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Examining Technology and Teaching Efficacy of Preservice Teacher Candidates: A Deliberate Course Design Model

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Abstract:
Training programs that improve technology self-efficacy of teacher candidates will better prepare candidates to overcome technology challenges with greater levels of confidence. The purpose of this study was to examine self-efficacy levels of preservice teacher candidates who participated in scaffolded technology training designed to establish and build upon personal successes and motivations related to technology skill development and use of technology. A purposeful sample of 424 pre-service teacher candidates enrolled in an Instructional Technology course were administered the *Technology and Teaching Efficacy Scale* at the beginning and end of the semester to assess perceived confidence in his or her abilities to implement technology into classroom lessons/activities to promote students' success through the use of technology. Findings suggest that preservice teacher candidates, who participated in a technology course that was designed to develop confidence in the use and implementation of technology had an impact on use of technology and teaching self-efficacy.

Keywords: Use of technology, teaching, self-efficacy, technology integration, preservice teacher candidates

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Among the many theoretical perspectives in the field of motivation are achievement goal theory (Ames, 1992; Dweck & Legget, 1988; Nicholls, 1984), expectancy-value theory (Eccles et al., 1983; Wigfield & Eccles, 2000) and self-efficacy (Abbitt, 2011; Bandura, 1986; Holden & Rada, 2011). Within these theories exists a substantial body of research that examines how learners build meanings based on their own experiences through achievement related behaviors (Schunk, Pintrich, & Meece, 2008). The purpose of this study was to examine self-efficacy levels of preservice teacher candidates who participated in scaffolded technology training designed to establish and to build upon their personal successes and motivations. Scaffolded learning processes build upon prior knowledge, increase efficacy, and support further growth. Improved confidence levels based on success can affect intrinsic interest levels in areas of technology use and integration, supporting transfer of skill level development from the training environment to the classroom.

The scaffolded course design used in this study incorporated motivational belief constructs derived from theories of achievement goal, expectancy-value, and self-efficacy to influence learners' confidence levels and achievement outcomes. Research supports the relationship between a positive self-efficacy in relation to technology knowledge and future classroom use of technology (Albion, 2001; Holden & Rada, 2011; Lumpe & Chambers, 2001; Voogt, Fisser, Roblin, Tondeur, & van Braak, 2013). Understanding how these theories are related and how they affect the confidence levels of learners facilitates design and development of effective technology training. Technology integration in EC-12 classrooms continues to be a primary component of long-range educational plans within public school systems and is why teacher education programs address the training of teacher candidates in technology skill development and technology use. Training programs that increase technology self-efficacy of teacher candidates will better prepare candidates to overcome technology challenges with greater levels of confidence (Watson, 2006)..

Motivation Model

Building upon the research of Hulleman, Durik, Schweigert, and Harackiewicz (2008), motivation was examined as a model where achievement goals and initial interest lead to perception of task value (expectancy-value), thus supporting learner's technology skill development and continued interest in technology (self-efficacy). Achievement goal theory (Ames, 1992; Dweck & Legget, 1988; Nicholls, 1984) supports the belief that learner engagement is critical to achievement-related processes and outcomes.

Wigfield and Eccles (2000) expanded earlier research on expectancy-value theory by relating the theory to predictors of success. The beliefs of individuals as related to their confidence in accomplishing an academic task (self-efficacy) and the value they place upon accomplishing the task are essential for understanding achievement behaviors and predicting academic outcomes. Schunk et al. (2008) demonstrated that just as self-efficacy is a positive predictor of performance outcomes, task value is a reliable predictor of the future use of the task by the learner. Perceiving value in tasks or activities has been associated with motivation and maintained interest. In an instructional setting, where new skills acquisition and subsequent application are applied and built upon, the individuals' perceived value of the skill, their engagement in the skill acquisition process, and their confidence in their success in acquiring the skill are critical. Students' competence perceptions arise, in part, from prior performance experiences and are predictive of achievement (Bandura, 1994; Usher & Pajares, 2008).

Learners establish intrinsic task value when they are interested in the task for its own qualities and when they find the task to be enjoyable and fun. This enjoyment and personal connection with a task, through interaction and experience, can facilitate attention, cognitive processing, effort, and subsequent interest (Hidi, 1990; Hidi & Harackiewicz, 2000). Learners view tasks as having utility value when they perceive the task as useful and relevant to areas outside of the training environment. When learners perceive value in the tasks or activities encountered during training, their level of situational interest increases (Hidi & Renninger, 2006). In what could be viewed as a reciprocal effect, as value is perceived by learners, their interest levels increase and the value of the activity and their desire to continue with the task or activity increases, resulting in maintained situational interest. If maintained over time, sustained situational interest can lead to well-developed individualized interest. Individualized interest will then directly affect continued return to the new task or activity or reuse of the new skill or knowledge.

Interest that develops or deepens in a particular context depends on the extent to which value, positive effect, and knowledge acquisition experiences happen in relation to the activity (Hidi & Renninger, 2006; Mitchell, 1993). Additionally, individual interest reciprocally relates to other motivational variables such as self-efficacy and self-regulation. Lipstein and Renninger (2007) hypothesized that interest is a mediator for the development of self-efficacy and self-regulation skills, as interest maintains attention and effort required to develop knowledge and to continue learning over time.

Self-Efficacy, Confidence, and Technology

Bandura (1994) defines self-efficacy “as people’s beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives” (para. 1). His research indicated that those individuals who possessed high levels of self-confidence in their own abilities would approach difficult tasks as challenges rather than as obstacles (Bandura, 1994). Therefore, higher levels of self-efficacy will produce higher levels of performance. Teacher candidates often enter technology training with low levels of self-efficacy. For the technology novice, new technologies may seem threatening and overwhelming, resulting in intensification of existing beliefs about their inability to master technology related tasks. Introducing candidates, who possess low levels of self-efficacy, to technology skills that are familiar or personally gratifying will help alleviate feelings of inadequacy and potential failure. Slowly building a sense of success regarding new technology skill acquisition will promote self-confidence and increase interest in further skill development.

Skill Development and Skill Transfer

Two critical issues found in technology training are skill development and skill transfer. Scaffolded learning processes during new technology skill acquisition establish the foundation for the candidates’ sense of success, self-confidence, and increased interest in further skill development. When candidates experience high levels of anxiety or fear regarding technology skill acquisition even the simplest of tasks can become overwhelming, creating barriers to continued growth. In the course under study, developed using scaffolded training, candidates experience learning opportunities that offered incremental acquisition of technology skills, where new skills built upon existing skills. This process helped candidates become confident, self-supporting users of technology. The ultimate goal of technology training is to empower teacher candidates in their own skill use so that they confidently integrate technology into their future classrooms. Scaffolding in technology skill acquisition requires breaking skills into small obtainable components that empower the candidates and provide a sense of success and accomplishment. Scaffolding of technology skills helps alleviate feelings of panic and uncertainty because of incremental introduction of skills. The slower processes of growth help reduce stress and anxiety during instruction.

A second issue in technology training is the ability to transfer the skills and knowledge related to integrating technology into the classroom curriculum without actual classroom experience and hands-on practice. Technology training aligned with the curriculum and relevant to what teachers do in the classroom is more helpful than training restricted to the development of basic technology skills (Zhao & Bryant, 2007). Effective training in the integration of technology requires consistent modeling of effective uses of technology in the classroom and in the curriculum. Instruction must demonstrate appropriate uses of a variety of technology tools for both teaching and learning. Simply telling a teacher the capabilities of technology is not enough; teachers must be able to envision the technology as it relates to their own content area if they are to master ways to integrate technology effectively (Zhao & Bryant, 2007). “Cookie cutter” courses that focus on basic skills and application training will not enable the transfer of skills from the training environment to the classroom.

Course Design Model

Given that the technology training course occurs early in the course sequence for teacher certification, candidates have not yet developed differentiated knowledge of pedagogical skills relevant to their future teaching assignments. The goal of the technology course in this study was to provide a broad skill base for diverse candidates in multiple teaching areas and certification grade levels. Pre-service teacher candidates need to have a flexible concept of technology use and integration as they progress to content specific disciplines during their teacher education program.

In addition to the scaffolding of technology skill sets, this course also scaffolded the concepts and instructional processes behind the assignments. Since candidates are so diverse in their certifications and grade level choices, a recognized set of curricula served as a base resource for most of the semester's technology assignments. Environmental Education (EE) materials provided the foundational curriculum for technology integration assignments. The EE materials used course were cross-discipline, cross-grade level, and standards-aligned. Since the EE materials were developed, reviewed, revised, and field-tested by experienced educators, we argue that repeated exposure to high quality curricular examples provided experiences that, over time, increased candidates' sense of preparedness and perceived teaching self-efficacy. Because curricula were used repeatedly through the semester, exposure may effectively mimic a vicarious mastery experience for candidates. While enactive mastery has the strongest effect on personal efficacy beliefs (Bandura, 1994), candidates in this course are not yet at the point in the teacher education program that will allow them to prepare or teach a lesson in an authentic setting. However, there are various types of vicarious mastery experiences that can be effective for improving self-efficacy beliefs. Bandura (1994) considered that "All of the vicarious modes of influence – whether conveyed through effective actual modeling, symbolic modeling, videotaped self-modeling, or cognitive self-modeling – enhance efficacy beliefs and improve performance" (p. 95). Candidates with the most opportunities to experience different learning experiences will more likely be comfortable using technology to aid teaching and learning (Ertmer & Ottenbreit-Leftwich, 2010). The goal of the technology course was to encourage teacher candidates to move beyond simple acquisition of technology skills to more conceptually advanced levels where they were able to apply teaching methods that facilitated technology integration in their lessons and classroom activities and to explore the potential impact on student learning.

Candidates enrolled in this prerequisite course were of all ages and possessed varying levels of computer knowledge. The scaffolded course design model supported candidates' confidence levels, learning processes, and skill development. The course began with an activity that engaged candidates in a multimedia task that allowed freedom of expression and creativity through a technology-based activity that encouraged self-promotion. Candidates created a digital story that embraced dispositional characteristics and behaviors defined by the School of Education (SOE). Candidates shared their stories with classmates as a class introduction. Using simple video tools to highlight their lives and display accomplishments, empowered them and provided candidates with an immediate sense of accomplishment. "I was proud to introduce myself to my classmates. I was excited to learn how to do this through a photostory. I had always wanted to make one, but never knew how (Student A)." Extending use of images as a communication medium the candidates selected a social justice or environmental issue they felt compassionate about addressing. They used an online photo tool, "FotoFlexer", to create a layered image that integrated text and images to illustrate their selected issue. This allowed candidates to expand on basic image manipulation skills using a more sophisticated graphic tool. Using visual tools offered candidates "instant gratification" for their efforts and bolstered confidence in technology use. "I really enjoyed making these things. But more importantly, it showed me especially creative and fun things I can make and do in the classroom to draw students in, to spark their interests, and generate curiosity and a motivation to learn (Student B)."

During subsequent small assignments, the instructional focus was on building skills sets beginning with basic skills needed to communicate online, create electronic documents, and conduct web-based exploration. Candidates were required to communicate with the instructor through both course and university email systems. They communicated with classmates about their digital stories using the course discussion tool. "My favorite way to share my knowledge and mastery is through group discussion. While some students groan at the long discussion, I enjoy the interaction with my professors and other peers. I also hope, in the long run...that it will actually help other students. Passing knowledge along is very important (Student C)." Candidates created an electronic portfolio to house course artifacts. The visual or "showcase" aspect of the portfolio afforded another vehicle for personal gratification and measure of accomplishment. "I think that this would be a great way to show my command of the subject matter that I plan to teach (Student D)". The portfolio afforded expansion of technology skill and online exploration.

Candidates extended word processing skills as they designed/developed a newsletter using desktop publishing software. Desktop publishing introduced advanced features of document creation. Newsletter assessment included significant focus on aesthetics and creativity to encourage intrinsic motivation, while exploring functions of new technology tools. Offering opportunities for new technology exploration can build confidence and motivate candidates to initiate future technology inclusion.

Candidates explored concept-mapping software, through an individualized assignment that revisited dispositional characteristics and behaviors. Revisiting content with introduction of a new technology helped scaffold candidates through skill development processes. Scaffolding continued as skills acquisition accelerated and reached a peak at course mid-point.

Higher order thinking skills became critical components of using advanced software as candidates began to develop integrated lesson models. At the course mid-point, candidates explored and utilized tools for data collection, graphic representation, and interactive presentation. Candidates initially explored 5E lesson plan components as a sequential process, and then over the next five modules isolated individual 5E components to extend understanding of lesson plan phases. Candidates would explore an integrated technology for support/enrichment within each of the 5E components.

In the 5E model Engage component candidates completed an assignment that required quality evaluation of a WebQuest. Scaffolding took place as candidates began with evaluation of a WebQuest prior to use of or creation of a WebQuest or web related activity. In the Explore component, data collection software and the integration of higher order questioning through database exploration supported student-learning processes and extended technology skill set development. Once acquainted with databases and classroom use candidates built data collection sets for their lesson. In the Explain component, candidates revisited the video tool (e.g. MovieMaker, iMovie, Slice) to design and develop an instructional video to support/extend lesson content.

Candidates often entered the course with prior knowledge/skill using PowerPoint. Therefore, in the Extend/Elaborate component, candidates built upon prior knowledge by designing/developing non-linear PowerPoint games. Games extended technology skills and use of critical and higher order thinking skills for student activities. In the Evaluate component, candidates built upon earlier collage skills with a more sophisticated tool, incorporating text, images, sound, video, and animation. Candidates used the online tool, Glogster, to develop a student-based product to assess mastery of lesson content. Candidates used an online rubric maker to develop a rubric to assess student created technology product.

Technology skill building tapered off, as the final assignment required candidates to apply newly acquired skills during final project development. The final project required candidates to work collaboratively to develop an integrated lesson inclusive of technology integration options during 5E lesson plan phase. Instructions provided to candidates indicated they were to select a different technology than those explored in the course for each 5E components. Individuals earned extra credit if they selected an appropriate technology outside the course scope. In addition to the supporting nature of the collaborative project, the culminating activity helped candidates realize their increased skill levels and competence in technology integration. “I really enjoyed the group project. At first, I was a little nervous not knowing what to expect from my group. We were all able to communicate and everything worked out great (Student E)”.

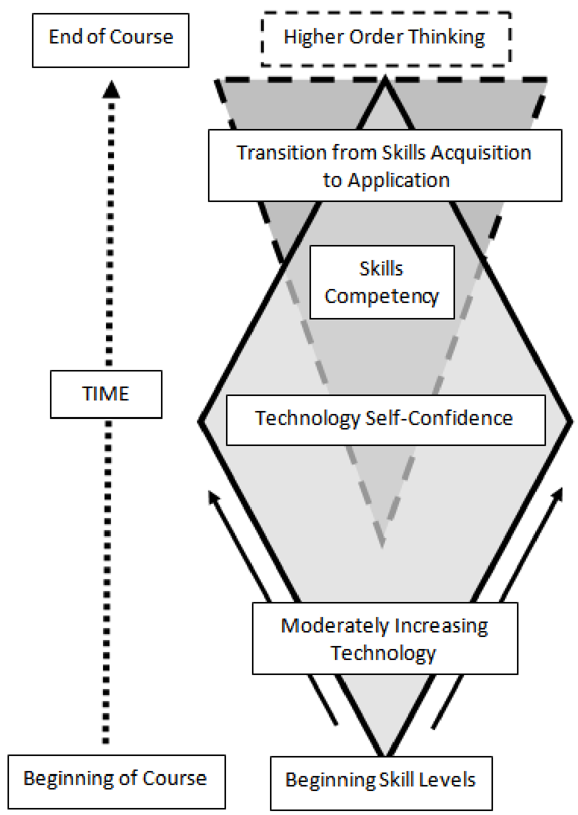

Figure 1. *Technology course design conceptual model (Smith & Willis, 2011).*

The scaffolded course design model (see Figure 1) design emphasizes intrinsic motivation as a key to success where achievement goals and interest levels lead to task value (expectancy-value) and supports learners’ technology skill development and continued interest in the technology (self-efficacy). For the design model, consider an image of a diamond as candidates move from the narrow bottom (representing low skills) towards the wider mid-point of the diamond, where skill building increases with introduction of more sophisticated software. During the model’s early phase, candidates gain skills through personally gratifying activities that stimulate intrinsic motivation. Moving up the shape, as the diamond begins to taper back to a point, so does focus on new skill acquisition. At this point, candidates are again exposed to technologies that offer a sense of immediate success and security but that offer opportunities to extend and apply new skills at a higher level. The final project offers candidates an opportunity to culminate new skills in a showcase product that emphasizes their growth and accomplishments.

Methods

Participants

A purposeful sample of 424 pre-service teacher candidates enrolled in INST 3133 Survey of Instructional Technology were solicited to participate in this study. Of the 424 respondents on the pre-survey, 83.3% were female and 17.0% were male. Participant's ages ranged from 16-60 years of age (with a mean of 26.6 years) and race/ethnicity was reported to be: 63.0% White, 19.0% Hispanic, 3.0% Black/African American, and 2.0% Asian.

Instrumentation

Each of the pre-service teachers were administered the *Technology and Teaching Efficacy Scale* (Mayo, Kajs, & Tanguma, 2005; Tanguma, Underwood, & Mayo, 2004) to assess perceived confidence in his or her abilities to implement technology into classroom lessons/activities to promote students' success through the use of technology (see Appendix). An equal number of items addressed the two subscales: (a) use of technology and (b) teaching. The instrument consists of 22 items, regarding both use of technology and teaching self-efficacy, and are rated on a 5-point Likert type scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). Composite scores range from 22 to 110; the higher the composite, the greater the Technology and Teaching Self-Efficacy. Psychometric findings provide support for the internal consistency or reliability of this instrument: Cronbach's alpha for entire instrument = .98, use of technology = .97, and teaching = .96).

Data Collection and Analysis

Pre-service candidates were administered the *Technology and Teaching Efficacy Scale* on the first and last day of the academic semester so as to assess his or her perceptions before and at the end of the INST course. Data was analyzed using descriptive statistics (e.g., percentages, means) and a two-tailed paired *t*-test to assess whether a statistically significant mean difference existed from pre- to post.

Results

In addition to technology skill development, the course exposed candidates to instructional strategies, lesson planning, as well as dispositions, characteristics, and behaviors of effective teachers. Therefore, responses are reflective of candidates' beliefs and perceptions, both prior to and after taking the course, regarding their abilities as future teachers and the potential impact of technology use in their future classrooms. The items encouraged introspection of their own educational experiences and retrospection of their future as classroom teachers. Candidates were prompted to respond to survey questions as if they were already in a PK-12-classroom. Comparison of the pre- and post-survey results within each year examined the impact of the course on the self-efficacy of the teacher candidates who completed the technology training. The survey items fell into five rating subscales ranging from strongly disagree (SD) to strongly agree (SA). Initial analyses included descriptive and inferential statistics.

Technology and Teaching Self-Efficacy

To assess whether there was a statistically significant mean difference between the pre- and post-self-efficacy of the participants in regards to use of technology and teaching for student success a two-tailed paired t-test was conducted. Table 1 provides the numerical results. Findings suggested that there was a statistically significant mean difference between the pre- and post-self-efficacy scores, $t(423) = -17.60$, $p < .001$, $d = 1.14$ (large effect size), $r^2 = .493$. The mean scores increased from 76.95 (pre-course) to 93.65 (post-course). The Survey of Instructional Technology course had a large effect on the self-efficacy of the teacher candidates and 49.3% of the variance in those scores can be attributable to the course.

Table 1
Paired t-test Results for Technology and Teaching Self-Efficacy

	Mean	Standard Deviation	Mean Difference	*t*-value	df	*p*-value
Pre-Scores	76.95	14.10	16.7	-17.60	423	< .001*
Post-Scores	93.65	15.30				

Note. Statistically significant (p < .05)

Table 2
Pre-Scores – Use of Technology Efficacy Scale (%)

Survey Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. My students learn better because I am able to incorporate technology into their activities	1.7	2.1	11.8	**53.8**	30.7
2. I am able to incorporate technology into any classroom subject	3.1	21.0	**37.7**	31.6	6.6
3. I can incorporate technology into my teaching without sacrificing the basics	.5	14.9	28.5	**47.2**	9.0
4. I am able to use technology to capture a student's interest	1.7	9.0	13.0	**53.5**	22.9
5. I am able to use technology in my teaching to improve the quality of education	.9	11.1	23.3	**48.8**	15.8
6. I can get students excited about learning by using technology in the classroom	1.7	5.7	13.7	**54.7**	24.3
7. I am able to use technology to solve many classroom problems	3.1	18.9	**44.8**	27.6	5.7
8. My students can think better because of my use of technology in the classroom	.9	7.3	15.3	**56.4**	20.0
9. I can use technology to make classrooms more appealing to my students	1.4	13.9	34.4	**38.7**	11.6
17. My students retain more because I incorporate technology into their learning activities.	2.6	15.8	**36.8**	36.6	8.3
19. Students are successful in my classes because of my ability to effectively incorporate technology into my teaching	1.9	16.3	**45.8**	29.7	6.4

Technology Self-Efficacy

Participants were asked to rank pre- and post-self-efficacy concerning their perceived abilities in the use of technology. Tables 2 and 3 display the overall percentages per item for pre- and post-course participant responses. Prior to taking this course, the majority of the responses fell in the *Agree* category. At the completion of the semester, the majority of the participants reported "*Strongly Agree*" in most of the survey items. The smallest percent increase in self-efficacy was reported with “My students learn better because I am able to incorporate technology into their activities” (21.7%), while the largest percent increase was found to be in “I am able to incorporate technology into any classroom subject” (48.8%). These findings indicate that the knowledge and training received in the Survey of Instructional Technology course has increased participants’ technology self-efficacy, and thus a sense of preparedness to integrate technology into their future classrooms. Mean increases in self-efficacy ranged from .29 to 1.27. The largest mean increase from pre- to post- course participation was found to be in “I am able to incorporate technology into any classroom subject”. Table 4 displays the descriptive statistics for each item in this subscale.

Table 3
Post-Scores – Use of Technology Efficacy Scale (%)

Survey Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. My students learn better because I am able to incorporate technology into their activities	2.4	.5	5.4	39.4	**52.4**
2. I am able to incorporate technology into any classroom subject	2.1	.5	3.3	38.7	**55.4**
3. I can incorporate technology into my teaching without sacrificing the basics	1.7	.5	5.4	40.3	**52.1**
4. I am able to use technology to capture a student’s interest	2.1	0	3.1	31.6	**63.2**
5. I am able to use technology in my teaching to improve the quality of education	2.4	0	4.5	37.7	**55.4**
6. I can get students excited about learning by using technology in the classroom	2.4	.2	2.6	34.7	**60.1**
7. I am able to use technology to solve many classroom problems	2.1	2.1	16.0	**43.9**	35.8
8. My students can think better because of my use of technology in the classroom	2.4	.5	3.8	36.1	**57.3**
9. I can use technology to make classrooms more appealing to my students	2.1	.9	6.4	43.4	**47.2**
17. My students retain more because I incorporate into their learning activities.	2.6	1.2	9.7	**46.**0	40.6
19. Students are successful in my classes because of my ability to effectively incorporate technology into my teaching	2.6	1.9	22.4	**40.8**	32.3

To assess whether there was a statistically significant mean difference between the pre- and post-self-efficacy of the participants in regards to the use of technology a two-tailed paired t-test was conducted. Table 1 provides the numerical results. Findings suggested that there was a statistically significant mean difference between the pre- and post-self-efficacy scores, t(423) = -17.982, p < .001, *d* = 2.50 (large effect size), r^2 = .781. The mean scores increased from 39.26 (pre-course) to 47.79 (post-course). The Survey of Instructional Technology course had a large effect on the self-efficacy of the teacher candidates and 78.1% of the variance in those scores can be attributable to the course.

Table 4

Descriptive Statistics for the Use of Technology Efficacy

Survey Item	Mean Pre	Standard Deviation Pre	Mean Post	Standard Deviation Post	Mean Difference
1. My students learn better because I am able to incorporate technology into their activities	4.10	.82	4.39	.81	0.29
2. I am able to incorporate technology into any classroom subject	3.18	.94	4.45	.77	1.27
3. I can incorporate technology into my teaching without sacrificing the basics	3.49	.87	4.40	.76	0.92
4. I am able to use technology to capture a student's interest	3.87	.92	4.54	.75	0.67
5. I am able to use technology in my teaching to improve the quality of education	3.67	.90	4.44	.79	0.76
6. I can get students excited about learning by using technology in the classroom	3.94	.87	4.5	.77	0.56
7. I am able to use technology to solve many classroom problems	3.14	.89	4.09	.89	0.95
8. My students can think better because of my use of technology in the classroom	3.87	.85	4.56	.80	0.58
9. I can use technology to make classrooms more appealing to my students	3.45	.92	4.32	.81	0.88
17. My students retain more because I incorporate technology into their learning activities	3.32	.93	4.21	.86	0.89
19. Students are successful in my classes because of my ability to effectively incorporate technology into my teaching	3.22	.86	3.98	.93	0.76

Table 5
Paired t-test Results for the Use of Technology Self-Efficacy

	Mean	Standard Deviation	Mean Difference	*t*-value	df	*p*-value
Pre-Scores	39.26	7.08	8.53	-17.98	423	< .001*
Post-Scores	47.79	7.71				

Note. Statistically significant (p < .05)

Teaching Self-Efficacy

Participants were asked to rank pre- and post-self-efficacy concerning their perceived abilities in teaching. Tables 6 and 7 display the overall percentages per item for pre- and post-course participant responses. The smallest percent increase in self-efficacy was reported with "Students who have difficulty learning from other teachers are able to learn in my class" (20.3%), while the largest percent increase was found to be in "I am good at explaining things in terms that students can understand" (36.8%) and "Even students with poor academic records can benefit from my teaching" (37.0%). These findings indicate that the knowledge and training received in the Survey of Instructional Technology course has increased participants' technology integration self-efficacy, and thus a sense of preparedness in teaching. Mean increases in self-efficacy ranged from .60 to .99. The largest mean increase from pre- to post- course participation was found to be in

"Even students with poor academic records can benefit from my teaching". Table 8 displays the descriptive statistics for each item in this subscale.

Table 6
Pre-Scores – Teaching Efficacy Scale (%)

Survey Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
10. All of my students benefit because of the way I teach	2.4	20.5	**43.4**	28.3	5.4
11. When my students are successful it is because I have done a good job as a teacher	.9	10.1	26.4	**51.2**	11.3
12. I am good at explaining things in terms that students can understand	.9	9.2	17.0	**61.8**	11.1
13. Even students with poor academic records can benefit from my teaching	1.7	16.5	**37.3**	36.3	8.3
14. When students do not understand a concept, I can explain it so it becomes clear to them	1.4	11.6	29.7	**46.5**	10.8
15. I can create an atmosphere conducive to learning	.7	8.7	21.9	**56.4**	12.3
16. I am able to accurately evaluate my students' progress	2.1	17.5	31.8	**42.0**	6.6
18. I vary my teaching strategies to meet the needs of my students	2.1	14.6	29.0	**42.0**	12.3
20. Other teachers consider me a valued colleague	1.2	15.3	34.2	**42.7**	6.6
21. I am perceived as an asset to my school	1.4	9.9	31.6	**48.6**	8.5
22. Students who have difficulty learning from other teachers are able to learn in my class	9.0	21.5	**45.8**	17.7	6.1

Table 7
Post-Scores – Teaching Efficacy Scale (%)

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
10. All of my students benefit because of the way I teach	2.4	4.5	23.1	**38.9**	31.1
11. When my students are successful it is because I have done a good job as a teacher	1.9	.9	8.7	**46.9**	41.5
12. I am good at explaining things in terms that students can understand	2.1	.2	3.8	46.0	**47.9**
13. Even students with poor academic records can benefit from my teaching	1.9	.2	7.3	**45.3**	**45.3**
14. When students do not understand a concept, I can explain it so it becomes clear to them	2.1	1.2	11.8	**46.5**	38.4
15. I can create an atmosphere conducive to learning	2.1	.2	5.0	46.0	**46.7**
16. I am able to accurately evaluate my students' progress	2.4	1.2	14.9	**44.1**	37.5
18. I vary my teaching strategies to meet the needs of my students	2.1	.7	6.4	**46.9**	43.9
20. Other teachers consider me a valued colleague	2.6	1.4	11.8	**48.1**	36.1
21. I am perceived as an asset to my school	2.4	1.4	11.1	**51.2**	34.0
22. Students who have difficulty learning from other teachers are able to learn in my class	1.7	6.1	31.8	**34.0**	26.4

Table 8

Descriptive Statistics for the Teaching Efficacy

Question	Mean Pre	Standard Deviation Pre	Mean Post	Standard Deviation Post	Mean Difference
10. All of my students benefit because of the way I teach	3.14	.88	3.92	.96	.78
11. When my students are successful it is because I have done a good job as a teacher	3.61	.85	4.25	.80	.63
12. I am good at explaining things in terms that students can understand	3.72	.81	4.37	.76	.64
13. Even students with poor academic records can benefit from my teaching	3.33	.90	4.31	.78	.99
14. When students do not understand a concept, I can explain it so it becomes clear to them	3.54	.89	4.18	.84	.64
15. I can create an atmosphere conducive to learning	3.70	.82	4.35	.77	.64
16. I am able to accurately evaluate my students' progress	3.33	.91	4.13	.88	.80
18. I vary my teaching strategies to meet the needs of my students	3.48	.96	4.30	.80	.82
20. Other teachers consider me a valued colleague	3.38	.86	4.14	.87	.75
21. I am perceived as an asset to my school	3.5	.84	4.13	.84	.60
22. Students who have difficulty learning from other teachers are able to learn in my class	2.90	.99	3.77	.96	.87

To assess whether there was a statistically significant mean difference between the pre- and post-self-efficacy of the participants, in regards to technology and teaching efficacy, a two-tailed paired t-test was conducted. Table 9 provides the numerical results. Findings suggested that there was a statistically significant mean difference between the pre- and post-self-efficacy scores, $t(423) = -16.412$, $p < .001$, $d = 1.03$ (large effect size), $r^2 = .458$. The mean scores increased from 37.68 (pre-course) to 45.86 (post-course). The Survey of Instructional Technology course had a large effect on the teaching self-efficacy of the teacher candidates and 45.8% of the variance in those scores can be attributable to the course.

Table 9
Paired t-test Results for Teaching Self-Efficacy

	Mean	Standard Deviation	Mean Difference	*t*-value	df	*p*-value
Pre-Scores	37.68	7.95	8.18	-16.412	423	< .001*
Post-Scores	45.86	7.91				

Note. Statistically significant (p < .05)

Discussion and Implications

The results of this research demonstrate the value of integrating multiple theoretical perspectives in the study of motivation. We demonstrated how achievement goals can operate as frameworks within which individuals perceive task value in activities, and how these task values may operate as proximal predictors of achievement outcomes. The course under study was a required pre-requisite for admission into the teacher education program. Candidates enrolled in this class were not yet eligible for enrollment in content methods courses or courses that included field-based classroom experiences. However, EE materials used in the course were developed, reviewed, revised, and field-tested by experienced educators. Repeated exposure to high quality curricular examples provided experiences that increased preparedness and perceived teaching self-efficacy. As research indicates, there are various types of vicarious mastery experiences that can be effective for improving self-efficacy beliefs including actual modeling, symbolic modeling, videotaped self-modeling, or cognitive self-modeling all of which enhance efficacy beliefs and improve performance (Bandura, 1994).

This course introduced initial certification teacher candidates to the tools and skills necessary to understand and implement a variety of technology tools for use in the EC-12 classroom. While learning new technologies, candidates explored, through the EE curriculum, authentic situations in which technology may be appropriately integrated. The teacher candidates utilized EE materials as foundation curriculum for designing and developing lessons that integrated technology into teaching and learning experiences. As noted in the literature, training that increases participant confidence levels during skill acquisition can positively influence future use of the new skills and continued skill development (Albion, 2001; Holden & Rada, 2011; Lumpe & Chambers, 2001). The course included educational applications of instructional and informational technologies that promoted the integration of technology into the curriculum.

The results of this study are indicators of the success of the skill-building scaffold model implemented and its contribution to both the technology and teaching self-efficacies of the participants. In this model, technology skill development, through scaffolded processes, incrementally built upon small, early successes in technology skill acquisition. By increasing confidence levels in technology use, candidates showed changes in technology and teaching self-efficacy. Survey results indicated that at the conclusion of the course, candidates felt more capable using and integrating technology. The responses recorded by the candidates indicated growth in beliefs about the impact that technology would have on teaching and learning processes. The respondents' scores also reflected increases in their assessments of their own abilities as future teachers.

The results of this study will also add to the current body of research regarding self-efficacy and its impact on technology use and integration. Results of the analyses will inform teacher educators of the impact of technology training as it relates to candidate self-efficacy and skill transfer, suggesting potential areas for revision or modification of existing technology training; laying foundations for development of a reproducible technology training model. Studies that explore the application of the scaffolded training model, implemented in this course, are necessary if we are to understand the relationship between the scaffolded training model, skill acquisition, skill transfer, achievement goal theory, expectancy-value theory, and self-efficacy.

Recommendations for Future Research

There are several recommendations for future research in this area of study. First, the use of a control group that received technology training through a less scaffolded approach would offer the researcher an opportunity to get a more accurate representation of the potential impact of the design model used in this study. Second, although the Technology and Teaching Efficacy Scale (Mayo et al., 2005; Tanguma et al., 2004) was a reliable and validated instrument, a suggestion for future research is to find a different survey with a larger focus on technology skill, use, and integration. Third, it is suggested a follow-up be conducted with the same candidates as they advance in the teacher education program, preferably during their field-based experiences.

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Appendix
Technology and Teaching Efficacy Scale

Please read each of the following statements and circle the response that most closely describes your level of agreement or disagreement. The responses are:
SD=Strongly Disagree D=Disagree N=Neutral A=Agree SA=Strongly Agree

1. My students learn better because I am able to incorporate technology into their activities	SD	D	N	A	SA
2. I am able to incorporate technology into any classroom subject	SD	D	N	A	SA
3. I can incorporate technology into my teaching without sacrificing the basics	SD	D	N	A	SA
4. I am able to use technology to capture a student’s interest	SD	D	N	A	SA
5. I am able to use technology in my teaching to improve the quality of education	SD	D	N	A	SA
6. I can get students excited about learning by using technology in the classroom	SD	D	N	A	SA
7. I am able to use technology to solve many classroom problems	SD	D	N	A	SA
8. My students can think better because of my use of technology in the classroom	SD	D	N	A	SA
9. I can use technology to make classrooms more appealing to my students	SD	D	N	A	SA
10. All of my students benefit because of the way I teach	SD	D	N	A	SA
11. When my students are successful it is because I have done a good job as a teacher	SD	D	N	A	SA
12. I am good at explaining things in terms that students can understand	SD	D	N	A	SA
13. Even students with poor academic records can benefit from my teaching	SD	D	N	A	SA
14. When students do not understand a concept, I can explain it so it becomes clear to them	SD	D	N	A	SA
15. I can create an atmosphere conducive to learning	SD	D	N	A	SA
16. I am able to accurately evaluate my students’ progress	SD	D	N	A	SA
17. My students retain more because I incorporate technology into their learning activities	SD	D	N	A	SA
18. I vary my teaching strategies to meet the needs of my students	SD	D	N	A	SA
19. Students are successful in my classes because of my ability to effectively incorporate technology into my teaching	SD	D	N	A	SA
20. Other teachers consider me a valued colleague	SD	D	N	A	SA
21. I am perceived as an asset to my school	SD	D	N	A	SA
22. Students who have difficulty learning from other teachers are able to learn in my class	SD	D	N	A	SA

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