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# Preservice Teacher Experience with Technology Integration: How the Preservice Teacher's Efficacy in Technology Integration is Impacted by the Context of the Preservice Teacher Education Program

***Abstract:*** *This paper explores self-efficacy theory (Bandura), situated learning theory (Lave & Wenger), and self-determination theory (Ryan and Deci), the technological pedagogical content knowledge framework (TPCK or TPACK; Mishra & Koehler) and the International Society for Technology in Education (ISTE) Standards (for Educators) as they relate to the preservice teacher education program, including both coursework and field experience. Regarding teacher education program coursework, this paper examines research studies that report on findings from both quantitative and qualitative research about preservice teachers' experience with technology integration in the context of the teacher education program, in which the TPACK framework or ISTE Standards were used in the curricular design of the program's academic coursework. Regarding teacher education program field experience, this paper examines the context provided by the mentor teachers' self-efficacy regarding and use of technology.*

***Keywords:*** *Self-Efficacy Theory, Self-Determination Theory, Situated Learning Theory, Community of Practice (CoP), Technological Pedagogical Content Knowledge (TPCK or TPACK), International Society for Technology in Education (ISTE) Standards*



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***摘要*** *(Liz Ebersole: 在职前教师教育计划的背景下，职前教师在技术融合方面的经验）：*
*本文探讨了自我效能理论（Bandura），情境学习理论（Lave和Wenger），自我决定理论 （Ryan和Deci），技术教学内容知识框架（TPCK或TPACK；Mishra＆Koehler）和国际教育技术协会（ISTE）标准（针对教育工作者），因为它们与职前教师教育计划有关，包括课程工作以及实地经验。针对教师教育计划的课程工作，本文分析了一些研究报告，这些研究展示了在教师教育计划的背景下，有关职前教师技术融合经验的定量和定性研究的一些成果，其中在教师培训计划中使用了TPACK框架或ISTE标准。它们都曾被用于学术课程工作的课程设计当中。关于教师教育计划的实地经验，本文考察了指导教师在技术使用方面的自我效能的实例。*
***关键词*** *：自我效能理论，自我决定理论，情境学习理论，实践社区（CoP），技术教学内容知识（TPCK或TPACK），国际教育技术协会（ISTE）标准*
***摘要*** *(Liz Ebersole: 在職前教師教育計劃的背景下，職前教師在技術融合方面的經驗）：*
*本文探討了自我效能理論（Bandura），情境學習理論（Lave和Wenger），自我決定理論 （Ryan和Deci），技術教學內容知識框架（TPCK或TPACK；Mishra＆Koehler）和國際教育技術協會（ISTE）標準（針對教育工作者），因為它們與職前教師教育計劃有關，包括課程工作以及實地經驗。針對教師教育計劃的課程工作，本文分析了一些研究報告，這些研究展示了在教師教育計劃的背景下，有關職前教師技術融合經驗的定量和定性研究的一些成果，其中在教師培訓計劃中使用了TPACK框架或ISTE標準。它們都曾*

*被用於學術課程工作的課程設計當中。關於教師教育計劃的實地經驗，本文考察了指導教師在技術使用方面的自我效能的實例。*
***關鍵詞**：自我效能理論，自我決定理論，情境學習理論，實踐社區（CoP），技術教學內容知識（TPCK或TPACK），國際教育技術協會（ISTE）標準*

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***Zusammenfassung** (Liz Ebersole: Preservice Lehrer Erfahrung mit der Technologieintegration: Wie sich die Wirksamkeit von Preservice LehrerInnen bei der Technologieintegration durch den Kontext des Preservice Teacher Education Programms auswirkt): Dieses Papier untersucht die Selbstwirksamkeitstheorie (Bandura), die Theorie des situated learning (Lave & Wenger) und die Selbstbestimmungstheorie (Ryan & Deci), den technologisch-pädagogischen Wissensrahmen (TPCK oder TPACK; Mishra & Koehler) und die Standards der International Society for Technology in Education (ISTE) (für Pädagogen) in Bezug auf das Preservice Teacher Education Programm, einschließlich Kursarbeit und Praxiserfahrung. In Bezug auf die Lehrveranstaltungen für Lehrerausbildung untersucht dieses Papier Forschungsstudien, die über Ergebnisse aus der quantitativen und qualitativen Forschung über die Erfahrungen von Preservice LehrerInnen mit der Technologieintegration im Rahmen des Lehrerausbildungsprogramms berichten, in dem der TPACK-Rahmen oder die ISTE-Standards bei der curricularen Gestaltung der akademischen Studienarbeiten des Programms verwendet wurden. In Bezug auf die Felderfahrung des Lehrerbildungsprogramms untersucht dieses Papier den Kontext, der durch die Selbstwirksamkeit der MentorenlehrerInnen in Bezug auf Technologie und deren Einsatz gegeben ist.*
***Schlüsselwörter:** Selbstwirksamkeitstheorie, Selbstbestimmungstheorie, Situated Learning Theory, Community of Practice (CoP), Technological Pedagogical Content Knowledge (TPCK oder TPACK), International Society for Technology in Education (ISTE) Standards*

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***Аннотация** (Лиц Эберсоле: Опыт студентов педагогического факультета с технологической интеграцией): В данной статье дается анализ теории самоэффективности (Бандура), теории ситуативного обучения (Лейв, Венгер) и теории самодетерминации (Райан, Деси), рассматривается технолого-педагогический контент обучения (Мишра, Келер) и стандарты международной ассоциации по развитию информационных технологий в образовании (ISTE), включая теоретическую и практическую части. Применительно к занятиям, которые проводятся при подготовке будущих учителей, в работе анализируются результаты исследований, в которых в свою очередь в квантитативном и квалитативном аспектах рассматривались оценочные показатели самих участников данных курсов с интегрированием в процесс подготовки информационных технологий. В рамках этих подготовительных курсов использовались стандарты профессиональной подготовки учителей ISTE и TRACK. В статье анализируется также контекст, заданный через самоэффективность будущих наставников с проекцией на информационные технологии и их эффективное использование.*
***Ключевые слова:** теория самоэффективности, теория самодетерминации, сообщество практики, концепция технологического педагогического контента знаний, международная ассоциация по развитию информационных технологий в образовании*



# Introduction

The teacher education program serves as the gateway to the larger community of practice (CoP) for preservice teachers. It is here that their preconceived ideas about teaching, established through preservice teachers' own experiences in K-12 education, are confirmed and extended or challenged and reformed. Regarding technology integration, each preservice teacher will enter the teacher education program having had unique experiences with technology integration in their K-12 schooling, as a result of their own teachers' efficacy and use, as well as their own independent use of technology for academic

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purposes. Opportunities for learning about technology integration during the preservice teacher education program are to a certain extent governed by the context provided by the college or university (access to tools and courses) and the faculty (self-efficacy, quality and frequency of use) (Foulger & Williams, 2007; Keeler, 2008; Sutton, 2011; Lewis, 2015; Hughes, Liu, & Lim, 2016). How then, or to what extent, does the context of the preservice teacher program enhance or diminish the preservice teacher's self-efficacy and self-determination regarding technology integration?

As part of the teacher education program, the preservice field experience, in which preservice teachers gain practical experience in real classrooms, also provides a context that may either enhance or diminish the preservice teacher's self efficacy regarding technology integration. The preservice teacher observes the mentor teacher in the context of the classroom and school environment, including the daily skills, habits and mannerisms required to be as successful teacher. Regarding technology integration, there may or may not be dissonance between what preservice teachers observe in their preservice field experience and what they have learned in their academic program, or they may or may not have an opportunity to employ practices they have acquired in their academic program during their field experience. According to Ertmer & Ottenbreit-Leftwich (2010), "although knowledge of technology is necessary, it is not enough if teachers do not also feel confident using that knowledge to facilitate student learning" (p. 261). How then, does the context of the preservice field experience, including the mentor teacher and the classroom and school environment, affect the preservice teacher's self-efficacy regarding technology integration?

# Theoretical Construct

## Self-Efficacy Theory



According to Albert Bandura (1995), "perceived self-efficacy refers to beliefs in one's capabilities to organize and execute the courses of action required to manage prospective situations. Efficacy beliefs influence how people think, feel, motivate themselves, and act" (p. 2). During the teacher education program experience, preservice teachers are working towards competency and building confidence in their ability to become masters of content and pedagogy. Bandura (1995) wrote that an "influential way of creating and strengthening efficacy beliefs is through the vicarious experiences provided by social models" (p. 3). He explained that when "people [witness other people] similar to themselves succeed by perseverant effort [it] raises observers' beliefs that they, too, possess the capabilities to master comparable activities" (ibid.). Ertmer (2005) noted that

> having access to multiple models increases both the amount of information available about how to accomplish the performance and the probability that observers will perceive themselves as similar to at least one of the models, thus increasing their confidence for also performing successfully (p. 33).

The faculty of the teacher education program, (many of whom are former classroom teachers), as well as the preservice field experience mentor teacher, are "social models" who embody the "who" that the preservice teacher is striving to become (Bandura, 1995; Ertmer, 2005).

Regarding the influence of "social models," Bandura (1995) wrote:

> Modeling influences do more than simply provide a social standard against which to judge one's own capabilities. People seek proficient models who possess the competencies to which they aspire. Through their behavior and expressed ways of thinking, competent models transmit

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> knowledge and teach observers effective skills and strategies for managing environmental demands. Acquisition of better means raises perceived self-efficacy. Undaunted attitudes exhibited by perseverant models as they cope with obstacles repeatedly thrown in their path can be more enabling to others than the particular skills being modeled. (p. 4)

Preservice teachers' perceptions of self-efficacy may be significantly affected by their preservice learning experiences, including the competencies learned by observing the faculty in the teacher education programs and the mentor teachers in their preservice field experiences (Ertmer, 2005). On the connection between self-efficacy and technology integration, Ottenbreit-Leftwich, et al. (2018) wrote:

> Because self-efficacy represents a critical factor in pre-service teachers' intention to integrate technology, it is important to develop not only technology integration skills and knowledge during teacher education programs, but also to alleviate pre-service teachers' concerns and develop their feelings of self-efficacy. One method for doing this is through cases or vicarious experiences, which can build the observer's confidence and control, reduce anxiety and increase self-efficacy with a particular task (p. 2).

Regarding innovation, Bandura (1995) emphasizes that "innovative achievements also require a resilient sense of efficacy. Innovations demand heavy investment of effort over a long period with uncertain results" (p. 13). Therefore, preservice teachers may benefit from a teacher education program and field experience in which the faculty and the mentor teacher incorporate innovative uses of technology in their classroom practice and who exhibit a resilient sense of efficacy when faced with the challenges that are inherent to both innovation and technology use in the classroom (Ertmer, 2005).

## *Situated Cognition/Contextual Learning Theory*



Lave & Wenger (1991) wrote that "learning viewed as situated activity has as its central defining characteristic a process we call *legitimate peripheral participation*," and they explained that "learners inevitably participate in communities of practitioners" and the learners' "intentions to learn are engaged and the meaning of learning is configured through the process of becoming a full participant in a sociocultural practice" (p. 38). Merriam (2017) noted that "[situated learning] theory posits that the particular learning that takes place is a function of three factors in the context where it occurs: the people in the context, the tools at hand (tools can be objects like a whiteboard, language, or symbols), and the particular activity itself" (p. 88). Access to tools is an important consideration for preservice members of a community of practice. Lave & Wenger (1991) wrote that "control and selection, as well as the need for access, are inherent in communities of practice;" they also noted that "depending on the organization of access, legitimate peripherality can either promote or prevent legitimate participation" (Lave & Wenger, 1991, p. 103).

Sutton (2011), supported this idea with respect to preservice teachers:

> In order for preservice teachers to see a connection between the words and actions of university faculty regarding the importance of technology integration, in order for them to see the relevance of technological skills to their content areas, and in order for them to have sufficient time to retain and reflect on the technology skills they have been exposed to, they need to be provided with authentic learning experiences using technology throughout their teacher preparation program. (p. 44)

During their coursework and field experience, the preservice teacher is in the process of becoming a member of the existing community of practice, which includes the teacher education program faculty,

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the field experience mentor teacher, other preservice teacher candidates and educators, and the classroom and school environments, including the tools that they have access to in these environments. Therefore, preservice teachers may benefit from a teacher education program that allows for legitimate peripheral participation in an authentic context with master practitioners (faculty and inservice teacher mentors) who model technology integration and permit preservice teachers to use the technologies that they may encounter as inservice teachers.

# Self-Determination Theory (SDT)

## *Cognitive evaluation theory (CET).*

Ryan & Deci (2017) wrote that "cognitive evaluation theory (CET) represents a formal mini-theory developed within SDT that focuses on factors that facilitate or undermine intrinsic motivation" and, they continued, "in its most general form, CET argues that events that negatively affect a person's experience of autonomy or competence will diminish intrinsic motivation, whereas events that support perceptions of autonomy and competence will enhance intrinsic motivation" (p. 124).
Regarding preservice teacher education, Lewis (2015) posited that "understanding what motivates preservice teachers to begin integrating standards-based technology into their lesson planning will aid teacher educators in determining the best approach to convey this information during teacher preparation programs" (p. 236). While Polly, Mims, Shepherd, & Inan (2010) reported that

> preservice teachers who observed and experienced technology integration in their field experiences reported more positive attitudes towards technology… more frequent use of technology (…) and more instances of preservice teachers teaching with technology to support learning (p. 866).



During the teacher education program (coursework and field experience), the preservice teacher may have experiences that either facilitate or undermine their intrinsic motivation to be an innovative user of technology. Therefore, preservice teachers may benefit from a teacher education program that proactively seeks to build their competence in technology integration.

# Frameworks

## *Technological Pedagogical Content Knowledge (TPCK or TPACK)*

According to Mishra & Koehler (2006), "thoughtful pedagogical uses of technology require the development of a complex, situated form of knowledge that we call Technological Pedagogical Content Knowledge (TPCK)" (p. 1017). TPCK (or TPACK) expands on the work of Shulman (1986, 1987) which linked pedagogical knowledge (the *how*) to content knowledge (the *what*) in teacher education (Mishra & Koehler, 2006). As a result of Shulman's (1986; 1987) research, the PCK of TPCK was accepted as a necessary reform in teacher education (Mishra & Koehler, 2006). Mishra & Koehler (2006) note that, "Shulman did not discuss technology and its relationship to pedagogy and content," but posit that it is not because Shulman "considered [the issue of technology] unimportant," only that, at the time, "most technologies used in classrooms had become commonplace and were not even regarded as technologies" (p. 1023). What is important to note is that "prior to Shulman's seminal work on PCK," content

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knowledge and pedagogical knowledge were taught as separate courses of study, similar to how technological knowledge is treated today (Mishra & Koehler, 2006, p. 1024).

According to Mishra & Koehler (2006), the TPACK framework "emphasizes the connections, interactions, affordances, and constraints between and among content, pedagogy, and technology," and emphasizes that "knowledge about content (C), pedagogy (P), and technology (T) is central for developing good teaching," while most importantly, "rather than treating these as separate bodies of knowledge, this model additionally emphasizes the complex interplay of these three bodies of knowledge" (p. 1025).

Mishra & Koehler (2006) defined Technological Pedagogical Knowledge (TPK) as "knowledge of the existence, components, and capabilities of various technologies as they are used in teaching and learning settings, and conversely, knowing how teaching might change as the result of using particular technologies" (p. 1028). Technological Content Knowledge (TCK) is defined as "knowledge about the manner in which technology and content are reciprocally related" (Mishra & Koehler, 2006, p. 1028). Finally, Technological Pedagogical Content Knowledge (TPCK) is defined as "an emergent form of knowledge that goes beyond all three components (content, pedagogy, and technology)" and that requires an understanding of how technology is seamlessly infused in each of the components (Mishra & Koehler, 2006, pp. 1028-1029). Figure 1 illustrates the relationship between the three components that comprise the TPACK framework: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK) (tpack.org, 2012).

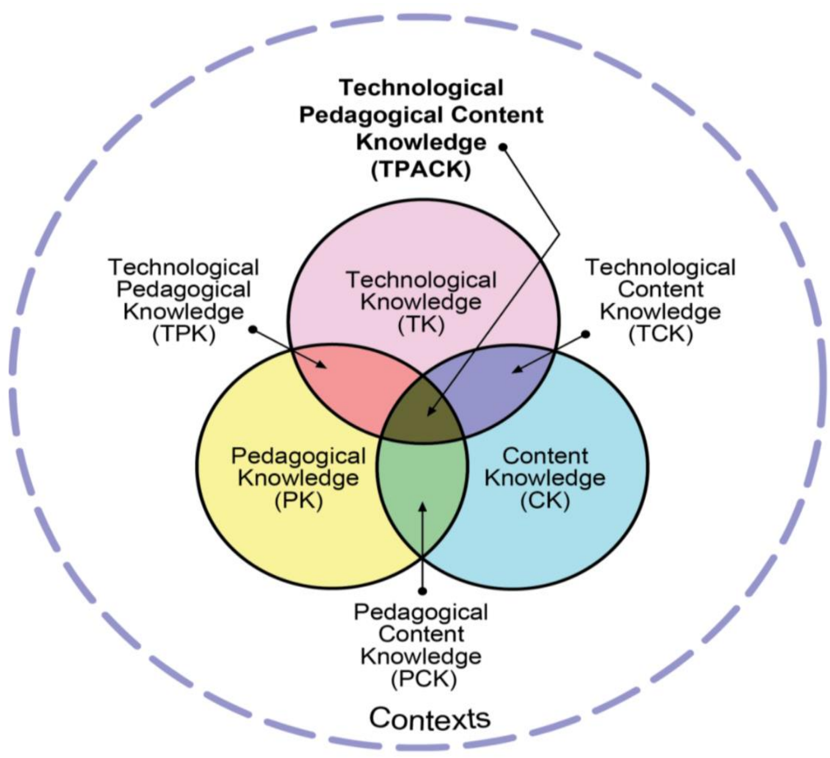


***Figure 1.*** Technological Pedagogical Content Knowledge (TPACK) framework. Reproduced with permission of the publisher, © 2012 tpack.org.

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The Council for the Accreditation of Educator Preparation (CAEP; 2019) appears to acknowledge and perhaps support TPACK in Accreditation Standard 3.4: "Providers present multiple forms of evidence to indicate candidates' developing content knowledge, pedagogical content knowledge, pedagogical skills, and the integration of technology in all of these domains" (CAEP Accreditation Standards, Appendix A).

Mishra & Koehler (2006) wrote about the connection between the TPACK framework and situated learning theory and how it has influenced curriculum design, through an approach called "*learning technology by design*" (p. 1034). The researchers noted that "learning is best supported when the content is part of a context that the students can perceive as meaningful, assign value to the subject matter, and develop an understanding of the relation of it with their lives" (ibid.).

A few researchers have pointed out shortcomings of the TPACK framework. Archambault & Barnett (2010) noted that

> there is confusion among the field of educational technology, not only concerning the definitions, but also the specific activities and methods to develop TPACK. This makes it difficult to implement knowledge from a framework that is yet to be fully defined, which limits its practical application (p. 1661).

Graham (2011) acknowledged that

> a strong TPACK framework can (…) provide theoretical guidance for how teacher education programs might approach training candidates who can use technology in content-specific as well as general ways," but Graham also noted that, "in order for that potential to be realized, researchers must work together to shore up weaknesses in the clarity of TPACK construct definitions and in articulating ways that the constructs are related to each other (p. 1959).



Despite the possible limitations of the TPACK framework, Archambault & Barnett (2010) and Graham (2011) suggest that rather than abandoning the framework, more research is needed for clarity and practical application.

# International Society for Technology in Education (ISTE) Standards

ISTE (2019) describes the ISTE Standards as "a framework for students, educators, administrators, coaches and computer science educators to rethink education and create innovative learning environments." The ISTE Standards for Educators, which were first published in 2000 and revised in 2007 and 2017 provide two essential identities, "Empowered Professional" and "Learning Catalyst," and seven roles: 1) "Learner;" 2) "Leader;" 3) "Citizen;" 4) "Collaborator;" 5) "Designer;" 6) "Facilitator;" 7) "Analyst" (ISTE 2017). Each role has several indicators (standards/conditions) that must be met. Furthermore, ISTE (2019) describes the ISTE Essential Conditions as "14 critical elements necessary to effectively leverage technology for learning," which "offer educators and school leaders a research-backed framework to guide implementation of the ISTE Standards, tech planning and systemwide change."

It is important to note that ISTE (2019) has evidence that all states in the United States use some version of the ISTE Standards to inform their technology standards frameworks and that several states in the United States have adopted the ISTE Standards for Students as their core technology standards. This makes the ISTE Standards relevant to teacher education programs in the United States. According to Lewis (2015):

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> Professional competency standards for teachers exist to create consistency and accountability in PK-12 education throughout the United States. Standards exist for all content areas, and in the last decade and a half technology standards have also been established not only by state departments of education across the nation but also by professional organizations such as the International Society for Technology in Education (ISTE). (p. 235)

Furthermore, the CAEP (2019) Accreditation Standards include the following references to technology standards:

- Standard 1.5:
  Providers ensure that candidates model and apply technology standards as they design, implement and assess learning experiences to engage students and improve learning; and enrich professional practice.
- Standard 2.3:
  Clinical experiences, including technology-enhanced learning opportunities, are structured to have multiple performance-based assessments at key points within the program to demonstrate candidates' development of the knowledge, skills, and professional dispositions, as delineated in Standard 1, that are associated with a positive impact on the learning and development of all P-12 students.

In the literature, Simsek & Yazar (2016) successfully validated the "education technology standards self-efficacy (ETSSE) scale, which was based on the ISTE Standards-T [standards for teachers]," and involved preservice teachers as participants in the validation study (p. 311-312). This demonstrates that researchers are making the connection between the integration of technology standards in preservice teacher education programs and possible implications for preservice teachers' self-efficacy with regards to technology integration. However, the following year, ISTE "released an updated version of the [standards for teachers]," renaming them to "ISTE Standards for Educators" and completely revising the indicators (Smith, 2017). Therefore, the scale developed by Simsek and Yazar (2016) may need revision and revalidation. A search of Education Source and ERIC via EBSCOhost did not yield any evidence that this has been done.



## Literature Review

A literature search was performed in Education Source and ERIC via EBSCOHost using the search terms "technological pedagogical content knowledge" or "TPACK" and "preservice teacher education." Two further search terms, "preservice field experience" and "mentor teacher" were added to isolate research focused on the context of the preservice field experience. The search was limited to peer reviewed academic journal articles published in English between 2010 and 2019 for which full text was readily available.

A second literature search was performed in Education Source and ERIC via EBSCOHost using the search terms "ISTE Standards" and "preservice teacher education." Two further search terms, "preservice field experience" and "mentor teacher" were added to isolate research focused on the context of the preservice field experience. The search was limited to peer reviewed academic journal articles published in English between 2010 and 2019 for which full text was readily available.

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# Empirical Findings

## *Technological Pedagogical Content Knowledge Development (TPCK or TPACK)*

Abbitt (2011) performed a study involving preservice teachers who were enrolled in an early childhood education (ECE) teacher education program. The purpose of the study was "to explore the relationship between preservice teachers' perceived knowledge and self-efficacy beliefs" (p. 135). All of the study participants were "enrolled in a one-credit course focusing on technology integration" that was "designed to improve preservice teachers' technology skills and demonstrate technology-enhanced approaches to teaching" (Abbitt, 2011, p. 137). Abbitt (2011) noted that the study took place during the "final semester of coursework prior to a 16-week teaching internship and completion of the ECE program" (p. 137). Two previously validated survey instruments were used: 1. Survey of Preservice Teachers' Knowledge of Teaching and Technology (Schmidt et al., 2009); 2. Computer Technology Integration Survey (Wang et al., 2004; Abbitt, 2011, p. 137).

Abbitt (2011) found that

> within the sample, self-efficacy beliefs about technology integration are more strongly related to the specific knowledge domains where technology is blended with pedagogy and content knowledge (TPK, TCK, TPCK) than they are to the general knowledge about pedagogy (PK) or content-area knowledge (CK) (p. 140).

Abbitt (2011) concluded that, "as preservice teachers develop a more complex view of the role of technology in education, it follows that their needs for supporting technology skills evolve as well," and that "an approach that provides multiple opportunities to develop technology skills throughout their teacher preparation program may provide the necessary scaffolds to develop a rich knowledge base and self-efficacy beliefs about technology integration" (p. 141).



Buss, Wetzel, Foulger, & Lindsey (2015) performed a study involving preservice teachers who were enrolled in the teacher education program at a university in Arizona that was undergoing a program overhaul regarding the program's approach to technology integration. The purpose of the study was "to describe and measure the effectiveness of a new integrative approach in which learning to use technology is infused into methods courses" when compared with "a traditional, stand-alone [technology] course" (p. 160). As part of their required coursework, study participants were enrolled in either a stand-alone educational technology course or technology-infused methods courses, depending on their stage in the program (Buss et al., 2015, p. 162). The researchers used a mixed-method design, including a 53-item previously validated survey instrument (based on the work of Schmidt, et al., 2009) and follow-up focus group interviews (Buss et al., 2015, p. 163).

Buss et al. (2015) found that the participants' "posttest quantitative TPACK scores all increased as compared to the pretest scores" and "the effect sizes for the pre- to posttest changes were quite large, indicating the effects were meaningful and not merely due to the large sample size" (p. 168). Furthermore, the researchers noted that "the qualitative data indicate the majority of candidates believed they were better able to integrate technology, that is, utilize TPACK knowledge domains, based on their preparation in the courses" (Buss et al., 2015). These findings point to the application of the TPACK framework as a method for increasing preservice teachers' self-efficacy, as well as self-determination, in integrating technology. These findings also highlight the importance of this learning taking place in

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the situated context of the teacher education program, within a community of practice that includes knowledgeable faculty who provide “strategies to facilitate candidates’ TPACK learning” (p. 168). Furthermore, the interaction effects noted by Buss et al. (2015) may indicate that the TPACK of the faculty (the teachers of the technology-infused courses) is an important factor that needs to be considered when applying the TPACK framework to teacher education program curriculum (p. 168). Professional development may be necessary to prepare the teacher education program faculty so that they are best able to model technology use within the context of the content and pedagogy coursework and engage preservice teachers with “hands-on opportunities” with technology (Buss et al., 2015, p. 168, pp. 170-171).

Shinas, Karchmer-Klein, Mouza, Yilmaz-Ozden, & Glutting (2015) performed a study involving preservice teachers who were enrolled in a teacher education program at a “large university in the Mid-Atlantic region of the United States” (p. 50). The purpose of the study was “to examine the technological pedagogical content knowledge (TPACK) development” and, in particular, the “unique contributions of TK, PK, and TPK in the development of TPACK” in the preservice teachers as a result of their teacher education program coursework (Shinas et al., 2015, pp. 47-49). As part of their required coursework, the participants had completed: 1) a one-credit course, “Educational Technology Professional Tools,” which introduces students to a variety of technologies, and 2) a two-credit course, “Integrating Technology in Education,” which is taken at the same time as methods coursework and field experience, and features “structured course content around the TPACK domains with explicit attention to the interactions among technology, content, and pedagogy” (Shinas et al., 2015, p. 50). The researchers used a previously validated survey instrument, the Survey of Preservice Teachers’ Knowledge of Teaching and Technology (Schmidt et al., 2009; Shinas et al., 2015, p. 50).



Shinas et al. (2015) reported that the findings in this study “[provide] evidence that building preservice teachers’ TK, PK, and TPK influences their overall TPACK development” (p. 53). Furthermore, the researchers noted that “this research suggests PK is foundational to TPACK development among preservice teachers,” and the finding that “TPK made the largest impact to TPACK… suggests that preservice teachers must learn to recognize technology not as an isolated construct, but as a critical component of effective teaching and learning” (Shinas et al., 2015, p. 53). Finally, the researchers noted that the findings in this study “reinforce the value of educational technology coursework in supporting preservice teachers’ development of TPACK when offered along with opportunities to build knowledge of pedagogy within authentic settings” (Shinas et al., 2015, p. 53).

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Sutton (2011) performed a study involving preservice teachers who had graduated from “a post-baccalaureate, fifth-year teacher preparation program… at a large RU/VH university in the southeastern United States” and who were, at the time of the study, employed as classroom teachers (p. 40). The purpose of the study was to: 1) “identify and analyze the preservice technology training experiences of novice teachers;” 2) “determine which of these experiences novice teachers found to be ‘relevant and useful’ or ‘not relevant and useful’” 3) examine “novice teachers’ perceptions of how well their teacher preparation program equipped them with the knowledge and skills necessary to fulfill the National Educational Technology Standards for Teachers (NETS-T);” and 4) “develop themes regarding what constitutes relevant and useful technology training experiences for preservice teachers” (Sutton, 2011, p. 39). As part of their required coursework, the participants had completed a standalone technology course that was aligned with the NETS-T (ibid., p. 40-41). The researcher used qualitative methods,

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including conducting interviews with the novice teachers, examining documents related to the stand-alone technology course, and writing "reflective field notes" (ibid., p. 41).

Sutton (2011) identified three major themes: 1) "a disconnect between preservice teachers' technology training and other aspects of their professional education;" 2) "a lack of content-area relevance;" and 3) "inadequate retention and transfer" (p. 43). Regarding the first theme, "disconnect," the researcher reported that the novice teacher participants "were not able to see many connections between their one required technology course and the teaching theories and methods that they were learning in their other courses" (ibid.). Regarding the second theme, "relevance," the researcher reported that "the most striking report from these novice teachers was that during their university studies, they rarely had the opportunity to experience, as learners, the particular ways that technology could enhance instruction in the content areas that they would later be teaching" (Sutton, 2011, p. 44). Regarding the third theme, "retention and transfer," the researcher reported that "these teachers said they would have liked to have seen these technology standards incorporated into all of their courses so that they could have gradually built confidence in their ability to implement the standards" (ibid.). He noted several implications, including that "the faculty who instruct preservice teachers must be qualified to demonstrate and model the vision of technology integration that they promote" and connected authentic learning experiences throughout the teacher education program to preservice teachers' ability to "retain and transfer the knowledge and skills they have gained in regard to technology integration" when they become classroom teachers (ibid, p. 44).

# Discussion



All of the studies examined in this paper were able to demonstrate that the context of the teacher education program has an effect on the preservice teacher's sense of self-efficacy and/or self-determination regarding technology integration.

## *Limitations of These Studies*

Abbitt (2011) noted that limitations of his study included small sample size and lack of diversity of participants. The researcher reported, "although these results may be representative of this cohort group, the ability to generalize these results to more diverse student populations, over longer time periods, or other contexts may be limited," and he also noted a limitation in the use of self-reporting by participants, which "represent[s] perceptions of knowledge and beliefs rather than evidence of demonstrated knowledge and ability" (p. 140). Another limitation not noted by Abbitt (2011) is that there was no control group in the study, which presents threats to internal validity (Campbell & Stanley, 1963).

Buss et al. (2015) noted, "a limitation of the study is its total reliance on self-report data before implementation of full-fledged TI experiences in various types of classroom experiences" (p. 171). Similarly, Shinas et al. (2015) noted that limitations of their study include "the use of a self-report survey," that "data were analyzed according to domains identified by the authors in a single study," and that "all participants were from the same setting and were completing the same teacher preparation program" (p. 53). Another possible limitation is that two of the researchers in Shinas et al. (2015) were also the teachers of the course from which participants were selected.

Sutton (2011) reported that "the findings from this study cannot be generalized and may not produce similar results at other universities" (p. 45).

### *Suggestions for Future Study*

Buss et al. (2015) posed a question for future research: “What happens to TPACK scores when teacher candidates are required to employ TI in their practicum or field experiences, student teaching experiences, and after graduation in their own classrooms” (p. 171).

The preservice teachers in Shinas et al. (2015) were required to apply their learning about technology integration in their preservice field experience, which in this study was happening at the same time as the coursework. However, the researchers pointed out that “although [their] findings were statistically significant, it cannot be determined whether these can be generalized to a greater population” (Shinas et al., 2015, p. 53). Further quantitative studies are needed in order to strengthen these results. Also, as with Buss et al., it is not known whether the preservice teachers sustained their efficacy in technology integration when they became practicing teachers. Further research is needed to determine whether the self-efficacy in technology integration gained through experiences in the preservice teacher education program is sustained throughout the teacher’s career in education.

Sutton (2011) made the following recommendations for future research: 1) a “replication of [the researcher’s] study at the state or national level;” 2) to “expand [the researcher’s] study by interviewing the designated technology teachers from each school and/or the technology coordinators to see what types of technology training experiences they believe preservice teachers need;” and 3) research “on how university faculty are using technology in their own teaching and to what extent these uses align with the NETS•T [now the ISTE Standards for Educators]” (p. 46; ISTE, 2019).

## Conclusion



The proliferation of technology and the rate at which new uses in K-12 education emerge has created a new context which requires practicing teachers “to do more than simply learn to use currently available tools; they also will have to learn new techniques and skills as current technologies become obsolete” which “is a very different context from earlier conceptualizations of teacher knowledge, in which technologies were standardized and relatively stable” (Mishra & Koehler, 2006, p. 1023). The implication for teacher education programs is that “knowledge of technology” has become “an important aspect of overall teacher knowledge” (ibid, p. 1024).

The teacher education program presents the context in which the preservice teacher should encounter technology in conjunction with the pedagogical and content knowledge they need to master in order to eventually become innovative members of the larger community of practicing teachers. Mishra & Koehler (2006) noted that “the rich, complex, and situated perspective that we and others have been arguing for clearly requires the development of very different strategies for developing teachers (p. 1033). Teacher education programs need to “not only [show] how to use technology effectively in the classroom, but also [require] students to explore, create, and plan with technology, both prior to and during their field experiences” (Lewis, 2015, p. 238).

In the vision statement of its “Advancing Educational Technology in Teacher Preparation: Policy Brief,” the U.S. Department of Education (2016) stated:

> Faculty at schools of education across the country should operate with a common language and set of expectations for effective and active use of technology in Prekindergarten-grade 12 (P-12) and at postsecondary education levels. Further, schools of education should work with P-12 schools and school districts to provide meaningful opportunities for pre-service teachers, in-service teachers, school and district leadership and faculty to co-learn and collaborate to better

understand and use technology as a tool to transform teaching and learning experiences for learners of all ages. (p. 4)

This vision statement calls on the community of educator practitioners (teacher education programs, districts, schools) to address the need for legitimate peripheral participation among its members, both preservice and inservice, to ensure all members are prepared to "effectively select, evaluate, and use appropriate technologies and resources to create experiences that advance student engagement and learning" (U.S. Department of Education, 2016, p. 4).

As more teacher education programs grapple with how best to prepare preservice teachers to successfully integrate technology in their future classrooms, further research is needed about whether and how self-efficacy theory, situated learning theory and self-determination theory, as well as the TPACK framework and ISTE Standards can be applied to program redesign.

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