Self-efficacy of preservice teachers in technology-based learning in diverse classrooms: a case study at an Indonesian private university

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Abstract
Purpose – This case study examines the experiences of 20 student teachers at an Indonesian private university in enhancing their self-efficacy in utilizing instructional technology.
Design/methodology/approach – The participants of this study had different cultural backgrounds and spoke different indigenous languages. Situated in diverse classroom settings, the participants were interviewed using online platforms to examine their learning experience when learning to integrate technology into teaching. Furthermore, observational data were collected through photographs taken during the learning process to triangulate the findings.
Findings – Grounded in case study analysis, the study reveals three emerging themes indicating the development of the preservice teachers' confidence in multilingual classrooms: (1) designing technology-mediated learning activities, (2) using learning technology to foster students' autonomy in learning and (3) promoting peer engagement in diverse classrooms through technology-based learning. Furthermore, the participants demonstrated their ability to develop self-efficacy in overcoming the challenges associated with technology use in education by adapting, innovating, and collaborating.
Research limitations/implications – The study has three limitations. First, the limited number of participants involved in the study restricts the generalizability of the findings and does not allow for testing the potential influence of variables such as age, gender or experience on preservice teachers' beliefs. Second, limitation pertains to the reliability of self-report data provided by the preservice teachers. Given that self-efficacy can fluctuate over time, a longitudinal study is needed to investigate whether preservice teachers' self-efficacy in utilizing technology for learning evolves over time. Third, while the study was conducted in diverse classroom settings, it lacks an in-depth exploration of how cultural diversity impacts the learning outcomes of these preservice teachers.
Originality/value – The findings suggest that nurturing the technological self-efficacy of preservice teachers enhances their competence in technology-mediated pedagogy, both during the pandemic of COVID-19 and in the future.
Keywords Digital technology, Diverse classroom, Preservice teachers, Self-efficacy
Paper type Research paper

Introduction
The advances of digital technology have opened up numerous opportunities for teachers to enhance their skills in utilizing technology for learning in the 21st century. The proliferation

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of information and communication technologies, such as the internet (Ditimi and Ayanda, 2013; Mikusa, 2015; Yunusa et al., 2019), has significantly contributed to this trend. The use of the internet and other digital technologies can greatly improve the learning experience. The pervasive presence of digital technologies in society has brought about both challenges and opportunities in the realm of teaching and learning (Anderson, 2023; Brunetti et al., 2020; Francom, 2020; Selwyn and Facer, 2014). Even at the higher education level, learning approaches incorporating digital technologies have become widespread (Schweighofer et al., 2019).

During the COVID-19 pandemic, learning underwent a significant shift, transitioning from traditional face-to-face instructions to fully online modes. This shift prompted the adoption of online and blended learning approaches, where technology and the Internet played a crucial role in facilitating uninterrupted learning. As a result, research focusing on online learning has gained prominence, aiming to understand the condition in various contexts and impact on students. For instance, Cardullo et al. (2021) conducted a study investigating the relationship between factors in the extended technology acceptance model (TAM) and self-efficacy in distance learning during the COVID-19 pandemic. Furthermore, a comprehensive review of 91 comparative studies conducted between 2000 and 2020 revealed that 37 studies (41%) found online teaching to be associated with better learning outcomes, 17 studies (18%) favored face-to-face instructions and 37 studies (41%) reported no significant difference between the two modes of instruction (Stevens et al., 2021).

Over the past decade, self-efficacy has emerged as a prominent area of study in education. Notably, Zimmerman and Kulikowich (2016) shed light on the significance of self-efficacy in motivating learners and its capacity to explain learner engagement and success in online learning environments. Extensive educational research conducted during this period consistently demonstrates the influential role of learner self-efficacy in shaping differences of student learning outcomes (Sadi and Uyar, 2013; Prior et al., 2016), with positive effects on overall learning achievements (Sadi and Uyar, 2013; Yokoyama, 2019). Thus, these findings highlight the substantial impact of learners’ self-efficacy on their academic progress.

Building upon the significance of self-efficacy, it is essential to consider its application within the context of learning in multicultural classrooms. Digital technology can play a pivotal role in cultivating a communication culture that supports responsive teaching within imaginative multicultural learning environments (Barzanò et al., 2017). By equipping preservice teachers with the ability to comprehend, acknowledge, and employ culturally sensitive interventions, they can help students refrain from engaging in undesirable behaviors while promoting harmonious interactions among peers, while respecting cultural norms of behavior. Integrating self-efficacy and culturally sensitive approaches, alongside leveraging digital technology, holds promise in creating inclusive and effective learning environments in multicultural classrooms.

Multicultural education has evolved from ethnic studies to become multicultural education, where the main focus is to depict the ways in which cultural, racial, ethnic, linguistic and religious diversity is manifested across countries worldwide (Banks, 2013). Furthermore, Mili and Towers (2022) reported that all forms of learning experiences in a multicultural classroom become individualized learning experiences where each student is actively engaged to achieve their learning outcomes. Previous studies show that learning in a multicultural context fosters the establishment of positive mindsets in preservice teachers, contributing to the honing of their abilities as teachers who embrace and value individual differences.

While ample studies have investigated preservice teachers’ self-efficacy in the context of building identity and agency, the examination of their lived experiences to develop technological self-efficacy remains limited. Furthermore, delving into the experiences of preservice teachers, who are immersed in a multicultural setting while learning to incorporate
technological tools into their teaching practices, is worth further investigation. Thus, the present phenomenological study aims to explore the lived experiences of preservice teachers as they cultivate their technological self-efficacy within a multicultural classroom environment. This study seeks to provide a better understanding of how preservice teachers develop their confidence and face challenges when integrating technology into their teaching methods.

Literature review

Self-efficacy and preservice teachers

Self-efficacy theory, proposed by Albert Bandura within the framework of social cognitive theory (Yokoyama, 2019), suggests that an individual's behavior is closely intertwined with their beliefs in their own capabilities, playing a pivotal role in attitude formation. According to Bandura (1982), self-efficacy theory posits a bidirectional influence between self-efficacy and learning outcomes (Olivier et al., 2019). Recognizing the crucial role of self-efficacy as a determinant of learning success, it becomes imperative to integrate it into e-learning for effective learning experiences (Prior et al., 2016).

Additionally, a significant relationship between e-learning self-efficacy scores and e-learning readiness has been observed (Bubou and Job, 2022). Alongside self-efficacy, factors such as information quality, compatibility and resource availability contribute to the increased utilization of technology in learning (Dubey and Sahu, 2023). Self-efficacy represents an individual's confidence and ability to control their motivation, behavior and social environment. Previous research has consistently demonstrated the positive and significant impact of self-efficacy on the inclination to adopt technology-based learning (Budu et al., 2018; Panigrahi et al., 2021). As self-efficacy increases, so does the desire to integrate technology into the learning process, ultimately leading to enhanced learning outcomes.

In the context of teacher education, according to Zipke et al. (2019), self-efficacy plays a vital role in increasing teacher candidates' knowledge and willingness to utilize technology in their teaching practices. In addition to content knowledge and pedagogy, teacher education programs need to address various essential skills, including best practices in culturally responsive teaching. The studies on preservice teachers' engagement with digital technology and their utilization of self-efficacy in relation to learning and teaching digital technology revealed variations in their skills and actions (Lemon and Garvis, 2016). In their study, Taylor and Wendt (2023) noted that culturally responsive classroom management self-efficacy positively influenced multicultural efficacy, which, in turn, enhanced educators' confidence in their ability to foster a collaborative environment among students from diverse cultural backgrounds. Multicultural efficacy, as evaluated in the context of self-efficacy and confidence (Guyton and Wesche, 2005), is essential for educators to feel more effective in engaging with students in a multicultural classroom. This is particularly significant because Geerlings et al. (2018) reported a decrease in self-efficacy when interacting with ethnic minority students as compared to interactions with students from the ethnic majority.

Technology-enhanced language learning in diverse classroom

The discourse surrounding the diverse classroom has been thoroughly explored, serving as a platform to introduce the notion of students from diverse cultural backgrounds. Briggs (1991) argues that classrooms have become a diverse place where students coming from different places come to learn. Teachers working in multicultural classroom are responsible for empowering individuals’ pride of their cultural background (McLeod, 1996). In relation to the integration of technology into teaching, Chisholm (1995) suggests that teachers who
incorporate the use of computers into their teaching in multicultural classrooms need to plan and manage how students learn and access the computers. This highlights the evidence that teaching students from different cultural backgrounds requires teachers not only to become more aware of the individual needs for respect but also to plan which technological tools to use and how to effectively teach using them.

In higher education context, Riley et al. (2016) stipulate that developing multicultural competencies among higher education leaders and faculty as well as involving students in the process are important. Empirically, Othelia Lee and Bertera (2007) demonstrated that the utilization of learning technology, such as online forums, can enhance students' self-efficacy in relation to cultural competence, thereby significantly impacting multicultural education. Developing students' self-efficacy is crucial for fostering their understanding of diversity and providing them with opportunities to collaborate with individuals, groups and communities from diverse ethnic and cultural backgrounds. Given the increasing diversity among student populations and the rapid pace of technological advancements, it is essential to equip prospective teachers with the necessary knowledge, skills and dispositions to foster global thinking. In addition, Su and Zou (2022) documented the importance of implementing technology-enhanced language learning providing the benefits of developing students' language knowledge, fostering collaboration, developing problem solving skills and generating positive attitudes toward themselves.

Students' diverse backgrounds should be effectively harnessed for learning. Empirically, Yılmaz et al. (2016) reported that prospective teachers perceive the concept of multiculturalism positively due to the social structure in which prospective teacher candidates have a responsibility and a positive attitude toward living together peacefully, harmoniously, and with mutual respect, accepting all identities in accordance with their cultural richness without fear. However, Vikoy and Haukás (2023) suggest most teachers encourage minority students' use of multilingualism as a resource in the classroom, especially when technology is used to supports them in diverse learning environments. The use of technology contributes to teaching and learning in multicultural environments (Liu et al., 2014). Further, preservice teachers' experience in using technology in the context of education in multicultural environments helps them to develop knowledge and skills in integrating technology into learning (Wilder et al., 2010). In addition, Cabrera et al. (1998) stated that the use of technology to assist students coming from diverse backgrounds by incorporating collaborative activities results in the formation of constructive and effective learning interactions among the students. It indicates that the transformative potential of technology in education not only prepares educators for multicultural contexts but also empowers preservice teachers, fostering productive learning interactions and equipping them worldwide for seamless integration.

**Methods**

*Design research*

The present study adopts case study approach. Yin (2009) defines case study as an empirical investigation that examines a real-life phenomenon within its natural context, employing various data collection methods for an in-depth analysis. Aligned with the perspective, Creswell (2014) also stipulates that case study involves in-depth exploration of programs, events, activities, processes, or individuals, bounded by specific time and activity constraints, with researchers collecting detailed information through diverse data collection methods over an extended period. The present research aims to delve into the lived experiences and perceptions of the preservice teachers in developing self-efficacy among preservice teachers. Specifically, the study seeks to investigate how student teachers navigate and express their self-efficacy in technology-based learning within a diverse classroom.
To guide the study, the following research questions are addressed:

**RQ1.** How do preservice teachers in diverse classrooms develop self-efficacy in using technology for classroom learning during the pandemic?

**RQ2.** How do preservice teachers in diverse classrooms face challenges in planning technology-mediated lessons?

**Context and participants**

This study was conducted at a private university in Indonesia that offers undergraduate preservice teacher education programs encompassing various disciplines, including English, biology and history education. The university integrates learning technology courses in the programs, presented from the second semester to the sixth semester. The participants of this study were students from the English, biology and history education programs. These students have diverse demography, ethnic and sociocultural backgrounds. They speak different indigenous languages such as Osing, Java, Madura, Mandar and Bali, while they also speak Indonesian as the national language. In addition to language variations, there are unique disparities in students’ prior educational experiences due to their attendance at boarding schools, as well as variations in the types of gadgets and technological devices accessible for learning. This diversity made the classroom culturally rich, with communication not posing a primary barrier.

The teaching materials related to learning technology are progressively introduced to the prospective preservice teachers over the course of their programs. In the first year, they are acquainted with basic technology implementation in learning, such as using websites/platforms for designing learning activities. In the second year, they gain exposure to applications/software for creating presentation media and processing teaching materials in various formats, including images, audio and video. Examples of these tools include Canva, iSpring, Google Classroom, Quora, Lectora, Adobe Photoshop and Corel, among others. In the third year, they are guided in creating learning media, covering the entire process from planning to designing and developing teaching materials in the form of learning media. The creation of learning media is undertaken in groups, allowing for the exploration of diverse self-efficacy and cultural backgrounds among prospective teachers. It is important to note that due to the COVID-19 pandemic and its aftermath, a hybrid learning approach combining both face-to-face and virtual classes has been implemented.

This study focused on preservice teachers who have completed a 6-semester teacher education program and have taken all the courses related to learning technology. Specifically, there were 9 students from the English education study program, 6 students from the biology education study program and 5 students from the history education study program who have completed all the learning technology courses. They were between 20 and 23 years old. There were 11 male students and 9 female students. Dengan ethnic Jawa 35%, Ngalum 5%, Madura 15%, Osing 20%, Mandar 15% and Bali 10%.

**Data collection and analysis**

The study involved preservice teachers at an Indonesian university. Ethical approval for the study was obtained, and the student teachers were voluntarily to sign a consent form that provided an explanation of the study’s purpose prior to participation. The consent letter assured students of their voluntary participation and their right to withdraw from the study at any time. It was also made clear that their decision to participate or withdraw would not impact their course grades. Additionally, consent was obtained from students whose photos were taken during the interviews, ensuring their permission was granted for their use. Written informed consent was obtained from the students. Confidentiality was guaranteed, any facial photographs taken were blurred and they could withdraw from the study if they wanted to.
felt uncomfortable. In other words, their safety and comfort were guaranteed (Phelan and Kinsella, 2013). Following ethical approval, interviews were conducted under the researcher’s supervision to minimize the influence of social desirability bias (Bergen and Labonté, 2020; Ferdiansyah et al., 2022).

The data collection methods employed in this study were (1) group interview and (2) classroom observation. The researchers conducted informal group interviews during the class activities. These interviews were conducted online using Zoom Meetings, and a focus group format was employed to explore the participants’ self-efficacy in technology-based learning within a multicultural classroom. The participants were invited to engage in a 30-minute discussion about their learning experiences, which was recorded for transcription and translation into English. Subsequently, a second interview was conducted to provide further elaboration and confirm the responses gathered in the initial meeting.

In addition to the interviews, data collection involved direct observation to capture the learning activities. The investigation was carried out through virtual ethnography methodology to explore participating prospective teacher students. Virtual ethnography also reflects the implications of communication mediated by the internet (Hine, 2015). This also was done to triangulate the data and enhance its reliability. The direct observation primarily focused on recording students’ active involvement during peer collaboration. The interview protocol utilized in this study was based on the Information and Communication Technology Teaching Self-Efficacy (ICT TSE) measure developed by Jenßen et al. (2021). The protocol aimed to examine participants’ self-efficacy related to teaching with information and communication technology (see Table 1).

Data analysis
We analyzed the group interview interactions and video classroom observation through first undertaking multimodal transcription. Following Bezemer and Mavers (2011), the transcription process included framing, selecting, highlighting and finally writing the transcription. We focused on the “framing” process to answer the research questions to examine participants’ self-efficacy related to teaching with information and communication technology. Then, we moved to the “selecting” process. In this phase, we selected data including textual responses, speech, gesture and image and highlighted the interplay between these different types of text and transcribed oral and visual text into written description.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>Is it important for you to understand how ICT tools work in learning?</td>
</tr>
<tr>
<td></td>
<td>Is it important that you can modify the ICT tool in learning?</td>
</tr>
<tr>
<td></td>
<td>Are you able to adapt the ICT tool to your needs in learning?</td>
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<tr>
<td>Value</td>
<td>Whether you can use ICT tools to increase student motivation in learning</td>
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<tr>
<td></td>
<td>Do you feel that using ICT tools makes it easier to track the learning process in learning?</td>
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<td></td>
<td>Whether the use of ICT tools can be understanding of the learning process?</td>
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<td></td>
<td>Does the use of ICT tools improve performance?</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>Do you enjoy using ICT tools?</td>
</tr>
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<td></td>
<td>Are you excited to think about the possibility of using ICT tools for teaching?</td>
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<tr>
<td></td>
<td>Do you enjoy designing digitally supported learning environments?</td>
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<tr>
<td>ICT-TSE</td>
<td>Do you believe that you can use ICT tools to teaching in some ways that benefit students?</td>
</tr>
<tr>
<td></td>
<td>Do you believe you can weigh the advantages and disadvantages of ICT tools when planning lessons?</td>
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<tr>
<td></td>
<td>Do you believe that you can design digitally supported learning environment?</td>
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<tr>
<td></td>
<td>Do you believe you can use ICT tools in a way that facilitates the learning process later?</td>
</tr>
</tbody>
</table>

Table 1.
Guided interview questions

Source(s): Adapted from Jenßen et al. (2021) framework on ICT TSE
To analyze the transcribed data, we employed thematic analysis adopted from Braun and Clarke (2006) according to the following steps. The first step is familiarization of the data. In this step, we reread the data set to understand the participants’ responses based on their context and experience of teaching with information and communication technology. This activity formed the basis for our next step of coding. In this step, we focused on and highlighted developing broad codes which created a pattern. The third step was searching for themes among the broad codes. In this step, we examined the highlighted data to interpret patterns within the data. Then, the next process was reviewing themes. We critically reviewed the coded themes across the data set to see whether the themes were significantly reflected or represented in the data set and compatible with the research questions. To address the issue of possible coder bias, the three researchers independently coded the data and then compared results. The third researcher had not been present during the data collection phase, and she served as an independent reviewer of the coding and discussed contextual issues with the other two researchers to come to a consensus. We took these steps, as recommended by (Nowell et al., 2017), to ensure an auditable decision trail and enhance the trustworthiness of our thematic analysis in this qualitative study that parallels the criteria of validity and reliability in quantitative research. Finally, we unpacked the themes by defining and naming the coded themes as demonstrated in the research findings and discussion section below. From the interviews, the findings presented in the report encompass 11 out of a total of 20 participants. This outcome stemmed from the analysis and thematic assessment, which yielded similar participant responses. Consequently, the discussion of the findings excluded 9 other participants. Based on the data obtained from interviews, observations and visual data, a thorough examination and interpretation were conducted. The data were then subjected to lexical coding, and themes were generated based on the identified codes. Table 2 presents example of data analysis.

Based on the analysis yang dilakukan, this study yielded two main findings, each with its own subfindings. The first finding pertains to the development of prospective preservice teachers’ confidence in utilizing technology in diverse classrooms (see Figure 1). This includes their confidence in designing technology-mediated learning activities, fostering autonomy through the use of learning technology and promoting peer engagement in multicultural classrooms. The second finding focuses on the role of technology in enhancing the teaching and learning process. Table 2 presents example of data analysis.

<table>
<thead>
<tr>
<th>Data type</th>
<th>Example</th>
<th>Data identity</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interview</td>
<td>While learning to use ICT, I feel happy [enjoyment; value] and I will later be able to teach using Social Media etc. [ICT-TSE]</td>
<td>(zoom meeting, interview, March 20, 2023, FGH)</td>
<td>Participants are expected to master the use of technology as a teacher</td>
</tr>
<tr>
<td>Picture</td>
<td><img src="image.png" alt="Image" /> Figure 1. Pre-service teachers present the results of their independent work</td>
<td>(Photo taken from personal documentation, 20 May 2022)</td>
<td>Participants present their manual work, which is then digitized and shared with the screen sharing feature</td>
</tr>
</tbody>
</table>

Source(s): Authors’ own creation/work

Table 2. The example of data analysis
classrooms through technology-based learning. The second finding focuses on the enhancement of preservice teachers’ self-efficacy in overcoming challenges related to technology integration in learning. This involves their ability to adapt to technological changes, innovate teaching practices and collaborate effectively with peers.

Findings

The development of preservice teachers’ confidence in using technology in diverse classroom

a) Confidence in designing technology-mediated learning activities

In this study, the preservice teacher participants received training in designing technology-mediated learning activities. They were introduced to the use of synchronous applications such as Zoom and Google Meet for teaching visual literacy and textual literacy in the context of history learning within a virtual classroom. This training aimed to enhance the student teachers’ confidence in effectively delivering local history lessons, especially in the event of a pandemic. One of the participants shared their experience, highlighting the positive impact of such training. AGB expressed that learning with the assistance of technology enhances her motivation to remain committed to continuous learning.

This course equipped me with the skills to use synchronous technologies such as Zoom and Google Meet to design activities in remote learning. I feel confident that even when I am faced with a pandemic situation. I can keep learning. (Interview participant AGB, May 20, 2022)

The interview excerpt also indicates that AGB made use of synchronous technologies to mediate learning interaction despite remote situation. The ability of technological tools to facilitate peer interaction in the virtual classroom was also developed through technology training. They utilized features such as screen sharing to present materials, simulating a face-to-face class experience (see Figure 2). Moreover, the participants shared that the introduction to learning technology courses not only facilitated student interaction virtually but also enhanced their own confidence in using technological tools for teaching and learning purposes. For example, participant SP emphasized the significance of the virtual aspect of learning mediated by Zoom in establishing students’ social presence in online learning.

I gained confidence in the feasibility of online learning that fosters social presence through the activities and scaffolding implemented during synchronous learning. (Interview participant SP, May 21, 2022)

The interview excerpt shows that SP was aware that social presence was important to achieve in online learning through appropriate learning tasks and scaffolding. Furthermore, the other participant, SW shared that through this approach, she had the opportunity to showcase her independent learning outcomes and share them with her peers during

Figure 2.
Peer tutor learning

Source(s): Authors’ own creation/work
synchronous sessions. She demonstrated her creativity by initially creating mind maps manually and then digitizing and presenting them through Zoom (see Figure 3).

In this course I was given the freedom to operate presentation media through the screen sharing feature, I am more confident to communicate with peers. (Participant interview WS, May 20, 2022)

The interview data and virtual observation reveal that the prospective preservice teachers have developed their skills in utilizing presentation media and learning platform features, which in turn enhances their confidence in delivering instructional materials. Additionally, data garnered from the interview indicates that the courses have significant implications for the students’ ability to effectively plan learning activities, create teaching media and deliver presentations.

b) Confidence in using learning technology for autonomy development

In this study, the preservice teachers engaged in independent online learning activities that fostered critical thinking, collaboration, responsibility and confidence. Through these activities, students were able to reflect on their learning experiences and the challenges they encountered when expressing their ideas through technological mediation. The use of multiplatform technology in the learning process promoted the development of learning autonomy, allowing preservice teachers to make informed decisions about the appropriate mediations to employ (see Figure 4). In the interview, KD expressed the importance of specific and direct examples of online learning tools and activities. They helped improve his motivation to learn independently.

Online learning like this allows me to get a lot of experience accompanied by direct examples of technological tools for specific learning objectives. Learning through examples helps me increase my motivation in learning independently. (Interview participant KD, May 25, 2022)

Furthermore, the pre-service teachers, working together as a team, engaged in critical thinking activities that involved presenting case studies and analyzing the underlying causes of the problems, as well as brainstorming potential solutions. Additionally, they collaborated and worked on a project that was then presented to their peers. These activities not only fostered a sense of responsibility among student teachers but also allowed them to enhance their learners’ autonomy by effectively conveying their ideas. For instance, in the Education Entrepreneurship course, students were encouraged to utilize social media platforms to introduce and promote their products or services. One participant shared his experience.

This course has provided me with the necessary skills to effectively utilize social media platforms for introducing my products. I can work independently on the media creation. Thus, I strongly believe

Source(s): Authors’ own creation/work

Figure 3. Preservice teachers present the results of their independent work

Self-efficacy of preservice teachers
that this knowledge is crucial in expanding my network through the power of internet technology. (Interview participant TK, May 22, 2022)

In the education entrepreneurship course, preservice teacher students are assigned to do the task of creating social media content and presenting their work. TK found out that the project enabled him to create promotion media using social media platforms to expand his product market. From this, his peers then provided feedback based on his presentations. The screen sharing feature is utilized to present the material, simulating a face-to-face classroom environment (see Figure 5). Furthermore, participant SP mentioned that receiving feedback from peers before disseminating the social media product was an integral part of the process.

This kind of online collaborative learning also can give me feedback mediated by Zoom. I get feedback from my peers before disseminating the project. Although it is collaborative, we share equal responsibility and work independently. (Interview participant SP, May 23, 2022)

SP highlighted the importance of peer feedback for product improvement, which was mediated by a virtual learning platform. He expressed that the project fostered collaborative learning at certain points and promoted learner autonomy at other points. Meanwhile, even after the COVID-19 pandemic has ended, the preservice teachers continue to collaborate and hold discussions prior to mediating learning materials because they used to work collaboratively and independently during online learning. DN, for instance, said that peer discussions were positive and the pandemic allowed him to become more independent.

Peer discussions can enrich ideas and serve as a crucial planning stage to develop high-quality learning materials. Although the face-to-face meeting is implemented after the pandemic, I feel I am more independent of using technology in learning and teaching. (Interview participant DN, March 21, 2023)
The following example illustrates a collaborative activity of face-to-face learning among preservice teachers in a multicultural classroom, where they collectively discussed the advantages and disadvantages of using ICT in lesson planning. They were divided into groups and assigned them with selecting a theme for the learning material. Through group consensus, they determined the specific content to be covered and collaboratively develop learning media aligned with the learning objectives of the material (see Figure 6).

My group members and I reached a consensus to create learning videos focused on local history as the learning materials for our history subjects. With a minimal help from the lecturer, we can become more independent working as a team. (Interview participant PG, March 20, 2023).

The interview data reveals PG’s group ability to take initiative in their learning activities. He was sure that working in group made them less dependent on their lecturer which develop their learner autonomy. Moreover, through team-based project assignments, they have the opportunity to explore ideas and transform them into tangible products. This has significant implications for fostering autonomy among students in managing their ideas and creating technology-mediated learning materials.

c) Confidence in building peer engagement in diverse classrooms through technology-based learning

The preservice teachers involved in this study had diverse cultural backgrounds. However, they were encouraged to engage in learning activities with respect to cultural difference. Additionally, they were assigned to work in groups to determine their project topics and collaborate on their creations. The involvement of peers in multicultural classrooms was evident during the presentation of their project assignments of biology lesson, which took place in designated breakout rooms. Participant BK expressed that these small group presentations, facilitated by technology, prepared them to become innovative teachers and sensitive to cultural difference.

My group members and I agreed to develop Biology materials to be developed in the form of learning videos on ethno-science in Biology subjects. In our project, we create a digital storytelling on how organic farming is practiced by Osing community. (Participant interview BK, March 23, 2023)

The interview excerpt shows how BK and his team created biology materials on ethnoscience through digital storytelling. This indicates their ability to incorporate cultural practice into their teaching materials. Furthermore, the preservice teachers learned how to utilize technology in the preparation of their learning materials. They prepared various resources that would be presented through technological means, such as video presentations, animated PowerPoint slides, and some even combined PowerPoint slides with videos. The incorporation of technology in the learning process proved to enhance the motivation of the preservice teachers in facilitating their lessons (see Figure 7).
In diverse classes with individuals having diverse self-efficacy, the environment stimulated preservice teachers to express their opinions based on peer presentations. The preservice teachers motivated and supported each other in presenting their materials using learning technology. The case of the History department students shows a unique experience when they created a project on sociocultural lives of Osing people. KD, representing his team, expressed that working collaboratively on digital poster presentation about the lives of Osing people improved his awareness on cultural diversity.

I am from Madura. When my group was assigned to create a digital poster on sociocultural topic, we agreed to discuss *Barong Ider Bumi* ceremony held by the Osing people. I learned a lot how my culture is different from my group member’s culture. (Participant interview KD, March 20, 2023)

The interview data shows how technology-mediated learning can foster the development of culture difference awareness among preservice teachers. Additionally, working on digital podcast has allowed them to understand how local dialect impacts on their English pronunciation. SP remembered when he was invited by his pair from Jawa to talk about his daily life in the digital podcast project. Although SP was not confident due to his local dialect, his partner supported him.

I always think that my English pronunciation was influenced by my local accent of Mandar. So, when the lecturer asked us to create digital podcast for speaking class, I was a bit nervous. However, my partner motivated me that my accent was interesting. (Participant interview SP, March 20, 2023)

Overall, the interview data reveal that preservice teachers possess the skills to present technology-mediated teaching materials using various multiplatform tools. These tools enable them to create a wide range of technology-based teaching materials tailored to the specific subject matters, such as biology, history and English lessons. This skillset has significant implications for student teachers as it empowers them to foster collaboration and active participation among students, thereby enhancing the diversity of technology-assisted mediation in the learning process as well as diversity of cultural backgrounds.

*Development of preservice teachers’ self-efficacy toward the challenges of using technology in learning*

Meanwhile, the findings on the second sub-theme in this study revealed the development of self-efficacy among preservice teachers in overcoming the challenges of using technology in learning through adaptation, innovation and collaboration. Despite having varying levels of self-efficacy in using technology, preservice teachers in diverse classes demonstrated a commitment to serious learning. Active participation in collaborative activities during...
technology-mediated learning was evident, indicating their willingness to tackle challenges. The study’s findings emphasize the importance of continuous adaptation, innovation and collaboration for preservice teachers. DN expressed his experience of working with limited access to technological tools during his stay in pesantren (Islamic boarding school).

When I stayed in the pesantren, the caretakers of the Islamic boarding school established a policy to regulate the use of technology very restrictively and only at specific times. Thus, I let my friends know about this situation and they understand. (Interview participant DN, March 20, 2023)

The data show that DN who studied in Islamic boarding school and faced limitations due to the rules restricting the use of smartphones, laptops and electronic devices demonstrated a diverse range of sociocultural backgrounds that differed from those coming from a nonboarding school educational background. This can help other students understand this sociocultural challenge of using technology in restricted mode and time. Moreover, adapting to the use of technology in classroom teaching, whether in virtual or face-to-face settings, was a key aspect. During the COVID-19 pandemic, preservice teachers successfully adapted to synchronous learning using the Zoom application. Moreover, even in normal conditions, when face-to-face learning was the mode of instruction, the preservice teachers demonstrated adaptability in incorporating technology in the classroom (see Figure 8).

Through online learning, I have the flexibility to study from anywhere. Previously, I had to physically be in the same class as my friends. This shift has required me to become more independent in my learning. (Interview participant VK, March 20, 2023)

Online learning has transformed my learning experience. While interactions are more limited, I can still engage with my peers during group learning activities through various online platforms. (Interview participant AK, March 20, 2023)

The interview data reveal a new pattern of interaction in learning, facilitated by the use of technology in the diverse classroom. This enables preservice teachers to explore their technological self-efficacy. Therefore, it is crucial to cultivate efficacy in technology use

**Figure 8.** Student learning activities in online and face-to-face settings

**Source(s):** Authors’ own creation/work
among preservice teachers during the learning process. This fosters their openness and adaptability to changes in the field of education.

In diverse classes, preservice teachers integrated innovated by integrating multiplatform-based digital learning technologies in their learning. They engage in synchronous learning activities using applications like Zoom and Google Meet (see Figure 9). This learning approach combines hybrid classes, where prospective teacher students created digital teaching materials by digitizing their manually drawn illustrations. Various tools such as PowerPoint presentations, Canva and learning videos were utilized in the process.

I firmly believe that leveraging technological advancements is crucial for effective learning. As a pre-service teacher, I strive to innovate my teaching materials by incorporating technological mediation. This allows me to effectively manage learning activities and create engaging educational experiences for my students. (Interview participant BK, March 20, 2023)

I was given examples of digital platforms that I can use to mediate teaching materials. With this, I can have more choices to determine what type of digital platform I will use (Interview participant HM, March 20, 2023).

The many innovations in technology make me more motivated. As a pre-service teacher, I will be able to teach students more innovatively. Interesting teaching materials convince me to be able to teach better. (Interview participant WS, March 20, 2023)

The interview data highlights the significance of equipping the diverse preservice teachers with diverse digital literacies, enabling them to effectively utilize technological advancements in their teaching practices. The exposure to various digital platforms empowers these preservice teachers to become innovative educators capable of designing and implementing engaging learning activities. Embracing innovation in teaching and learning is crucial for the continuous self-development of prospective teachers in response to the rapid growth of technology.

In multicultural diverse, collaborative learning becomes a valuable platform for preservice teachers to exchange ideas and foster their learning initiatives. By sharing their experiences, preservice teachers can explore the development of their self-efficacy within a multicultural context. These collaborative activities take place during synchronous classes, utilizing features such as breakout rooms (see Figure 10), where preservice teachers engage in discussions to plan and develop their project tasks.

My colleagues and I discussed the project assignment given to us, through this learning activity we were able to convey ideas and then we decided to mediate a certain type of material. (PG participant interview, March 21, 2023)
My friends and I have different ideas for mediating learning materials, then we do in-depth exploration and elaboration to determine and decide which type of learning technology mediation we will select. (Interview participant DN, March 20, 2023)

The interview data highlight the collaborative activities among preservice teachers in diverse classes, where their diverse experiences allow for the exchange of ideas and acceptance of each other’s differences. This fosters an environment where preservice teachers can embrace diverse perspectives and work together toward a common goal of creating technology-mediated teaching materials for effective learning.

Discussion

The present study aims to explore the self-efficacy of preservice teachers in diverse classrooms and its impact on their preparedness for technology-mediated teaching in the future. Through various learning activities in multicultural classes, preservice teachers can develop their self-confidence, collaborative skills and learning autonomy. Lemon and Garvis (2016) conducted research that revealed the increasing confidence of preservice teachers in using technology for future teaching. Furthermore, the diversity of self-efficacy, technological knowledge and skills among preservice teachers can provide valuable input and enhance motivation. Furthermore, Ayşegül Takkaç Tulgar (2020) reported three key domains influencing students’ self-efficacy, beliefs and experiences include educational factors, interpersonal dynamics and cultural considerations. With insights from this research, it is anticipated that classes comprising students from diverse backgrounds will not hinder their learning journey.

Nickel and Zimmer’s (2019) research emphasizes the importance of preservice teachers’ professional development, which is influenced by their involvement in learning, self-efficacy, and commitment. This fosters their dedication to teaching in the future. Similarly, Insook Han et al. (2017) found that preservice teachers with higher readiness and beliefs exhibit a more consistent intention to prepare themselves for technology integration compared to those with lower readiness.

Collaboration among preservice teachers in preparing their future lessons through technology plays a significant role in building their confidence, primarily due to the valuable peer feedback received during discussions. This finding aligns with previous literature that explores the influence of teaching experience and preservice teachers’ beliefs in using technology for teaching, demonstrating meaningful differences in their level of intention, as shown in Insook Han et al’s (2017) research.

Furthermore, this study on technology-based learning in diverse classrooms identifies emerging knowledge and skills for preservice teachers, as highlighted in Jenßen et al’s (2021)
The results indicate that while the influence of value appraisal and enjoyment is relatively small, the interviews reveal that the knowledge and skills in technology use are influenced by the prospective teachers’ educational background and cultural context. This resonates with Yilmaz et al. (2016) who reported that preservice teachers positively assess the concept of multiculturalism due to the social structure in which student teacher candidates hold the responsibility and adopt a positive attitude toward living together peacefully, harmoniously, and respecting one another, accepting all identities in accordance with their cultural richness without fear.

The findings also demonstrate that the challenges of implementing technology in diverse classrooms with varying levels of self-efficacy are met with a positive attitude, fostering an environment where preservice teachers can freely express their ideas and provide mutual support in their learning process. Thus, this study suggests the importance of considering individual beliefs and cultural experiences when providing preservice teachers with technology-related experiences.

Wilder et al. (2010) identified a digital divide in multicultural classrooms, primarily resulting from socio-economic and technological disparities affecting the integration of ICT in teaching and learning. However, the interviews conducted for this study revealed that the digital divide in multicultural classrooms actually motivates students and promotes mutual assistance in preparing learning materials using technology. Therefore, multicultural education has the significance of collaborative activities between ethnic groups in multicultural classes (Riley et al., 2016).

Moreover, collaboration in multicultural classrooms has been found to significantly enhance self-efficacy (Lee and Bertera, 2007) and contribute to equitable teaching and learning in international settings through the utilization of technology (Liu et al., 2014). These findings form the basis for fostering self-confidence in using technology, developing learning autonomy and promoting engagement among preservice student teachers in diverse classrooms.

Limitations
Methodologically speaking, this case study has two major limitations. First, the limited number of participants involved in the study restricts the generalizability of the findings and does not allow for testing the potential influence of variables such as age, gender or experience on preservice teachers’ beliefs. Moreover, the selection of participants was based on their voluntary participation, which may introduce a bias in the sample. Future research should aim to involve a larger and more diverse participant to provide a more comprehensive understanding of preservice teachers’ confidence in using technology.

The second limitation pertains to the reliability of self-report data provided by the preservice teachers. It is related to the retention held by preservice teachers due to the relatively short duration of the study, including the final competencies possessed by the participants because in this research, there was no assessment of initial abilities and final abilities after being provided technology-mediated learning. As noted by Stough (2006), participants may have inaccurate recall or may overestimate their abilities, which could affect the validity of the findings. Additionally, this study only examined the self-efficacy of preservice teachers in multicultural classrooms at a single point in time. Given that self-efficacy can fluctuate over time, a longitudinal study is needed to investigate whether preservice teachers’ self-efficacy in utilizing technology for learning evolves over time. The third limitation is that the study lacks of deep investigation of how multicultural diversity of the participants impacts on their learning engagement and learning outcomes. Therefore, it is crucial for future studies to delve deeper into the interactions between self-efficacy, multicultural perspectives and technology use in learning, thus fostering a more comprehensive understanding of the underlying dynamics. Therefore, to
enhance the credibility and dependability of case studies, particularly those of explanatory nature, researchers could employ counter-arguments to elucidate the social phenomenon being examined, ensuring that the formulated propositions are engaging, sound, logical and cogent (Priya, 2021).

Conclusion
This study aims to investigate the development of preservice teachers’ self-efficacy in technology-based learning within a blended and diverse classroom setting. The findings of this study demonstrate that preservice teachers are able to cultivate confidence in designing effective learning activities, fostering learning autonomy and promoting peer engagement in the learning process. Moreover, the diverse classroom environment facilitates the development of adaptability skills among preservice teachers as they explore innovative ways to utilize technology and critically assess the advantages and disadvantages of information technology in their lesson planning. Consequently, this fosters preservice teachers’ confidence in designing well-structured digital learning environments and encourages their integration of technology in order to enhance learning autonomy. Furthermore, the diverse classroom setting also plays a significant role in bolstering preservice teachers’ confidence in facilitating the learning process. The collaborative and supportive nature of the environment motivates preservice teachers to inspire one another and collaborate in the preparation of technology-based learning materials.

References


Further reading


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