Exploring the New Era of Technology-Infused Education

Lawrence Tomei
Robert Morris University, USA

A volume in the Advances in Educational Technologies and Instructional Design (AETID) Book Series

IGI GLOBAL
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Published in the United States of America by
IGI Global
Information Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue
Hershey PA, USA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: http://www.igi-global.com

Library of Congress Cataloging-in-Publication Data

CIP Data Pending
ISBN: 978-1-5225-1709-2
eISBN: 978-1-5225-1710-8

This book is published in the IGI Global book series Advances in Educational Technologies and Instructional Design (AE-TID) (ISSN: 2326-8905; eISSN: 2326-8913)

British Cataloguing in Publication Data
A Cataloguing in Publication record for this book is available from the British Library.

Chapter 8
Pre-Service Teachers' Motivation to Use Technology and the Impact of Authentic Learning Exercises

Jennifer R. Banas
Northeastern Illinois University, USA

Cynthia S. York
Northern Illinois University, USA

ABSTRACT

In this quasi-experimental study, the authors explored the impact of authentic learning exercises on pre-service teachers' motivational beliefs to integrate technology, as well as the ability of those beliefs to predict intentions to integrate. A questionnaire was used to assess 104 pre-service teachers' motivational beliefs, namely intrinsic and extrinsic goal orientations, task value, self-efficacy, and control of learning in relation to technology integration. Results indicated authentic learning exercises might have enhanced motivational beliefs, particularly self-efficacy and intrinsic goal-orientation. Also, motivational beliefs predicted their intentions to integrate technology into future instruction, with task value predicting significantly. The chapter concludes with implications for practice.

INTRODUCTION

Using technology and integrating technology are two different things (Dockstader, 1999). In today's society, individuals would find it hard to not *use* technology. Digitally recording favorite televisions shows, updating one's status on social media, or video-calling a friend in another time zone have become common places activities. *Technology integration*, however, is about the seamless integration of technology into classroom instruction, and putting technology into the hands of the learners versus keeping it in the hands of the teacher (Cennamo, Ross, & Ertmer, 2013). At the "intersection of pedagogical knowledge and technological knowledge" (Cennamo et al., 2013, p. 2), technology integration is the consideration

DOI: 10.4018/978-1-5225-1709-2.ch008

of the specific content to be taught and the most appropriate technology tools that will help reach the intended outcomes.

Despite the availability of technology afforded to schools, many teachers ineffectively integrate or do not integrate technology (Harris, Mishra, & Koehler, 2009; Vrasidas, 2015). In part, lack of integration may be due to deficiencies in professional preparation (Haydn & Barton, 2006; Lawless & Pellegrino, 2007). Most teacher education programs are not constructed to influence pre-service teachers' beliefs about technology (Chien, Chang, Yeh, & Chang, 2012; Kay, 2006). Programs might only include one designated educational technology course and other professional preparation courses may offer little to no experience with making technology integration decisions (Haydn & Barton, 2006). Consequently, unless a pre-service teacher is self-motivated to learn how to integrate technology, he or she is unlikely to do so in a future classroom (Kim & Keller, 2011; Smarkola, 2011).

Knowing professional preparation plays an important role in whether or not pre-service teachers will use technology in future classrooms (Chai, Koh, & Tsai, 2010; Haydn & Barton, 2006; Lawless & Pellegrino, 2007; Ottenbreit-Leftwich et al., 2012), there is value in uncovering pre-service teachers' existing beliefs regarding technology integration, the predictive relationship of those beliefs with technology integration, and the types of learning experiences that influence beliefs and intentions (Inan & Lowther, 2010; Kay, 2006). More specifically, understanding pre-service teachers' expectancy-value related motivational beliefs towards technology integration and their intentions to integrate could help teacher educators design better professional preparation that hones in on activities that support future technology integration.

This quasi-experimental study sought to uncover pre-service teachers' expectancy-value beliefs (specifically intrinsic goal orientation, extrinsic goal orientation, task value, control of learning and self-efficacy) towards technology integration, the impact of authentic learning exercises on those beliefs, and the predictive relationship between those beliefs and intention. The purpose of the authentic exercises was to provide pre-service teachers with the opportunity to practice making contextual technology integration decisions similar to in-service teachers. The driving idea was these types of exercises might positively influence motivational beliefs, and consequently intentions, by way of helping pre-service teachers to form an early teaching schema that includes integrating technology to enhance student learning.

BACKGROUND

In this background section, the authors provide an overview of motivation as defined and assessed in this study. Next, a case for intention as an estimate of future behavior is made. Finally, how authentic learning exercises are used as an instructional strategy to influence pre-service teachers' motivational beliefs and intentions is explained. The research questions follow this discussion.

Motivation and Technology Integration

Without sufficient motivation, it is unlikely pre-service teachers will put forth effort to learn and later use technology in their future classroom (Cullen, & Green, 2011; Kim & Keller, 2011; Sang, Valcke, Van Braak, Tondeur, & Zhu, 2011; Smarkola, 2011). Brophy (1999) stated, "Motivation is a theoretical concept used to explain the initiation, direction, intensity, and persistence of behavior, especially goal-directed behavior" (p. 2). The multi-dimensionality of motivation as expressed in this definition suggests a single variable may not be sufficient to describe one's beliefs about technology integration. In this study, pre-service teachers' motivation to integrate technology was assessed via multiple dimensions, specifically intrinsic and extrinsic goal orientations, task value, control of learning beliefs, and self-efficacy. Collectively, these five dimensions are entrenched in McKeachie, Pintrich, Lin, and Smith's (1986) motivation and learning strategies taxonomy.

The motivation and learning strategies taxonomy suggests motivation is *not* a static trait, but rather a dynamic, contextually-bound construct mediated by value beliefs (i.e., intrinsic goal orientation, extrinsic goal orientation, and task value) and expectancy beliefs (i.e., control of learning and self-efficacy) with each belief contributing to motivation in its own way and varying from one situation to the next (Duncan & McKeachie, 2005). In this regard, the motivation and learning strategies is deeply rooted in expectancy-value theory, a theory that postulates the primary measureable outcome of motivation is effort, and task value and success expectancy are necessary preconditions (Eccles, 2009; Fishbein & Ajzen, 1975). According to Pintrich and DeGroot, the expectancy component has been conceptualized in a variety of ways (e.g. perceived competence, self-efficacy, attributional style, and control beliefs), but the main idea is that the individual believes they are able to perform and given task and they are responsible for the outcomes. The value component relates to one's goals for a given task, their beliefs about the task's importance, and their interest in performing it. Like expectancy, value has been conceptualized in a variety of ways, too (e.g. learning vs. performance goals, intrinsic vs. extrinsic orientation, task value, and intrinsic interests). These concepts are central to McKeachie et al.'s (1986) taxonomy.

According to Pintrich, Smith, Garcia, and McKeachie (1993), *intrinsic goal orientation* concerns the degree to which one performs a task for reasons such as challenge, curiosity, and mastery. In the realm of technology integration, this implies learning how to integrate technology would be a motivating end all to itself. *Extrinsic goal orientation*, in contrast, is a means to an end. One participates to earn a letter grade, award, promotion, or other external recognition. *Task value* relates to how interesting, important, or useful a task is perceived. For example, a pre-service teacher might learn to use technology because he/she believes future students will need technology skills to be successful or that the technology tool renders learning more engaging or efficient. This is based on the premise that those who have high value for a task are more likely to engage with it (Pintrich & DeGroot, 1990). *Control of learning* refers to believing that effort leads to an identified outcome. If one inherently believes teaching with technology will improve teaching and student learning, one would be more inclined to do so. *Self-efficacy* is a self-appraisal of ability and confidence. One is more likely to perform a task when one believes he/she is capable of doing so. Successful performances, such as those embedded into professional preparation, help to develop this belief (Bandura, 1998).

The current study expands on expectancy-value theory in two ways. First, while some expectancy-value beliefs have been studied as correlates of technology integration (Davis, 1993; Hasan, 2006; Inan & Lowther, 2010; Smarkola, 2011; Taylor & Todd, 1995; Teo, 2012), the five dimensions as they appear together in the motivation and learning strategies taxonomy have not. For example, Davis' (1993) technology acceptance model explained two of the taxonomy's dimensions, perceived usefulness and perceived ease of use, with intentions. Teo (2012) combined Davis's (1993) technology model and Ajzen's (1985) theory of planned behavior to study two of the five expectancy-value dimensions, perceived usefulness (i.e., task value) and perceived ease of use (i.e., self-efficacy), and their relation to intentions. Taylor and Todd's (1995) decomposed theory of planned behavior explained the relationship of three of the taxonomy's dimensions (attitudes, subjective norm, and perceived behavioral control) with intentions. Inan and Lowther (2010) investigated the influence of two of the five dimensions, perceived ability to integrate technology (i.e., self-efficacy) and beliefs that technology could influence student learning (i.e., task value) on intention. Hasan (2006) investigated one of the dimensions, self-efficacy, in relation to different contexts and intentions. For simplicity, one may argue that intrinsic goal orientation, extrinsic goal orientation, and task value could be collapsed into one factor (e.g., value) and control of learning and self-efficacy could be collapsed into another (e.g., expectancy); however, the authors of this current study contend there is value in understanding how each of these beliefs contributes uniquely as well as the whole.

A second way this study expands on expectancy-value theory is the use of the motivation and learning strategies taxonomy's associated measurement tool, the Motivation Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1993), as a means of predicting intentions to integrate. Previously this tool has been used in studies related to motivation and learning strategies in technology-enhanced environments (Lewis & Litchfield, 2011), but it has not been used to measure motivational beliefs to integrate technology or to predict behavioral intentions (e.g., intentions to integrate technology in one's future classroom). Given the complexity of motivation as depicted in the motivation and learning strategies taxonomy, a multi-dimensional tool such as the MSLQ seems appropriate for the current study.

Intention and Motivation

While intention does not guarantee future behavior, well-grounded research has established it as a reliable predictor. Most notable among seminal research is the theory of reasoned action (Fishbein & Ajzen, 1975), the theory of planned behavior (Ajzen, 1985), and the integrative model of behavioral prediction (Fishbein, 2000). Moreover, research related to these theories has found intention to be a predictor of future technology integration (Sadaf, Newby, & Ertmer, 2016; Salleh & Albion, 2004; Venkatesh, Morris, Davis, & Davis, 2003). Knowing which factors best predict pre-service teachers' intentions to integrate technology could provide useful information to professional preparation programs seeking to design learning experiences that influence pre-service teachers (Cullen & Green, 2011; Lawless & Pellegrino, 2007). In this way, evaluating motivational beliefs and studying their relationship with intention to integrate technology is like conducting a needs assessment to better personalize pre-service teachers' professional preparation. In this investigation, the researchers sought to identify those constructs that most greatly predicted intention, and to influence those constructs, as well as intentions, by way of authentic learning.

Authentic Learning

With the exception of clinical observation and student teaching field experiences, most pre-service teachers' professional preparation lacks the contextual learning experiences afforded to in-service teachers whose technology decisions are situated in actual classroom experiences (Angeli & Valanides, 2009). For professional preparation programs, the goal should be getting pre-service teachers to view technology as a pedagogical tool to improve learning or to change how learning occurs (Downes et al., 2001). Per Downes et al. (2001), the key is not viewing technology as a content area, but rather viewing it as a pedagogical tool that improves learning while leaving the content intact. To accomplish this, pre-service teachers need regular practice making connections between technological, contextual, and pedagogical knowledge (Chai et al., 2010; Ertmer, 2005). Authentic learning exercises embedded into pedagogical methods courses can facilitate this connection (Kay, 2007).

There is no singular criterion that makes a learning activity authentic, but rather, it is a collection of characteristics. Via an extensive review of the literature on authentic learning and related concepts, Herrington and colleagues (Herrington & Oliver, 2000; Herrington & Herrington, 2006; Herrington & Kervin, 2007; Herrington, Oliver, & Reeves, 2003) established a list of criteria to describe authentic learning. These included that authentic learning will:

- Have real world significance.
- Be ill-defined and require learners to define tasks and sub-tasks needed to complete the activity.
- Be complex tasks to be investigated over a sustained period of time.
- Provide learners with the opportunity to examine the task from different perspectives, using a variety of resources.
- Provide the opportunity to collaborate.
- Provide the opportunity to reflect.
- Be integrated and applied across different subject areas and beyond domain-specific outcomes.
- Be seamlessly integrated with assessment.
- Create polished products valuable in their own right.
- Allow for competing solutions and diversity of outcomes.

Summarized, authentic learning is a multidisciplinary, pedagogical approach that allows learners, under the guidance of their instructors, to explore, discuss, and meaningfully construct concepts and relationships in the context of "real" problems and projects (Donavan, Bransford, & Pellegrino, 1999; Herrington & Herrington, 2006).

Authentic learning has been identified as an effective instructional strategy because it requires learners to make connections to existing knowledge and to explore new knowledge deeply in context (Lombardi, 2007). The contextual nature of the authentic learning experiences promotes deeper learning because of their associations with a setting, activities, and people (Lombardi, 2007). Per seminal research conducted by Resnick (1987), these experiences bridge the gap between theoretical learning and real-life application. This could be the same bridge Chai et al. (2010) described as being needed between technology, context, and pedagogy. A few technology-specific, authentic learning studies reveal this may be true. For example, Kurz and Middleton (2006) found providing pre-service teachers with opportunities to practice and reflect on the pedagogical uses of a software program not only led to more positive beliefs about the technology, but also more skillful insight into its constraints and affordances. Pope, Hare, and Howard (2002) found exposure to technology integration in the context of learning about pedagogy had a direct impact on pre-service teachers' efficacy and use of technology during student teaching. Similarly, Kay (2007) found having pre-service teachers replicate technology integration tasks performed by classroom teachers was a significant predictor of pre-service teachers' technology use during student teaching. And Wu, Chang, and Guo (2008) found that science teachers who learned to integrate technology into science lessons they would normally teach were more likely to indicate that integrating technology was useful and easy to do. These studies demonstrate that authentic learning exercises may be a means to bridge the contextual gap between technology and pedagogy, and to influence pre-service teachers' motivational intentions to integrate.

Authentic Learning and Motivation

The current study proposed authentic learning exercises would improve pre-service teachers' motivation to replicate those efforts in their future classroom. Research shows when pre-service teachers are provided with authentic learning tasks (i.e., assuming the role of a teacher designing of instruction), they demonstrate higher levels of motivation (Hill, 2007) and are more likely to integrate technology into student teaching (Kay, 2007; Tondeur et al., 2012). Such would be the case of a pre-service teacher assigned learning tasks during professional preparation that he or she would eventually perform in a future classroom. Exercises might include designing a technology-integrated curriculum unit and/or implementing technology-integrated lessons with classmates as practice. During student teaching, authentic learning exercises would include implementing technology-integrated lessons with actual students. These kinds of exercises would require the pre-service teacher to prepare for and reflect on the tasks needed to successfully implement the lesson, as well as to evaluate the impact of the lesson on student learning. The underlying intention of these activities would be to foster the potentially relevant motivational beliefs pre-service teachers need to become future technology integrators.

RESEARCH QUESTIONS

The purpose of this study was to investigate the impact of authentic learning exercises on pre-service teachers' motivational beliefs towards integrating technology to enhance student learning, and how those motivational beliefs predict intention. The following research questions were asked:

1. Do authentic learning exercises impact pre-service teachers' motivational beliefs (measured as intrinsic goal orientation, extrinsic goal orientation, task value, control of learning, and self-efficacy) to enhance student learning?
2. Do pre-service teachers' motivational beliefs predict intentions to integrate technology to enhance student learning?

METHODS

Context

The context of this study comprised four sections of the lead researcher's *Health Education in the Middle and High Schools* course at a university in the Midwest region of the United States. The course was a 3-credit, undergraduate level, required methods course for pre-service teachers working towards a health education endorsement. While health education was the content matter, development of curriculum design and instructional skills was the primary course goal.

Study Design

The study population was a sample of convenience, and randomization did not occur. The study design is depicted in Table 1. With Institutional Review Board approval, pre- and post-online assessments took

Table 1. Research design

Week 4	Week 5-12	Week 13
Motivational beliefs and intentions pre-assessment	Authentic learning experiences with technology integration (Curriculum unit, technology integrated lesson plans, and lesson presentations)	Motivational beliefs and intentions post-assessment

place during Weeks 4 and 13 of the 15-week long semester. To maintain anonymity, names of participants were not associated with their responses. Rather, pre- and post-responses were matched via a coded first question, the participant's former elementary school name, and the name of the street they lived on in third grade. Participants were given the option to participate in the study by completing a pre- and post-assessment or to complete an alternative assignment that would take approximately the same length of time. All students (n=104) chose to participate. To avoid potential bias resulting from the researcher also being the course instructor, a colleague read aloud a description of the study and provided students with a link to the online assessment when the researcher was out of the room.

Participants

Participants were 104 pre-service teachers working towards an endorsement in either health or physical education. Sixty participants were male and 44 were female. Ages of participants ranged from 20-42 years old, with 84.9% being 20-27 years old. Education levels were as follows: 17.9% high school diploma, 67% associate's degree, 11% bachelor's degree, and 1.8% master's degree. In light of their existing education, and with the exception of one student who indicated some prior technology training, all participants identified as novices with regards to developing curriculum and instruction that integrated technology.

Treatment: Authentic Learning Exercises

The authentic learning exercises consisted of pre-service teachers, in small groups, developing the outline for a 3-4 weeklong, technology-enhanced curriculum unit and four complete, technology-enhanced lesson plans. They also delivered one of the lesson plans to classmates as if the classmates were 6^{th}-12^{th} grade students. These exercises were completed in stages over eight weeks of the course. The exercises are described in detail below.

Technology integrated curriculum units. In the fourth week of the course, pre-service teachers formed teams to develop the outline for a curriculum unit for a selected health education content area (e.g., substance use and abuse, nutrition, mental health, reproductive health). This curriculum unit was rooted in the Backwards Design curriculum and instruction model (Wiggins & McTighe, 2005). The Backwards Design model is a 3-stage, conceptual framework that has been demonstrated to lead to higher levels of student performance (Kelting-Gibson, 2005).

- In Stage 1, an instructor identifies the overall goal of the unit, the desired student learning outcomes (i.e., objectives), and the state and/or national learning standards with which the learning outcomes align.

- In Stage 2, an instructor determines how they would assess student achievement of the objectives and develops appropriate assessment tools.
- In Stage 3, an instructor identifies learning activities that will ensure student achievement of the objectives and organizes these learning activities sequentially into a planning calendar.

The pre-service teachers completed all three stages of the Backwards Design model to develop a 3-4 weeklong curriculum unit in which objectives, assessments, and learning activities could be implemented in future classroom setting. Due to the brevity of the course, rather than the pre-service teachers writing 3-4 weeks worth of complete lesson plans in Stage 3, they wrote a descriptive outline, in the form of a calendar, of the activities that would take place each day. After the pre-service teachers completed their calendars (i.e. outlines), the researcher interrupted the unit project and introduced the pre-service teacher to a variety of technology tools. Next, the pre-service teachers developed four complete, technology-integrated lessons based on proposed activities for four different days in their calendar (see the next section for a description of these technology-integrated lessons). After designing these four complete, technology-integrated lessons plans, the pre-service teachers returned back to the project to complete the last step, a cover page with a summary describing their unit. In this summary, they not only described the objectives of the unit and its primary content, but they also described how technology was used strategically to enhance student learning.

Technology-integrated lesson plans. As indicated above, after the pre-service teachers completed their curriculum unit calendar, they practiced using four different types of technology tools and designed four complete, technology-integrated lesson plans to include into their units. The four different types of technology tools included:

- Idea/concept mapping and other information visualization tools
- Audiovisual tools
- Online surveys and other information gathering tools
- Blogging, wikis, websites, and other information sharing tools

To guide development of the assignments, each pre-service teacher was provided a lesson plan template which required him or her to provide the following items:

1. A summary of the learning activity;
2. Desired student learning outcomes;
3. A description of how the technology tool enhanced learning or rendered instruction more efficient and effective;
4. Step-by-step directions for both the teacher and student, with particular attention to ensuring students would be able to successfully and independently use the technology tool; and
5. Grading criteria for student performance.

Pre-service teachers were also asked to develop a prototype of completed student work. The purpose of the prototype was to get pre-service teachers thinking about the directions future students would need to successfully complete the assigned task and what difficulties those students might encounter.

DELIVERY AND REFLECTION ON TECHNOLOGY-INTEGRATED LESSONS

After receiving feedback from the researcher on the technology-integrated lesson plans, pre-service teachers selected and delivered one of the lessons to their classmates as if classmates were 6^{th}-12^{th} grade students. (Note: The classroom in which these lessons were implemented was a computer lab, thus affording each student a computer. Also a projector and screen was available to the pre-service teachers acting as instructors). After implementation, both the presenters and the audience discussed the strengths and weaknesses of the presentation. Finally, pre-service teachers were required to submit a reflection about what aspects of the lesson *they* felt went well and what changes they would make for future implementation. The purpose of this latter activity was to make pre-service teachers critically consider the factors that make for a successful technology-integrated lesson.

Overall, the intention of these authentic learning exercises was to provide pre-service teachers with ill-defined situations to contextually practice making the types of instructional decisions made by a classroom teacher who integrates technology. Moreover, pre-service teachers were able to perform these activities in collaboration with others, utilizing assistance from peers and the instructor, and with opportunities for reflective practice. Each of these characteristics aligns with the description of authentic learning as depicted by Herrington and colleagues (Herrington et al., 2003; Herrington & Oliver, 2000; Herrington & Herrington, 2006; Herrington & Kervin, 2007).

Instrumentation

To study the research questions, a pre- and post-assessment was administered online to course sections prior to the first authentic learning experience (approximately the beginning of week 4) and after the last learning experience (approximately week 13). The pre- and post-assessments were identical and were divided into three parts. In part 1, participants rated their agreement with statements about their motivational beliefs. In part 2, they rated their intention to integrate technology in their future classroom. In part 3, participants provided demographic data including age, gender, and major. Parts 1 and 2 are described next.

Part 1 Motivational beliefs. Motivational beliefs about integrating technology were measured using a modified version of Pintrich et al.'s (1993) MSLQ. To reflect the object of interest, a common phrase in the MSLQ needed rewording. Specifically, the phrase "*to learn the material in the course"* was replaced with "*to use technology as a tool to enhance student learning."* For example, the question, "It is important for me *to learn the material in the course*" was replaced with, "It is important for me *to use technology as a tool to enhance student learning*." Five subscales from the MSLQ were used in this study:

1. A 3-item *intrinsic goal orientation* scale measured the degree to which using technology to enhance student learning is due to challenge, curiosity, and mastery ($\alpha = .78$)
2. A 3-item *extrinsic goal orientation* scale measured the degree to which using technology to enhance student learning is to obtain a job, get a good grade in the course, or demonstrate ability to family, friends, and potential employers ($\alpha = .74$).
3. A 4-item *task value* scale measured the degree to which using technology to enhance student learning is interesting, valuable, and useful ($\alpha = .89$).

4. A 4-item *control of learning beliefs* scale measured the degree to which being able to use technology to enhance student learning is based on effort (α = .79)
5. A 4-item *self-efficacy* scale measured expectancy for success and confidence in using technology to enhance student learning (α = .87).

All 18 questions were based on a 7-point scale. Cronbach's α values are noted above with each item's description.

Intention to Use Technology

Intention to integrate technology was measured using three items that reflected the intention subscale of Fishbein (2000) integrative model of predictive behavior. This model, an extension of the theory of reasoned behavior (Ajzen, 1985) and social cognitive theory (Bandura, 1997), assesses the influence of attitudes, norms, and self-efficacy on intention to perform a behavior. The model purports that skills/ability work with intention to influence behavior. Because intention to integrate technology was perceived to be a behavior that could be influenced by motivation and skills (such as those needed to integrate technology) this subscale was ideal.

The 3 items used to measure intention to integrate technology were:

1. I plan to use technology as a tool to enhance student learning,
2. I will use technology as a tool to enhance student learning, and
3. I intend to put effort into using technology as a tool to enhance student learning.

Questions were based on a 7-point scale. A single intention variable was created by computing a mean score for all three items. Cronbach's α was determined to be .83.

RESULTS

The Statistical Package for Social Science (SPSS) Version 20 was used to analyze the data. To analyze research question one, a paired samples t-test, also referred to as a repeated-measures test, was used to calculate differences between pre-test and post-test scores. Means and standard deviations were also calculated. To identify the size of the treatment effect, eta squared was calculated for the five motivational beliefs variables and single intention to integrate (IIT) variable. To analyze research question two, pre- and post-test scores were averaged to develop composite intrinsic goal orientation (IGO), extrinsic goal orientation (EGO), task value (TV), control of learning (COL), self-efficacy (SE), and intention to integrate (IIT) scores. Standard multiple regression, using the enter method, was used to assess the ability of these motivational beliefs variables to predict intentions to use technology to improve student learning. Tests for multicollinearity were performed and are reported with the research question two results.

Research Question 1

Do authentic learning exercises influence pre-service teachers' motivational beliefs (measured as intrinsic goal orientation, extrinsic goal orientation, task value, control of learning, and self-efficacy)?

When analyzing research question one, paired-samples t-tests showed a statistically significant increase in all motivational beliefs *except* task value (TV). Based on Cohen's (1988) convention, a .14 eta-squared value indicates a large effect, .06 indicates a medium effect, and .01 indicates a small effect. This means the effect of the authentic learning exercises was large for intrinsic goal orientation (IGO) and self-efficacy (SE), moderate for extrinsic goal orientation and control of learning (COL), and small for task value (TV). In other words, of all the motivational beliefs, the authentic learning seemed to make the greatest impact on intrinsic goal orientation and self-efficacy.

It is possible that the authentic learning exercises did not impact task value because the pre-service teachers already held a high regard for integrating technology. A scan of mean scores in Table 2 confirms this idea; task value was rated higher than any other motivational belief. With task value already high, increasing it more might require some other factor or a modification to the authentic learning exercises.

Table 2. Results of paired-samples t-tests for motivational beliefs

Variable	N	Mean	SD	SE	t	Sig.	ES
Pre-IGO	104	4.92	1.35	.12	5.47	.00**	.22
Post-IGO	104	5.70	1.15	.11			
Pre-EGO	104	4.45	1.57	.15	2.90	.00**	.07
Post-EGO	104	4.89	1.36	.13			
Pre-TV	104	6.16	1.08	.11	1.49	.14	.02
Post-TV	104	6.32	.94	.09			
Pre-COL	104	5.44	1.12	.11	2.50	.01**	.06
Post-COL	104	5.72	1.06	.10			
Pre-SE	104	5.49	1.02	.09	3.91	.00**	.13
Post-SE	104	5.83	1.05	.10			

Notes: * Significant at the .05 level, ** Significant at the .01 level, IGO = intrinsic goal orientation, EGO = extrinsic goal orientation, TV = task value, COL = control of learning, SE = self-efficacy, IIT = intentions to integrate

Table 3. Correlations between motivational beliefs and intentions

	IIT	IGO	EGO	TV	COL	SE
IIT	—	.537**	.010	.858**	.404**	.587**
IGO	.537**	—	.286**	.528**	.318**	.655**
EGO	.010	.286**	—	.079	.071	.211*
TV	.858**	.528**	.079	—	.407**	.617**
COL	.404**	.318**	.071	.407**	—	.517**
SE	.587**	.655**	.211*	.617**	.517**	—

Notes: ** $p < 0.01$ level, * $p < 0.05$ level, IIT = intentions to integrate, IGO = intrinsic goal orientation, EGO = extrinsic goal orientation, TV = task value, COL = control of learning, SE = self-efficacy

Table 4. Linear regression results and collinearity diagnostics

	Unstandardized					Collinearity	
	B	**SE(*B*)**	**β**	*t*	*p*	**Tolerance**	**VIF**
IGO	.08	.06	.09	1.23	.220	.82	1.22
EGO	.03	.04	.04	.76	.449	.52	1.93
TV	.84	.07	.79	11.26	.000	.72	1.39
COL	.05	.06	.05	.80	.425	.40	2.50
SE	.01	.08	.01	.10	.924	.82	1.22

Notes: IGO = intrinsic goal orientation, EGO = extrinsic goal orientation, TV = task value, COL = control of learning, SE = self-efficacy

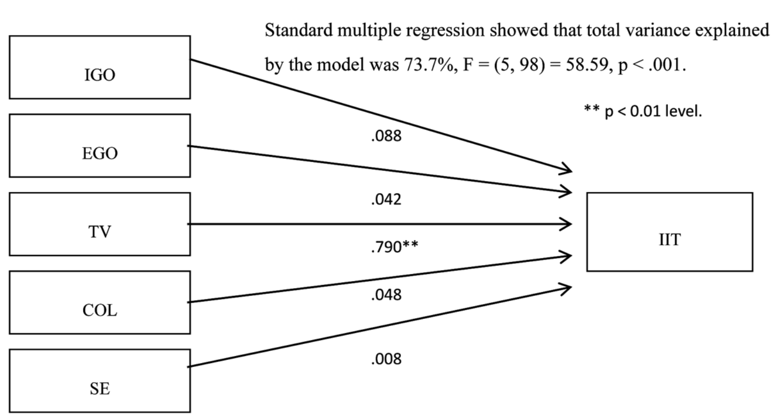
Research Question 2

Do pre-service teachers' motivational beliefs (measured as intrinsic goal orientation, extrinsic goal orientation, task value, control of learning, and self-efficacy) predict intentions to integrate technology to enhance student learning?

To answer research question two, the authors averaged the intrinsic goal orientation, extrinsic goal orientation, task-value, self-efficacy, control of learning, and intention pre- and post-scores to calculate a composite score. Next, standard multiple regression, via the enter method, was used to assess the ability of motivational beliefs (measured as IGO, EGO, TV, COL, and SE) to predict pre-service teachers' intentions to integrate technology (IIT). Multiple regression analysis assumes lack of multicollinearity. Multicollinearity exists when more than two predictors correlate very strongly. When this happens, it creates biased estimates between variables (Pallant, 2010). Collinearity diagnostics were performed and did not reveal violations.

In accordance with Pallant (2010), tolerance values were high (above .10) and variance inflation factor (VIF) values were low (below 10), both suggesting the likelihood of multicollinearity was low. Moreover, bivariate correlation values were below .70, therefore omission of variables was not considered (Pallant, 2010). Correlations appear in Table 3; tolerance and VIF values appear in Table 4.

Figure 1. Results of standard regression: ability of motivational beliefs to predict intention



The total variance explained by the model was 73.7%, F = (5, 98) = 58.59, $p < .001$. One of the measures was statistically significant, with task value (TV) recording a beta value (beta = .790, $p < .001$). See Figure 1 and Table 4. These results suggest there is a fairly significant relationship between motivational beliefs and intentions to integrate technology into one's future classroom. Moreover, task value plays a key role in the strength of that relationship.

DISCUSSION

This research expands on expectancy-value theory work in three ways. First, it contributes to the body of literature that looks at expectancy-value beliefs as potential correlates of technology integration (e.g. Davis, 1993; Hasan, 2006; Inan & Lowther, 2010; Smarkola, 2011; Taylor & Todd, 1995; Teo, 2012). Second, it demonstrates that the motivation and learning strategies taxonomy (McKeachie et al., 1986) is a way to study these relationships. And third, the MSLQ (Pintrich et al., 1993) is a tool to measure these relationships. Using the motivation and learning strategies taxonomy and the MSLQ, the researchers found authentic learning exercises have the potential to positively influence pre-service teachers' motivational beliefs towards technology integration and a predictive relationship might exist between motivational beliefs and intentions to integrate.

Regarding the impact of authentic learning exercises on the pre-service teachers' motivational beliefs, there was a significant improvement in intrinsic goal orientation, extrinsic goal orientation, control of learning, and self-efficacy. The impact was greatest for intrinsic goal orientation and self-efficacy. Although results from research question two indicate that self-efficacy was not a significant predictor of intention, the positive change from pre- to post-assessment is still valuable. According to Bandura (1997, 1998), self-efficacy is positively related to persistence even in the face of difficulties. Such persistence could be deemed beneficial to a future or practicing teacher who is learning to navigate new technologies and ways to integrate them. Similarly, although intrinsic goal orientation did not emerge in research question two as a significant predictor of intention to integrate, there is value in its improvement. According to Pintrich et al. (1993), intrinsic goal orientation is the degree to which one performs a task for reasons such as challenge, curiosity, and mastery. Like self-efficacy, such a trait could also be deemed an asset for a future or practicing teacher. As new technologies emerge daily, one must continually work to keep abreast of such developments and to dedicate times towards uncovering their potential. Possessing an intrinsic goal orientation towards technology integration would support such an act.

So, how did the authentic learning exercises come to positively impact self-efficacy and intrinsic goal orientation? According to Linnenbrink and Pintrich (2002), self-efficacy is facilitated by providing opportunities for learners to experience success within their range of capabilities and then by gradually developing new skills and capabilities. Pope, Hare, and Howard's (2002), Sadaf et al.'s (2016), and Wu et al.'s (2012) research validate this finding. They found exposure to technology in the context of pedagogical practice had a direct impact on pre-service teachers' efficacy. Also, Lombardi (2007) indicates that authentic learning awakens in learners the confidence to act. In the current study, pre-service teachers were provided with the opportunity to practice technology-integrated decision-making in both small and large contexts (i.e., whole curriculum units or individual lesson plans) with support and feedback from peers and their instructor. Also, the pre-service teachers worked in teams to develop technology-integrated curriculum that could be implemented in a real classroom setting. Next, they delivered a technology-integrated lesson and reflected on best ways to implement the lesson again in the future. Prior to these lessons, the pre-service teachers practiced using different technologies while also considering how those technologies could help future students achieve learning objectives. The underlying intention of such exercises was for the pre-service teachers to connect new experiences to existing knowledge, to understand how technology can support teaching and learning, and to foster the ability to do so. These activities allowed pre-service teachers to work towards mastery of new skills, a precursor to self-efficacy as found by Bandura (1997, 1998), and in an environment that encouraged exploring technologies affordances with the support and encouragement of their peers and instructor.

Regarding the improvement in intrinsic goal orientation, the pre-service teachers may have found the authentic learning exercises pleasurable. According to Deci and Ryan (1985) and Cullen and Green (2011), intrinsic motivation is highest when performing tasks that are personally meaningful (e.g., such as attainment value) and enjoyable. Moreover, they indicated this kind of motivation could sustain passion, creativity, and sustained effort towards completing a task. In this study, the intrinsic goal orientation assessment items related to challenge, curiosity, and mastery. This means that the authentic learning exercises positively stimulated pre-service teachers to learn more about technology integration for reasons external to their intended use, the improvement of future student learning. Even though intrinsic goal orientation (or intrinsic motivation as written in some literature) is a self-centered reason for integrating technology, there is implicit value in its stimulation. Research shows that intrinsic motivation is a positive force in sustained learner engagement (Eccles & Wigfield, 2002). Given the sometimes complex design of instructional and learning technologies, sustained learner engagement could be considered vital in motivating a pre-service teacher or teacher to persist in learning new technologies as they emerge. In this regard, providing pre-service teachers a supportive, well-structured, rewarding environment to learn and apply new technologies could be deemed imperative.

As for the ability of motivational beliefs to predict pre-service teachers' intentions to integrate technology, the motivation and learning strategies taxonomy, as used in this study, significantly predicted those intentions. To an extent, this finding is consistent with Davis (1993), Hasan (2006), Inan and Lowther (2010), Smarkola (2011), Taylor and Todd (1995), and Teo (2012) who found expectancy-value related factors to be precursors to intentions to integrate technology. However, this study, compared to the previous research, differed in that only one of the motivational beliefs, task value, predicted significantly. According to Eccles and Wigfield (2002) task value is the extent to which learners find a task interesting, important, and/or useful. This means the degree to which pre-service teachers in this study found integrating technology to be interesting, important, or useful predicted the degree to which they intended to become future technology integrators. Said differently, task value plays a largely significant role in whether or not a pre-service teacher plans to put effort into using technology to improve student learning in his or her future classroom.

Task value in academic settings is influenced by the following factors:

1. The enjoyment one expects to experience while engaging in the task—intrinsic interest;
2. The extent to which engaging in the task is consistent with one's self-image or identity—attainment value;
3. The value of the task for facilitating one's long range goals or in helping one obtain immediate or long range external rewards—utility value; and
4. The perceived cost of engaging in the activity (Eccles & Wigfield, 2002).

It should be noted, however, that that factor #1, intrinsic interest, and factor #3, utility value, could be likened to intrinsic and extrinsic goal orientations, which were *not* strong predictors of intention to integrate in the current study. In general, this list of factors coupled with the results from the current study implies teacher educators must keep abreast not only of the utilitarian value of integrating technology, but they must also take steps to identify what makes a given pre-service teacher value technology. From an efficiency standpoint, it would be difficult to assess and tailor instruction to meet the needs of each pre-service teacher, but definitely plausible to host classroom or online discussions to uncover the larger reasons why integrating technology to improve student learning is valued.

Ironically, the authentic learning exercises in this study *did not* significantly impact task value. As mentioned in the results, this could be because pre-service teachers already held high regard for technology integration. Haydn and Barton (2006) found the majority of teachers *did* have positive views about integrating technology; they just did not have the time to learn how to do it. If time is a barrier, teacher educators could help pre-service teachers develop a protocol that facilitates quick learning of new technologies and how best to integrate them. Activities fostering such a repertoire might look like the technology-integrated student assignments in this study. The pre-service teachers were given time to "play" with a variety of technology tools and to consider how the tools could make teaching more effective and engaging. In this context, the pre-service teachers build the confidence and savvy to navigate new technologies and to develop the speed required to integrate them efficiently into instruction. Kurz and Middleton (2006), Sadaf et al. (2016), and Wu et al. (2012) found these types of activities lead to more skillful insight about technologies' affordances. If one does not witness the potential that technology integration has for improved student learning, then one might not hold technology at the esteemed level required to become a regular user.

LIMITATIONS

There are at least three limitations of this study. First, it did not include a control group. Use of a control group would strengthen the experimental design and provide more insight into the influence of the learning activities. Second, the study group was a sample of convenience, thus increasing the potential for bias. To reduce bias, the researcher had a colleague administer the assessment. Also, the researcher did not look at results until after the study was completed to reduce the potential for changing the instructional techniques mid-study. Third, the study analyzed the relationship between motivational beliefs and intentions. While intentions can be a strong predictor of behavior, they do not guarantee it. Future studies, such as Sadaf et al. (2016), should include a longitudinal investigation into pre-service teachers' future technology integration practices. Despite these limitations, this study offers valuable insight into pre-service teachers' motivational beliefs about technology integration and the types of experiences that might influence them. Assessments that include open-ended questions, interviews, and focus groups could help to reveal such details.

CONCLUSION

Historically, Teo (2012) said, "developers and procurers of technological resources could rely on authority to ensure that technology was used" (p. 1). Such is not the case anymore. The decision to integrate technology ultimately depends on one's beliefs about technology (Ertmer, 2005) and it would be wise for professional preparation programs to pay heed to those beliefs. According to Fishbein and Cappella (2006), "The more one knows about the factors that underlie the performance (or nonperformance) of any given behavior, the more likely it is that one can design a successful intervention to change or reinforce that behavior" (p. 216).

Expectancy-value theory indicates value and expectancy are associated with willingness to take on challenging tasks (Bandura, 1997). If a pre-service teacher values technology integration, then his or her intentions should be more likely to take on the potential challenges associated with integration. Therefore, there is value in future research that identifies methods by which to augment or support existing pre-service teachers' task value beliefs. This study affirms that as the researchers found, that pre-service teachers' task value plays a fairly significant role in whether or not they intend to integrate technology into his or her future classroom. Even though intentions do not guarantee behavior, past research shows a strong predictive relationship (Ajzen, 1985; Sadaf et al., 2016; Salleh & Albion, 2004; Venkatesh et al., 2003).

This study also affirms that authentic learning exercises had a significant, positive influence on some motivational beliefs, of which most notable were intrinsic motivation and self-efficacy. Though the impact on task value was not significant, the researchers contend it is important to continue researching ways authentic learning exercises could positively influence task value. This belief is supported by the motivation and learning strategies taxonomy that suggests motivation is *not* a static trait, but rather a dynamic, contextually-bound construct mediated by value and expectancy beliefs which vary from one situation to the next (Duncan & McKeachie, 2005).

By understanding pre-service teachers' beliefs about technology integration and the kinds of learning experiences that positively support those beliefs, professional programs can help these future teachers to develop an early teaching schema that includes integrating technology. Ultimately, the goal is for pre-service teachers to enter prospective classrooms with positive expectancy-value beliefs so they are motivated to use technology in ways that enhance teaching and learning or render it more engaging and efficient. Further research into this domain will not only benefit pre-service teachers, but also their future students.

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