions

The case for transformation through a disorienting dilemma suggests an emerging one, which demonstrates the participants' willingness to accept change and technology in their practice, but still struggling to apply transformative practices to their planning. This suggests that given more time, with more experiences in planning and additional positive examples of implementation, transformation may be more evident in both thought and action. These data also indicate that transformation at thought and action is dependent upon seeing models of technology use, which would allay the main fears of lack of knowledge and experience. The more successful

Some implications suggest that transformation of beliefs regarding the use of technology in instruction may occur with more exposure in more teacher preparation courses rather than the one case examined in this study. As such, time functions as an element of transformation, with the benefits of multiple sustained exposure. Finally, participant worries about not having the right technology or children finding it too difficult may be allayed with intentional field experiences that use technology with children in the classroom.

Admittedly, there are some limitations to this study, in that it only captured one semester of time in one teacher preparation course using social studies methods. The generalizability of the findings may be limited by this context and to the elementary certification levels. More studies that span multiple courses over longer periods of time may better demonstrate the promise of transformation. Technology integration has become an essential piece to learning pedagogy for pre-service teachers. If they can overcome their fears about technology and transcend traditional practices, there may be the possibility of better technology integration and more relevant preparation of students in the 21st century.

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