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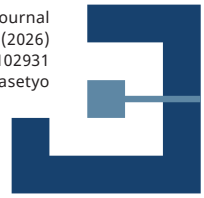

Castledown

Empowering EFL preservice teachers' TPACK development through a flipped classroom model in Indonesia

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This study investigates how a flipped classroom model supports the development of Technological Pedagogical Content Knowledge (TPACK) among prospective English language teachers in Indonesia. Conducted in a Computer-Assisted Language Learning (CALL) course at one of the teacher training universities in southern part of Indonesia, the research aimed to explore both the pedagogical design and implementation of flipped classroom, as well as its impact on students' TPACK development. The flipped model shifted content delivery to outside class using Moodle, enabling in-class time for collaborative, higher-order learning activities. Data from surveys, observations, and focus group discussions revealed that students were highly engaged, appreciated the hands-on experience, and showed increased confidence in integrating digital tools like Google Apps and Kahoot into language instruction. Quantitative findings showed high self-assessed scores in TPACK domains, particularly in technology integration, while pedagogical knowledge, especially classroom management, remained moderate. The study concludes that flipped classroom fosters autonomy, motivation, and technological fluency, positioning it as an effective strategy for teacher education in EFL contexts. However, the results also highlight the need for explicit training in core pedagogical skills. The research emphasizes a balanced curriculum that integrates both innovative teaching models and foundational pedagogy to prepare future educators for 21st-century classrooms.

Keywords: CALL, flipped classroom, TPACK, literacy skills

Introduction

As the proliferation of new technologies continues to reshape educational landscapes, it is imperative that teaching practices evolve in tandem. Educators around the world are increasingly integrating digital tools into their pedagogy to meet the demands of 21st-century learning, which emphasizes critical thinking, communication, collaboration, and creativity (Haryaka & Razak, 2025; Yilmaz, 2021; Silber-Varod, Eshet & Geri, 2019). To fulfill these expectations, future teachers must develop a strong foundation in instructional technology, defined as the discipline and responsible application of enhancing learning and performance through the development, implementation, and management of appropriate technological tools and methods (Januszewski & Molenda, 2008). For example, a systematic review conducted by Abdykerimova et al. (2025) found that digital tools significantly enhance students' engagement, conceptual understanding, and academic performance across primary and secondary education. This calls for teacher preparation programs to move beyond content and pedagogy by incorporating Technological Pedagogical Content Knowledge (TPACK), a framework that outlines the multifaceted expertise required for effective technology integration in classroom settings (Mishra & Koehler, 2006).

In Indonesia, however, many educators remain hesitant to embrace instructional technology, often due to cultural perspectives that regard teaching as a value-laden and tradition-bound profession (Fu & Satrianawati, 2022). Nonetheless, the rapid changes brought about by the digital era, especially those accelerated by the COVID-19 pandemic, require teachers to re-evaluate their pedagogical approaches. Consequently, the role of teacher training institutions becomes increasingly vital in preparing prospective educators not only as subject-matter experts but also as agents of technological and pedagogical transformation in English as a Foreign Language (EFL) instruction.

Integrating technology into EFL classrooms offers distinct advantages, such as creating more authentic and psychologically engaging learning environments by bridging the gap between the classroom and the outside world. Recent studies in Indonesia show that digital tools like Google Classroom, social media, and AI-powered applications are widely used to foster student autonomy, engagement, and collaboration, especially where learners have limited exposure to English outside school (Mali & Salsbury, 2021; Jati, 2023; Lisia et al., 2024). In the post-pandemic context, tools such as learning management systems, gamification, and online communication platforms have been shown to significantly boost behavioral and emotional engagement among EFL students (Pasaribu & Wulandari, 2021). However, successful integration depends on teachers' digital literacy and pedagogical adaptability. Professional development courses that connect technology with EFL instruction are essential, as they equip teachers with both theoretical understanding and practical skills for implementing innovative teaching models (Rakerda et al., 2025).

One such model gaining increasing attention is flipped classroom (FC). Flipped classroom reverses the traditional instructional paradigm by delivering content outside of class, typically through video or online platforms, and dedicating in-class time to active, student-centered learning (Strelan et al., 2020; Jensen et al., 2015). While not a new concept, FC [Flipped Classroom] gained significant traction in EFL programs at Indonesian universities following the pandemic and is now considered a viable alternative to the traditional, teacher-centered approaches still prevalent in many EFL contexts (Ebron & Mabuan, 2021; Tsai, 2021). In flipped classrooms, students engage with instructional materials before class and participate in collaborative, higher-order learning tasks during class, often with guidance from instructors and peers (Turan & Akdag-Cimen, 2020; Shabani & Jabbari, 2023).

Research has highlighted several psychological and academic benefits of this approach. Flipped classroom has been shown to enhance students' motivation (Chou et al., 2021; Hung, 2017), reduce language classroom anxiety (Chang & Lin, 2019; Webb & Doman, 2020), increase engagement with learning environments (Liu & Pei, 2023; Zou & Xie, 2019), and support the development of cognitive skills aligned with content-based instruction (Kim et al., 2017; Thai et al., 2020). Despite these promising outcomes, empirical evidence regarding its effect on learners' EFL proficiency remains limited. A review by Vitta and Al-Hoorie (2023) found that only 56 studies addressed actual learning gains, and many of these lacked strong research designs or reliable empirical measures (Strelan et al., 2020; Turan & Akdag-Cimen, 2020).

Although, FC is increasingly used in Indonesia, few studies have examined its specific impact on the TPACK development of pre-service EFL teachers. To address this gap, the current study explores how flipped classroom can support technological and pedagogical development within teacher education. It focuses on the implementation of a flipped classroom model in a *Computer-Assisted Language Learning (CALL)* course within an English Education study program at a private university in Yogyakarta, Indonesia. The course was delivered through the Moodle-based LMS called *Belajar* (https://belajar.usd.ac.id). The course provides pre-service English teachers with both theoretical foundations and practical experience in designing technology-enhanced language instruction.

Accordingly, this study is guided by the following research questions:

1. How is the flipped classroom pedagogically designed and implemented in a Computer-Assisted Language Learning (CALL) course for prospective English teachers at an Indonesian university?
2. To what extent does participation in a flipped CALL course influence the development of TPACK (Technological Pedagogical Content Knowledge) among prospective English language teachers in Indonesia?

The broader goal of this research is to contribute to the ongoing discourse on innovative teacher education practices. The findings are expected to inform curriculum designers, teacher educators, and policymakers about effective strategies for integrating technology in pedagogical training.

Literature review

Flipped classroom

Flipped classroom (FC) has emerged as a prominent pedagogical approach that reverses traditional instructional sequences. Rather than introducing new content during class and assigning practice for homework, FC shifts content delivery to outside the classroom, typically through instructional videos or readings, while class time is repurposed for active learning tasks such as discussion, collaborative exercises, and problem-solving. This structure enables teachers to guide students as they apply concepts in real time, fostering a more interactive and student-centered learning environment (Bergmann & Sams, 2012; Flipped classroom Network, 2014; Lage, Platt & Treglia, 2000).

The approach was first popularized by Bergmann and Sams (2012), who initially recorded lectures for students unable to attend class and later developed a comprehensive model that emphasized using classroom time for deeper engagement with content. According to Basal (2015), the effectiveness of FC lies not in the pre-recorded materials themselves, but in how class time is restructured to promote active learning. Ibrahim and Callaway (2017) note that the model often involves asynchronous video instruction outside of class and collaborative problem-solving within class. Empirical studies by Millard (2012), DeGrazia et al. (2012), and Roehl et al. (2013) support the notion that flipped classrooms can enhance student engagement, peer collaboration, individualized guidance, and readiness for class activities. These advantages align with student-centered learning principles grounded in sociocultural theories, such as those proposed by Vygotsky (1978), which emphasize interaction and scaffolding as central to the learning process.

A substantial body of research has investigated innovative instructional strategies to enhance the implementation of FC in EFL classrooms. Owing to its potential to offer more engaging and meaningful learning experiences, previous studies have frequently reported a positive relationship between FC and language learning outcomes (Leis et al., 2015; Hung, 2017). For example, a study comparing three instructional conditions in a college-level English course found that both structured and semi-structured FC groups significantly outperformed the non-flipped group on post-tests, demonstrating notable improvements in L2 proficiency (Hung, 2015). Similarly, a quasi-experimental study involving 130 university students reported a 3.9-point increase in post-test scores for those in the flipped group, indicating meaningful gains in overall L2 performance (Bicen & Beheshti, 2022).

However, not all research has shown uniformly favorable outcomes. A longitudinal study involving 61 Indonesian EFL students used three successive post-tests and found no significant difference in initial post-test scores between the flipped and non-flipped groups. Statistically significant improvements, however, emerged in the latter two post-tests (Zainuddin & Perera, 2019). Likewise, an investigation at a Chinese university revealed that while students in the flipped group performed significantly better on final exams, no such improvement was observed in their midterm results (Lee & Wallace, 2018). A recent study

confirmed the positive impact of FC on L2 learning but revealed variability across language skill areas. The most substantial improvements were found in reading, with moderate gains in writing and listening. Further analysis showed that students with lower proficiency levels benefitted the most, particularly in reading and listening comprehension (Yan et al., 2024).

Several studies have also explored the effectiveness of FC in developing specific language skills. In a flipped writing course involving third-year English majors, qualitative data from student journals and classroom observations indicated improved writing performance (Challob, 2021). Another study using non-randomized class-level treatment found that students in the flipped group achieved greater gains in overall written performance, although only partial improvement was observed in written communicative competence (Lee et al., 2025). In the area of speaking, a study evaluating an AI-assisted FC model found that students improved their spoken English, as reflected in pre- and post-test score comparisons (Lin & Mubarok, 2021). Regarding reading comprehension, findings based on questionnaires and interviews suggested that students with initially low performance enhanced their reading strategies during the intervention. However, no comparative test score data was reported between experimental and control groups (Huang & Hong, 2016). The impact of FC on listening skills remains inconclusive. For instance, a study involving 67 Iranian EFL learners used both teacher-made and standardized listening assessments. While the results from the teacher-made test supported the effectiveness of FC, outcomes from the TOEFL-based test did not show similar gains, indicating inconsistencies in assessment results (Amiryousefi, 2019).

Technological Pedagogical and Content Knowledge (TPACK)

Shulman (1986) introduced the concept of pedagogical content knowledge (PCK) to emphasize that, in order to be an effective teacher, one must possess not only knowledge of the subject matter but also knowledge of the methods and strategies needed to teach that content successfully. Building on this idea, Mishra and Koehler (2006) expanded the framework by adding a crucial component relevant to contemporary education: technological knowledge (TK). The interaction among these three core components—content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK)—gives rise to seven sub-components: TK, PK, CK, technological pedagogical knowledge (TPK), pedagogical content knowledge (PCK), technological content knowledge (TCK), and the integrated framework known as technological pedagogical content knowledge (TPACK). Figure 1 illustrates the relationship among these seven sub-components. Table 1 presents the seven TPACK components, their definitions, and the indicators used to examine teachers' technological, pedagogical, and content knowledge.

Teachers play a crucial role in educational development and are therefore expected to possess the knowledge and skills necessary for effective teaching and learning. However, research has shown that many Indonesian teachers remain resistant to integrating ICT due to cultural beliefs that position teachers as the sole source of knowledge in the classroom (Prasojo, 2019). To address this issue, collaboration between educators and educational

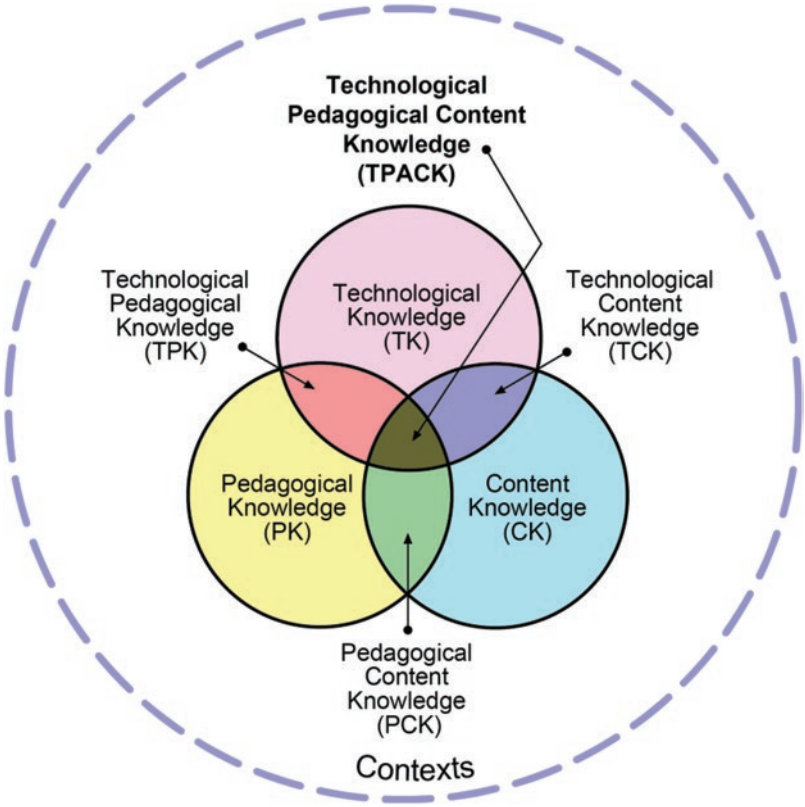

Figure 1. TPACK framework

Table 1. TPACK description and indicators

No	TPACK components	Definition	Indicator
1	TK	Basic knowledge on technology	They know how to use software and hardware
2	PK	Methods & Strategies in teaching	They can select certain teaching method
3	CK	Subject matter to be taught	They can express ideas in English
4	TPK	The use of technology for educational purposes	They can choose technologies that enhance students' learning for a lesson
5	TCK	Inter-relationship between technology and content	They use technologies as sources to develop English skills
6	PCK	Knowledge of using appropriate approach for particular subject	They know how to implement certain strategies to teach English
7	TPACK	Knowledge of facilitating students' learning to specific content through pedagogy and technology	They can teach lessons that appropriately combine literacy, technologies, and teaching approaches

technology practitioners is essential in helping future teachers develop relevant digital competencies, whether through ICT training, instructional modules, or other targeted interventions. Additionally, the relationship between

prospective teachers' self-efficacy in using technology and their TPACK should be taken into account. Understanding how confident teacher candidates feel about integrating technology can offer insight into the effectiveness of current teacher education programs. As Ling Koh, Chai, and Tay (2014) suggest, assessing both self-efficacy and TPACK levels can help determine whether teacher training curricula adequately support ICT integration and can identify areas in need of revision.

The importance of context in understanding and applying the TPACK framework has been widely acknowledged in the literature. While Mishra and Koehler's (2006) original model emphasized the integration of technological, pedagogical, and content knowledge, subsequent studies have highlighted that these domains are shaped by surrounding contextual factors. Mishra (2019) later expanded the model to include Contextual Knowledge (XK), which encompasses influences at three levels: the immediate (e.g., teacher beliefs and student backgrounds), the proximal (e.g., curriculum and institutional policies), and the distal (e.g., national education policies and societal norms). These layers interact to shape how teachers conceptualize and implement technology-enhanced instruction within their specific educational environments (Brianza et al., 2022; Rosenberg & Koehler, 2015; Schmid et al., 2024).

Given this complexity, scholars emphasize the need for context-sensitive approaches in both research and assessment related to TPACK. Survey instruments that are not tailored to the realities of teachers' instructional environments may misrepresent their technological and pedagogical competencies, leading to biased or inaccurate conclusions (Nguyen et al., 2024). Generic tools often fail to capture how teachers adapt their practices in response to curriculum demands, available resources, and student needs. As such, incorporating contextual variables into TPACK research is essential not only for accurate measurement but also for designing effective professional development that supports teachers in real-world classrooms.

While numerous studies have explored the implementation and outcomes of flipped classroom (FC) in language education, most have focused on general improvements in L2 proficiency and specific language skills such as reading, writing, and speaking (Hung, 2015; Challob, 2021; Lin & Mubarok, 2021; Yan et al., 2024). These studies emphasize the benefits of FC for enhancing student engagement, language performance, and learner autonomy. However, little attention has been given to how flipped classroom is concretely designed and implemented within specific course contexts, particularly in CALL (Computer-Assisted Language Learning) courses at Indonesian universities. Furthermore, despite the increasing emphasis on teacher preparedness in digital learning environments, there is a notable lack of research examining how flipped classroom influences pre-service teachers' TPACK development. While TPACK has been widely acknowledged as a critical framework for effective technology integration in education (Mishra & Koehler, 2006; Brianza et al., 2022), its development through flipped classroom models remains underexplored.

This study addresses these gaps by investigating how a flipped classroom is designed and implemented in a CALL course at an Indonesian university and the extent to which flipped classroom influences the TPACK levels of prospective English language teachers. By bridging flipped classroom and TPACK in a localized teacher education context, the study aims to provide practical insights for both instructional design and teacher training.

Methodology

Research context

This study was conducted in a CALL class, a one-semester (16-week) elective course offered to sixth-semester undergraduate students in the English Education Study Program at a private university in Yogyakarta, Indonesia. The program is recognized for its commitment to preparing pre-service English as a Foreign Language (EFL) teachers through curriculum that integrates pedagogical theory, language proficiency and instruction technology. The institution is actively engaged in national and international academic discourse, particularly in the areas of language education, teacher development, and technology-enhanced learning. The focus of the study was twofold: (1) to describe the design and implementation of a flipped classroom model in a class of prospective EFL teachers, and (2) to investigate the implications of this teaching strategy for the development of the participants' Technological Pedagogical Content Knowledge (TPACK).

Participants

The participants in this study consisted of 20 Indonesian undergraduate students, aged 18 to 20, with a fairly even gender distribution (11 females and 9 males). All participants spoke both Indonesian and English, with English being studied as a foreign language. The majority of students (15 of 20) were at the B1 level of English proficiency, while the remaining five had reached B2. This demographic profile reflects a relatively homogeneous group in terms of language background and age, with some variation in proficiency levels that could influence classroom interaction and learning dynamics. This participant group was purposely selected due to their representativeness of typical pre-service teachers in Indonesia, who are in the formative stages of develoing both pedagogical and technological competencies, which make them a relevant and bounded group for this case study.

All enrolled students were required to complete four year-long English language courses as part of the requirements for earning a degree as a Bachelor of Education, and were therefore considered prospective teachers. The CALL class met for three hours per week and was designed to introduce students to the foundational principles of computer-assisted language learning and web-based tools, as well as how to implement these tools in language classrooms. Additionally, the course aimed to help students develop self-efficacy in teaching English for their future careers.

This study was conducted in accordance with ethical standards for research involving human participants. While there was no Institutional Review Board (IRB) or formal ethics committee available at the authors' institution or at the

national level for social science research at the time of data collection, the researchers ensured adherence to established ethical protocols. These included obtaining informed consent, protecting participant confidentiality, and allowing participants to withdraw from the study at any time without penalty. The procedures followed were consistent with the ethical principles outlined in the Declaration of Helsinki.

Research method

This study employed a qualitative case study design to explore the implementation of flipped classroom and its impact on the development of Technological Pedagogical Content Knowledge (TPACK) among pre-service English as a Foreign Language (EFL) teachers. The case focused on a cohort of 20 undergraduate students enrolled in an English Education Study Program at a private university in Yogyakarta, Indonesia. The case was bounded by its institutional context, the participants' shared academic background, and the duration of one academic semester. Data were collected through a researchers-developed need analysis survey, classroom observations and a post-intervention. This information helped tailor the flipped CALL course to better support their learning goals and ensure that the design was responsive to their context. TPACK-EFL assessment questionnaire developed by Baser, Kopcha, and Ozden (2005) was distributed to measure to examine how the flipped classroom approach influenced the development of Technological Pedagogical Content Knowledge (TPACK) among 20 prospective English language teachers. A focus group discussion (FGD) with six randomly selected students was also conducted to investigate the prospective teachers' perceptions of the flipped teaching strategy in a technology integration course. Transcripts from the FGD were analyzed using thematic analysis (Braun and Clarke, 2006). The process involved coding the data inductively to identify recurring patterns and themes related to participants' experiences and reflections on the FL implementation. Triangulation between quantitative and qualitative findings was used to enhance the validity of the results. Table 2 presents the research instruments used in this study, along with their usage and corresponding references.

Table 2. Research instruments blueprint

Instrument	Usage	Reference
• Questionnaire	• Analyzing prospective teachers' attitudes	• Dudeney & Hockly (2007)
• Observation	• Implementation	• Smith, H W (1981)
• TPACK-EFL assessment	• Measuring TPACK-EFL level	• Baser, Kopcha, Ozden (2005)

Findings

Design and implementation process

This study aimed to implement flipped classroom effectively; therefore, a well-structured course needed to be systematically designed. With that in

mind, at the beginning of the semester, a need analysis survey was administered to assess students' attitudes toward technology and their readiness to engage in a flipped classroom environment. Understanding students' perceptions also provided valuable feedback for refining the pedagogical strategies and technological tools used throughout the course. The following table displays the results of the questionnaire.

Table 3. Need analysis survey

No	Statement	Mean	SD	Remark
1	I enjoy using technology	4.53	.51	Positive
2	I avoid using technology when I can	2.74	.73	Negative
3	I think using technology in class takes up too much time	2.63	.76	Negative
4	I know that technology can help me to learn many new things	4.42	.51	Positive
5	Technology intimidates and threatens me	2.84	.76	Negative
6	Teachers should know how to use technology in class	4.37	.60	Positive
7	I will be a better teacher if I know how to use technology properly	4.11	.57	Positive
8	I'm very confident when it comes to use technology in class	3.68	.82	Positive
9	I want to learn more about using technology in class	4.53	.61	Positive
10	I believe that internet can really improve my teaching practice	4.16	.50	Positive

Table 3 indicates that the students have positive perception toward technology which can be seen from their awareness on the myriads potential that technology can offer. In terms of educational tools, the researcher also tried to figure out students' preference of CALL tools that they would like to study during the course. The graph below (Figure 2) shows the result of the survey.

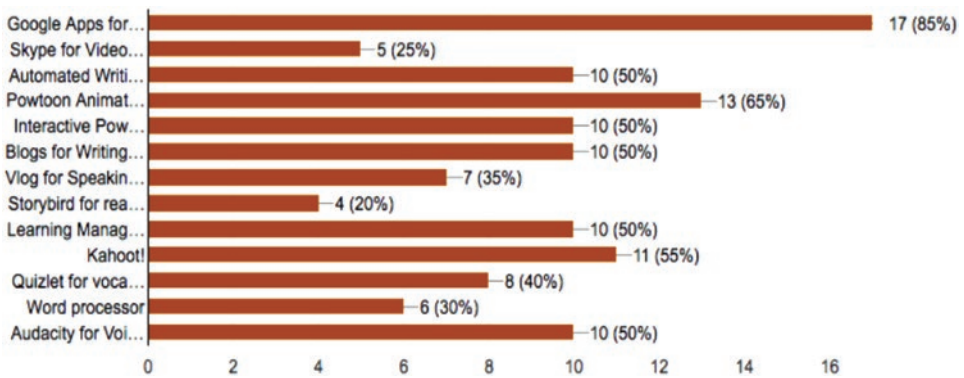

Figure 2. Frequency of technological tools preferred by the prospective teachers

The chart shows that Google Apps for Education (GAFE) received the highest percentage of responses, with 85% of students selecting it. Google has become an integral part of daily life, which likely explains why students

prefer GAFE as the educational tool they would most like to study. The second most selected tool was PowToon. However, it had already been introduced in a course called Language Teaching Media, which was offered in the previous semester. The third most preferred tool was Kahoot, which is widely recognized for its potential to gamify lessons (Healey, 2017). Through gamification, lessons are no longer perceived as rigid or formal, but rather as engaging and enjoyable experiences for students.

The researchers developed the syllabus and selected the materials to be included, while eliminating content that was not essential, in order to help student teachers become proficient future educators. The 16-week course was divided into six modules. A description of each module is presented in the following table.

Table 4. Designed syllabus of CALL course

Module	Topic	Assigned reading	Task
History of CALL	Three stages of CALL development	Warschauer (1996): History of CALL	Infographic
Asynchronous Teaching Method	Discussion board	Pasaribu (2017): Task-based Writing	Discussion board or forum
Synchronous Teaching Method	Teaching using social media (Twitter, FB, chatroom, Vicon)	Perez (2001): Computer-Mediated Communication	Zoom video conferencing with EduTech Practitioner in Germany
Learning Management System (LMS)	Types of e-learning	Zanjani et al. (2016): LMS Development	Developing an online learning
Google Apps for Education (GAFE)	Assessment tools	Railean (2012): GAFE	Developing reading test using Google form
Mobile-Assisted Language Learning	m-Learning apps (Kahoot & Quizlet)	Ardi (2017): m-Learning	Teaching simulation using mobile apps
Final Assessment	–	–	Poster presentation

The next step was to upload the materials to an accessible platform. The researchers used a Moodle-based Learning Management System (LMS) recommended by the university, which is accessible at belajar.usd.ac.id. Moodle was chosen because it is synchronized with the university's Academic Information System, meaning that students' data, such as full name and student number, are already integrated into the platform (Chernikov et al., 2019). Learning materials in the form of videos, PDF files, presentation slides, online quizzes, and other digital content were uploaded to Moodle before classroom meetings. These materials were accessible to students without restrictions of time or location, as long as they had internet access.

This learning model not only gives students the responsibility to manage their own learning which fostering learning autonomy (Gamage et al., 2022) but also allows for more classroom time to be devoted to exploring technological tools in greater depth, thereby increasing classroom efficiency.

After all the pre-selected materials were prepared, they were uploaded, embedded, or linked on the Moodle-based LMS to provide students with a systematic, weekly flow of content. The flipped classroom model consists of two main elements: the first involves automated, technology-supported activities such as video lectures (conducted outside of class), and the second emphasizes human interaction through in-class activities. The distribution of these activities is shown in Table 4.

Table 5. Distribution of the learning activities in the flipped classroom

Outside Activities	In-class Activities
• Reading journals	• Presentation
• Watching video	• Discussion
• Online quiz	• Group work
• Individual learning	• Simulation
• Self-paced study	• Doing exercise
	• Workshop
	• Video conferencing
	• Poster presentation

Table 5 shows that out-of-class time is primarily dedicated to activities requiring Lower Order Thinking Skills (LOTS), such as remembering, understanding, and applying. In contrast, classroom time is reserved for activities involving Higher Order Thinking Skills (HOTS), including analyzing, evaluating, and creating. This indicates that the flipped classroom model extends learning time and empowers students to take greater responsibility for their learning while enabling deeper engagement with the subject matter.

Once the planning phase was completed, the learning model was implemented in a 16-week course, consisting of 14 sessions for content delivery and 2 sessions for the midterm and final exams. Observations during the implementation revealed a high level of student engagement and enthusiasm. Students participated actively in group discussions, presentations, and teaching simulations. They also gained knowledge from peer interactions. Class time became more efficient because students arrived prepared. Additionally, students' self-esteem improved as they were able to engage meaningfully and contribute to class activities.

The highest level of student engagement was observed during a video conferencing session using Zoom, where a PhD student from Germany gave a talk on teaching English with social media. Students asked numerous questions and participated in the discussion enthusiastically.

Figure 3 depicts a videoconferencing activity conducted during the sharing session, after the instructional materials had been provided to students in advance. Because the students were already familiar with the content, the session functioned primarily as an opportunity for discussion and reflection, as evidenced by their attentive and engaged expressions in the images.

The FGD data further support the positive impact of the flipped classroom model on prospective English teachers. As illustrated in Table 6, participants

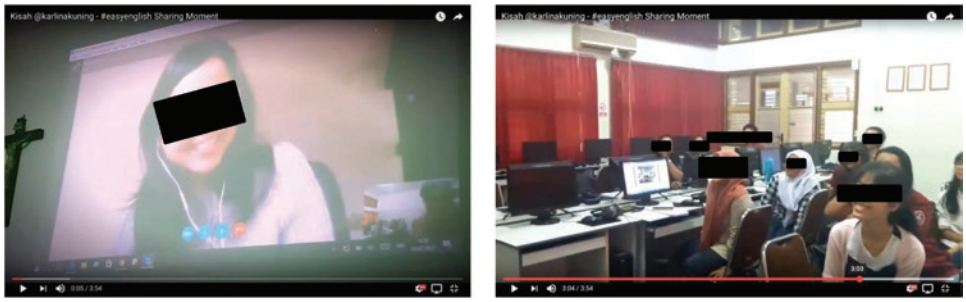

Figure 3. Students' expression in the video conference activity (Source: Author's documentation, 2023)

Table 6. Samples of FGD transcripts

Respondents	Extract
S3-FGD	• I think that I am equipped with the skills required for my future career as a teacher.
S4-FGD	• I like how this learning strategy gives me hands-on experience on how to integrate technology to teach English.
S1-FGD	• Flipped classroom enables us to have more personalized learning and collaborative learning at the same time.
S2-FGD	• The class is more interactive because we come to the class prepared. We don't have to listen to the lecturer talking for the whole class hours.

*S1 = Student 1, S2 = Student 2, etc.

expressed a range of benefits from this learning approach. One respondent shared, "I think that I am equipped with the skills required for my future career as a teacher" (S3-FGD), reflecting increased confidence in their readiness for professional teaching. Another participant appreciated the practical aspect of the course, stating, "I like how this learning strategy gives me hands-on experience on how to integrate technology to teach English" (S4-FGD). These insights highlight the hands-on nature of flipped classroom as instrumental in bridging theory and practice.

Additionally, the model's flexibility was recognized for fostering both personalized and collaborative learning experiences. One student noted, "Flipped classroom enables us to have more personalized learning and collaborative learning at the same time" (S1-FGD), emphasizing the dual benefits of autonomy and peer interaction. Another student commented on the increased interactivity of classroom sessions: "The class is more interactive because we come to the class prepared. We don't have to listen to the lecturer talking for the whole class hours" (S2-FGD). This shift from passive reception to active engagement aligns well with the theoretical frameworks underpinning the study, as well as with the principles of learner autonomy and active participation.

The Focus Group Discussion (FGD) data indicates that the prospective English teachers perceived several benefits from the implementation of the flipped classroom model. One participant expressed feeling better equipped

with the skills necessary for their future teaching career, while another appreciated the hands-on experience in integrating technology into English instruction. A third respondent emphasized the opportunity for both personalized and collaborative learning, and another noted that the classroom environment became more interactive, as students came to class prepared, reducing the need for lengthy lectures. Overall, the flipped classroom was perceived as a valuable and engaging learning strategy.

Influence of flipped classroom on TPACK of the prospective teachers

This study aimed to implement flipped classroom to provide prospective teachers with hands-on experience in integrating technology into their teaching practice. This strategy was expected to enhance the student teachers' self-confidence as future educators, as measured by the TPACK-EFL assessment. To address the second research question, the data collected from the assessment questionnaire were tabulated, and the results of the descriptive statistics are presented in Table 6.

Table 7 indicates that the prospective teachers' self-assessed knowledge across all seven TPACK components ranges from moderate to high. The highest mean score was recorded for Technological Pedagogical Content Knowledge (TPACK) (M = 4.3, SD = 0.53), suggesting a high level of self-confidence among the participants in integrating pedagogy and technology in English language teaching. Further details of the data are presented in Table 8.

Table 7. TPACK-EFL assessment

No.	TPACK components	Mean	SD
1	Technological knowledge (TK)	4.26	.74
2	Content knowledge of the subject (CK)	3.92	.92
3	Pedagogical knowledge (PK)	3.21	1.32
4	Pedagogical content knowledge (PCK)	3.95	.43
5	Technological content knowledge (TCK)	3.46	.86
6	Technological pedagogical knowledge (TPK)	4.17	.54
7	Technological pedagogical content knowledge (TPACK)	4.3	.53

Table 8 shows that the average TPACK score of prospective teachers in Indonesia falls within the "high" category. Technological Pedagogical Content Knowledge (TPACK) refers to the integration of three core knowledge domains: technology, pedagogy, and content. Prospective teachers are expected to be proficient in designing lesson plans supported by language learning software and internet resources, while also being capable of managing the complex interrelationships among technology, content, and pedagogy. They must develop appropriate, context-specific strategies and representations (Mishra, Koehler, Kereluik, Shin & Graham, 2014).

Table 8. TPACK assessment (TPACK component)

No.	Statements on TPACK	Mean	SD
1	I can use collaboration tools (e.g. GAFE, Blog, Storybird, WhatsApp etc.) to support students' language learning.	4.45	.74
2	I can support students as they use technology to support their development of language skills in an independent manner.	4.2	.92
3	I can use Web 2.0 tools (animation tools--such as PowToon, digital story tools, designing tools etc.) to develop students' language skills.	4.05	.72
4	I can design lesson plans supported by technological tools and resources to continuously improve the language teaching process.	4.2	.43
5	I can use evaluation tools (such as Google Form, Kahoot, Quizlet, etc) to assess my students' learning progress.	4.6	.86
	Total	4.3	.73

In contrast, the lowest score was observed in the Pedagogical Knowledge (PK) component (M = 3.21, SD = 1.32), indicating a moderate level of confidence among prospective teachers regarding pedagogical approaches. Table 9 shows the average mean of PK score of prospective teachers in Indonesia is in 'moderate' category.

Table 9. TPACK assessment (PK component)

No.	Statements on PK	Mean	SD
1	I can adapt my teaching methods to meet students' needs	3.15	.74
2	I know wide range of teaching approaches	4.10	.86
3	I can select effective teaching approaches to guide student thinking and learning	2.95	1.72
4	I know how to develop lesson plans to structure my teaching performance	3.45	.73
5	I know how to organize and maintain classroom management	2.82	1.92
	Total	3.21	1.19

The data from questionnaire shows that they know wide range of teaching approaches (M = 4.10; SD = .86). The students stated that flipped classroom provides more time for practical activities and hands-on experience which introduce them to innovative teaching methods and strategies. However, they have low confidence in terms of classroom management (M = 2.82; SD = 1.92).

Discussions

The results of this study offer a foundation for interpreting how flipped classroom influenced participants' TPACK development, which is further examined in the following discussion.

1. Design and implementation of the flipped classroom in a CALL course

This section discusses how the flipped classroom/learning model was pedagogically structured and applied within the CALL course for EFL pre-service teachers. The flipped classroom model implemented in this CALL course was designed to foster active, student-centered learning by shifting content delivery to pre-class activities and dedicating in-class time to collaborative, higher-order tasks. This approach aligns with sociocultural learning theories (Vygotsky, 1978) and the principles of active learning (Prince, 2004), which emphasize interaction, scaffolding, and learner autonomy.

In this model, students were required to read selected journal articles and watch curated video lectures prior to class meetings. Each group was assigned a journal article to present, and each topic was paired with a relevant video lecture, mostly sourced from YouTube due to its accessibility, authentic language exposure, and ease of integration. This pre-class preparation allowed classroom time to be used more effectively for engaging in discussions, clarifying difficult concepts, and exploring content through collaborative activities. This structure reflects the core principles of flipped classroom as defined by the Flipped classroom Network (2014) and operationalized in EFL contexts by researchers such as Tsai (2021), who emphasized the importance of pre-class autonomy and in-class interaction in promoting learner agency.

The integration of familiar tools such as Google Apps for Education, PowToon, and Kahoot was not only pedagogically strategic but also responsive to learners' digital preferences, as confirmed by the needs analysis. This echoes findings from Turan and Akdag-Cimen's (2020) systematic review, which highlighted that learner engagement and tool familiarity are critical to the success of flipped classrooms in EFL contexts.

Moreover, the use of Moodle as a learning management system facilitated asynchronous access to materials, supporting self-paced learning and preparation. This structure mirrors the model proposed by Zou and Xie (2019), who demonstrated that combining flipped classroom with just-in-time teaching (JiTT) and peer instruction significantly enhanced students' writing performance, motivation, and critical thinking. Their study also emphasized the importance of using cloud-based tools (e.g., Padlet, Google Docs) to foster real-time collaboration and a culture of peer feedback.

The course design also aligns with Tsai's (2021) findings, which showed that flipped classrooms can significantly enhance learner autonomy across multiple dimensions, including strategy use, self-management, and confidence. In Tsai's study, students in a flipped linguistics course demonstrated greater engagement with learning materials, more frequent use of metacognitive strategies, and increased willingness to take responsibility for their learning. These outcomes were similarly observed in the present study, where students reported feeling more prepared, confident, and engaged during in-class activities.

In-class activities in the CALL course were designed to promote higher-order thinking through simulations, group projects, and discussions. This is consistent with Chang and Lin's (2019) findings, which showed that integrating

interactive response systems (IRS) in flipped classrooms reduced learner anxiety and increased willingness to communicate (WTC). Their study demonstrated that structured peer interaction, supported by technology, can create a psychologically safe and engaging environment. This outcome was also observed in the present study through student feedback and classroom observations.

The findings from the focus group discussions reinforce the theoretical foundations of the flipped classroom, particularly its alignment with learner-centered and constructivist approaches. Participants' reflections indicate that the flipped classroom model fostered greater self-efficacy and confidence in their ability to integrate technology into future teaching practices, an outcome consistent with the goals of TPACK development. Increased self-efficacy and confidence were also found to reduce anxiety and enhance performance (Mauludin & Prasetyo, 2024). These findings support previous research suggesting that flipped classroom environments can improve pre-service teachers' technological and pedagogical readiness by offering authentic, practice-oriented learning experiences (Zhang & Fang, 2022; Kusuma, 2022; Mekhmeir, 2025). Furthermore, the model's emphasis on active and collaborative learning aligns with Vygotsky's sociocultural theory, which underscores the role of social interaction in cognitive development. The flexibility of the flipped classroom also appears to promote learner autonomy and engagement, consistent with studies reporting higher motivation and self-directed learning in EFL contexts (Aksoy & Tulgar, 2023; Kupchyk et al., 2025). Overall, these findings suggest that the flipped classroom not only enhances content understanding but also cultivates essential 21st-century teaching competencies.

Furthermore, prospective teachers did not perceive technology as a burden or time-consuming obstacle but rather as an essential tool that facilitates achieving learning objectives efficiently. However, despite recognizing the supportive role of technology, they expressed a need for more practical knowledge to confidently apply technological tools in their future classrooms. This aligns with findings by Kusuma (2022), who emphasized that while flipped classroom environments can foster TPACK development, structured support and contextualized practice are essential for building confidence in technology use. These insights reaffirm Mishra and Koehler's (2014) assertion that effective teaching today requires the integration of three core knowledge domains, content, pedagogy, and technology, into a unified framework known as Technological Pedagogical Content Knowledge (TPACK). The CALL course's emphasis on developing this integrated knowledge base thus appears crucial in preparing future teachers to meet the demands of technology-enhanced education.

Overall, the FGD responses demonstrate that flipped classroom not only enhances prospective teachers' confidence and skills in technology integration but also creates a more engaging, interactive, and learner-centered environment that supports both individual and collaborative learning. These outcomes confirm that the flipped classroom model, when thoughtfully designed and implemented, holds significant promise for advancing teacher education in the digital age.

2. Influence of flipped classroom on TPACK development

The findings of this study reveal important insights into prospective teachers' self-confidence and perceived competence across the various components of the TPACK framework after experiencing a flipped classroom approach in their CALL course. To address the second research question, the results indicate a moderate to high level of self-assessed knowledge, particularly in the integration of technology, pedagogy, and content, which aligns with the core aim of the flipped classroom model to enhance technological pedagogical skills.

The high mean score in the TPACK component (M = 4.3) suggests that the flipped classroom environment effectively enhanced pre-service teachers' confidence in integrating technology with pedagogical and content knowledge. This finding aligns with Zhang and Fang's (2022) study, which demonstrated that technology-integrated flipped classrooms significantly improved EFL teachers' sense of efficacy and ability to apply TPACK in practice. The participants' familiarity with tools such as Google Apps for Education, blogs, WhatsApp, PowToon, and Kahoot underscores the growing importance of digital tools in promoting pedagogical innovation and digital literacy. Engaging pre-service teachers in designing and implementing technology-rich lessons within flipped classroom contexts appears to deepen their understanding of TPACK and better prepare them for the demands of 21st-century classrooms. Such engagement also serves as a mediating process that helps address their weaknesses while strengthening their instructional competence (Mauludin et al., 2025). Moreover, the participants' positive attitudes toward technology are consistent with Degirmencioglu and Gilanlioglu's (2025) findings, which showed that pre-service English teachers' motivation and confidence in using educational technology are closely tied to perceived usefulness and hands-on experience. In this sense, engagement functions as a motivational mediator that supports both teaching and learning practices (Paradita et al., 2025).

The flipped classroom environment offers interactive activities that enhance students' willingness to communicate while reducing learning anxiety (Chang & Lin, 2019; Wu et al., 2020; Webb & Doman, 2020). Additionally, the flexibility in time and location afforded by flipped classroom significantly boosts students' self-efficacy (Thai et al., 2017). Flipped classroom settings also significantly increase students' motivation while improving their autonomous learning skills and academic abilities (Chou et al., 2021; Liu & Pei, 2023). These autonomous learning skills enable students to engage in more explicit learning experiences within a less anxiety-inducing environment (Paradita et al., 2025; Ayuningtyas et al., 2025).

Furthermore, the high confidence in designing lesson plans that integrate technological resources reflects students' perceived readiness to apply their knowledge in authentic teaching scenarios, reinforcing the flipped model's emphasis on active, learner-centered practice. This resonates with the findings of Tsai (2021) and Turan and Akdag-Cimen (2020), who emphasized the importance of learner engagement and technological familiarity for effective implementation of flipped classroom in language education. When students take responsibility for learning course content before class, they are more likely to

develop autonomy. Additionally, the flipped classroom supports differentiated instruction by allowing learners to engage with materials at their own pace and according to their individual needs (Turan & Akdag-Cimen, 2020).

However, the notably lower scores in the Pedagogical Knowledge (PK) domain (M = 3.21), especially in areas such as classroom management (M = 2.82), suggest that while the flipped classroom fosters technological competence and lesson planning skills, it may not fully address all dimensions of pedagogical expertise. The moderate confidence levels in selecting appropriate teaching methods and organizing classroom dynamics point to a continuing need for targeted support in developing foundational pedagogical strategies. This finding aligns with the literature noting that integrating technology effectively does not automatically lead to mastery in classroom management or adaptive teaching approaches (Koehler & Mishra, 2009).

The disparity between the high scores in technological and integrative TPACK components and the moderate scores in pedagogical knowledge highlight a key implication for teacher education programs. While technology integration is critical, the pedagogical aspect—particularly in managing diverse classroom behaviors and adapting instruction to student needs—requires sustained and focused development. The flipped classroom approach could be further enhanced by incorporating explicit training and reflective practices aimed at strengthening these pedagogical competencies.

Moreover, students' positive perceptions of flipped classroom, as indicated in the FGD, reinforce the quantitative findings. Their appreciation for increased hands-on experience and interactive learning supports the notion that flipped classrooms cultivate active learning and autonomy which are essential qualities for teacher readiness in technology-enhanced classrooms. Fully online flipped classes also offer an innovative, effective, and collaborative learning environment that helps address confusion and anxiety often associated with live, synchronous interactions (Shabbari & Jabbari, 2023). Online flipped instruction supports computer-mediated collaborative speaking and collective scaffolding by fostering a strong online learning community.

Nevertheless, students expressed need for more practical knowledge on classroom management suggests that future iterations of the course might benefit from integrating role-playing, case studies, or microteaching sessions to build confidence in handling real classroom challenges. The flipped classroom not only fosters student motivation and critical thinking through scaffolded learning and peer collaboration but also enables higher-order thinking and deep, coherent discussions in content-based second language learning (Zou & Xie, 2018; Kim et al., 2017).

Hence, the implementation of flipped classroom in the CALL course successfully enhanced prospective teachers' technological confidence and readiness to integrate digital tools into language teaching. The approach created an interactive, learner-centered environment that encouraged autonomy, motivation, and critical thinking. However, the findings also highlight the need for more robust support in foundational pedagogical knowledge, particularly in classroom management. To maximize the benefits of flipped instruction,

teacher education programs should adopt a balanced approach that emphasizes not only technological fluency but also practical pedagogical training to better prepare future educators for the multifaceted demands of modern classrooms. By providing empirical evidence, this study aims to support the development of scalable models for professional development programs that align with 21st-century educational demands.

Conclusion

This study investigated the design, implementation, and perceptions of a flipped classroom model in a CALL course for prospective English teachers, with a focus on its influence on students' TPACK. The findings demonstrate that the flipped classroom approach enhanced student engagement, learner autonomy, and technological confidence. Students reported feeling more prepared and active in class due to the shift of content delivery to pre-class activities, which allowed in-class time to be used for collaborative, higher-order tasks. These outcomes also align with the TPACK framework, affirming that integrating technology with pedagogy and content knowledge enhances teacher preparedness for digital classrooms.

However, while students demonstrated strong confidence in using digital tools, the moderate confidence in pedagogical knowledge suggests that technological fluency alone is insufficient for comprehensive teacher preparation. Therefore, a balanced curriculum that integrates explicit pedagogical training, particularly in classroom management and instructional adaptation, is essential for equipping prospective teachers to meet real-world classroom challenges.

This study is limited by its context-specific focus on a single CALL course, which limit the generalizability of the findings. Future studies could explore the longitudinal effects of flipped classroom on teachers' classroom practices during their teaching practicum or in-service experiences. Comparative studies involving different instructional models or varying degrees of flipped implementation could provide deeper insights into best practices. Ultimately, the flipped classroom holds significant potential for bridging theory and practice in EFL teacher education when paired with intentional pedagogical development.

Conflict of interest

The authors have no conflict of interest.

Use of generative AI

This manuscript made use of ChatGPT to assist in paraphrasing and improving the clarity of text. No AI tools were used for the generation of research hypotheses or the writing of conclusions. The final manuscript was authored and reviewed by the listed authors without additional AI input.

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