Investigating Which Challenges Considered by Pre-service Teachers Are Reflected with Their Technology Integration Self-efficacy

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This study explored pre-service teachers' considered challenges regarding K-12 technology integration (TI) and their association with pre-service teachers' TI self-efficacy. Using the content analysis approaches, the research team identified five challenges perceived by 212 pre-service teachers, and further found four significant associations between the challenges and their TI self-efficacy. Pre-service teachers' considered challenges of differentiating students' needs and using technologies to facilitate learning are positively correlated with their TI self-efficacy, while their considered challenges of applying theories and preparing technologies are negatively correlated with their TI self-efficacy. The results suggest that additional instructional modules should be designed to help pre-service teachers in distinguishing K-12 students' needs and aligning TI with learning outcomes. Moreover, future TI instruction should incorporate practical TI cases, lesson plans, and technology evaluation training.

Introduction

In higher education, teaching technology integration (TI) in educator preparation programs (EPPs) has become essential (Gomez et al., 2022; Rizk, 2020). Many TI courses are designed to promote students' TI self-efficacy as an important learning outcome, which influences pre-service teachers' willingness to implement TI in their future classrooms (Kwon et al., 2019; Roblin et al., 2018). Previous researchers have explored the factors that are associated with TI self-efficacy (Lee & Lee, 2014; Şen & Durak, 2022; Yunkul & Gunes, 2022). These factors (e.g., competencies, sentiments) help researchers or instructors have a better understanding of how to achieve pre-service teachers' higher levels of TI self-efficacy (Bakar et al., 2020; Barton & Dexter, 2020; Birisci & Emin, 2019).

Pre-service teachers' considered challenges about TI were rarely noticed as possible factors that are associated with their TI self-efficacy. It is possible that pre-service teachers' considered challenges about TI are associated with their TI self-efficacy because pre-service teachers can be inspired or depressed by the low or high difficulty level of overcoming their considered challenges (Durak, 2021; Farjon et al., 2019; Njiku et al., 2019). Therefore, identifying the associations would provide new directions for promoting pre-service teachers' TI self-efficacy in TI courses. To address the research gap, this study delves into two research questions.

1. What are K-12 pre-service teachers' considered challenges about technology integration?
2. Which challenges are associated with K-12 pre-service teachers' self-efficacy in technology integration?

Literature Review

Previous researchers were exploring the factors that are associated with TI self-efficacy. Baker et al. (2020) considered technological pedagogical content knowledge (TPACK) as a factor that could be associated with TI self-efficacy. Their study indicated that TPACK with all its subordinate knowledge types are significantly correlated with TI self-efficacy. The study of Birisci & Emin (2019) demonstrated similar results. Durak (2021) further found TI Sel-efficacy was also significantly associated with teachers or pre-service teachers' technology literacy, social interaction, and educational background. Among these studies, the TI challenges considered by pre-service teachers were rarely seen as the target factors. Such challenges can be primarily considered either easy or difficult to be overcame, which can correspondingly inspire or depress the pre-service teachers (Roblin et al., 2018). Therefore, it is worth investigating what these challenges are and if they are reflected with TI self-efficacy.

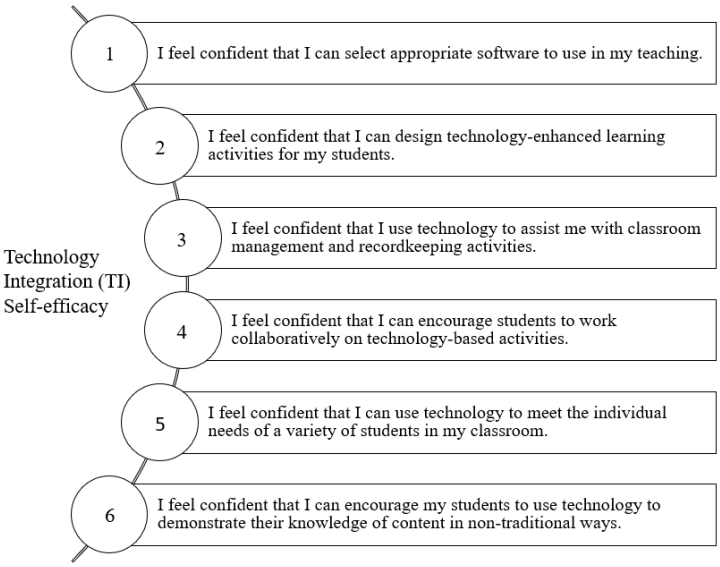
Methods

Data Collection

The participants were 212 K-12 pre-service teachers (196 females, 16 males) from an online course at a large public Southwestern university. An online survey consisted of six items of a 5-point Likert scale (see figure 1) and an open-ended question ("what would be the most important consideration when integrating technology?") and was distributed to the participants at the end of the semester. More than 97.6 % of students (n = 207) claimed they were moderate to highly proficient in computer skills.

Figure 1

TI Self-efficacy 5-Likert Scale Items (5-Strongly Agree, 1-Strongly Disagree)



Data Analysis

An exploratory mixed method research design was employed. Both qualitative and quantitative content analysis approaches were used to achieve the research purpose. The qualitative content analysis was applied for inducing the themes in the pre-service teachers' responses to the open-ended item. This study employed an open coding technique (Hsieh & Shannon, 2005). After coding 100 responses out of the 212 responses and revising the codes in multiple rounds, the research team confirmed the detected themes and sub-themes (see table 1). A double-coding protocol (Neuendorf, 2017) was implemented during the coding process. The interrater reliability was 0.91 before reaching the full agreement for each code.

Quantitative content analysis was applied for the rest of the 112 responses according to the themes identified previously. The research team continued to code 112 responses until a full agreement for each code was reached. After the whole coding process of 212 responses, each theme was transferred to a two-level ordinal variable in which zero stands for the existence of the theme in a pre-service teacher's response and one stands for the non-existence of the theme. In the end, correlational statistics were run to examine the associations between the five challenge variables with the self-efficacy variable, which was the mean value of the six 5-point Likert scale items.

Table 1

The Coding Framework (TI Challenges Considered by Pre-service Teachers)

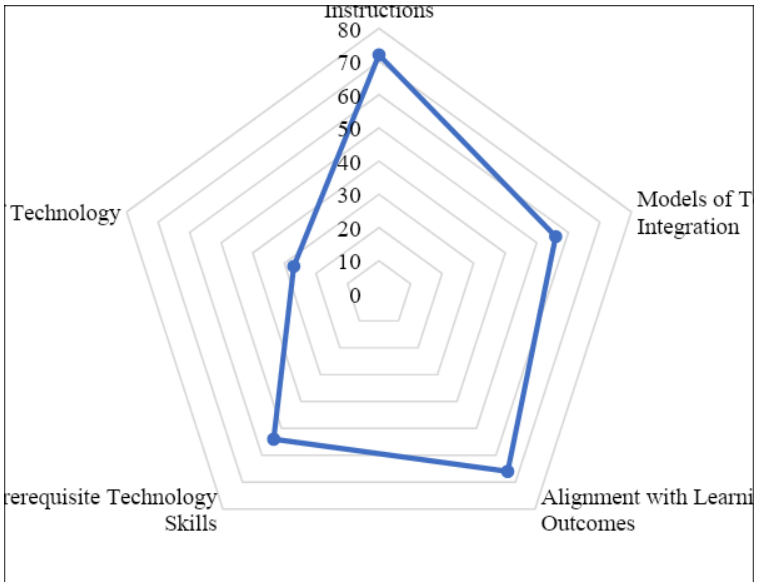
Theme	Definition	Example Meanings from Data
Differentiation of Instructions	Differentiating students' needs in instructions.	Is it appropriate for the student's age?
		… what your students comfort levels are…
		Not all students have access to technology…
		Is the way that it hits all learning types?
Models of Technology Integration	Appropriately integrating technologies into the classroom.	The most important consideration is SAMR.
		Classroom management is the challenge.
		How much technology is included?
		…know how to treat computers…
		The teacher must…monitor student behavior.
Alignment with Learning Outcomes	Using technologies to facilitate K-12 students' learning	…allows the student to learn content…
		… used to improve the learning outcomes…
		Are the children able to use it alone?
		…align its use to suit your objective…
		…aligned with the state standards…
Prerequisite Technology Skills	Equipping with technological skills	…teach our students how to use…
		You know exactly how to use the technology.
Management of Technology	Preparing high-quality and sufficient technologies for the classroom	The user friendliness of the technology.
		…engaging enough to help students…
		Not every school has the technology.
		… the technology is working appropriately…
		Allowing time to get familiarized with tech.

Results

There were five main themes suggesting pre-service teachers' primary considered challenges about TI. The first challenge refers to differentiating students' needs in instructions (i.e., Differentiation of Instructions, 34%). The second challenge referred to how to appropriately integrate technologies into the classroom (i.e., Models of Technology Integration, 26%). The third challenge referred to the use of technologies to facilitate K-12 students' learning (i.e., Alignment with Learning Outcomes, 31%). The fourth challenge is called Prerequisite Technology Skills (25%) which refers to equipping students with the required technological skills. The last challenge refers to preparing high-quality and sufficient technologies for the classroom (i.e., Management of Technology, 13%). Figure 2 shows the visualized distribution of the five themes as challenges. Regarding the distributions of the 5-likert TI self-efficacy items, the mean values of all the six multiple-choice items are four.

Figure 2

The Distribution of the Five Themes/Challenges



Spearman-rho was used to examine associations between the five main considered challenges and the mean score of pre-service teachers' self-efficacy. Among the detected significant associations, both the challenge about the differentiation of instructions ($r = 0.199$, $p < 0.001$) and the challenge about the alignment with learning outcomes ($r = 0.234$, $p < 0.001$) were positively correlated with pre-service teachers' TI self. The pre-service teachers who held the two challenges had a higher self-efficacy. On the other hand, the challenge about models of technology integration ($r = -0.256$, $p < 0.001$) and the considered challenge about the management of technology ($r = -0.195$, $p < 0.001$) were negatively correlated with pre-service teachers' TI self-efficacy at a significant level.

Discussion

The significant positive associations indicate that pre-service teachers have confidence in overcoming the relevant challenges and can be inspired by the low difficulty of meeting the conditions implied by these challenges. Considering such challenges results in correspondingly higher TI self-efficacy (Farjon et al., 2019; Njiku et al., 2019) in terms of differentiating instruction with technology and aligning learning outcomes with technology. To further enhance TI self-efficacy, TI instructors could offer data-driven instructional strategies in TI courses (Anderson et al., 2001; CAST, 2018) to emphasize the importance of differentiating K-12 students' needs and aligning TI with learning outcomes.

The significant negative associations indicate that the pre-service teachers have no confidence in overcoming the challenges and are consequently depressed by the high difficulty of meeting the conditions implied by these challenges. Thus, when they considered such challenges, their TI self-efficacy was correspondingly lower (Durak, 2021). To improve the TI self-efficacy regarding the two factors, TI instructors need to provide different TI models with more practical and authentic lesson plans. Also, pre-service teachers should have more opportunities to evaluate different technology tools and select the most relevant tool for given instructional context.

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