

Research Article

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Navigating ICT Integration: Empowering Teacher Educators to Cultivate TPACK 21st-century Learning Skills in Pre-Service Teachers

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Abstract

Background/purpose. Current language teaching pedagogy cannot merely be 'digitised'. Instead, new teaching methods must be developed when new technologies are introduced. However, the training in ICT integration was somewhat limited, and the modelling of ICT integration was lacking. Teacher educators themselves are struggling to keep abreast of current technologies. They are using and teaching with technology, but not necessarily teaching how to use it effectively. The biggest challenge in using ICT in Teaching and Learning is not the technology itself but the changes in the way it is being used to teach. Therefore, this study aims to contribute to the development of Technological Pedagogical Content Knowledge (TPACK) for quality ICT integration, thereby cultivating 21st-century learning skills (TPACK21cls) based on the SAMR model.

Materials/methods. Through qualitative methods, data were collected via interviews and reflections from 11 TESL pre-service teachers on their experiences of learning to use ICT tools for teaching and learning (T&L). Three teacher educators teaching the programme were also interviewed for triangulation purposes.

Results. The findings reveal a gap in guiding pre-service teachers to effectively integrate ICT tools for communication, collaboration, critical thinking, and creativity. Notably, teacher educators primarily utilized ICT tools at basic substitution and modification stages in the SAMR model, thereby limiting transformative learning experiences.

Conclusion. This underscores the significance of equipping teacher educators with the necessary skills for proficient ICT integration, thereby adequately preparing pre-service teachers to meet the evolving demands of modern education. Thus, a tailored guide is proposed to support teacher educators in delivering TPACK21cls to pre-service teachers.



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1. Introduction

Classrooms in this new millennium, where Information and Communications Technology (ICT) is ubiquitous, must evolve beyond simply digitizing traditional teaching methods. Employing ICT should be more than merely using PowerPoint presentations and videos instead of the blackboard to transmit knowledge. It may be so at the start of the 21st century to save time and add efficiency. However, in the current digital world, simply substituting old technology with new technology is insufficient to add value to learning. Learning is more than just a passive activity; it involves receiving knowledge and applying it in a meaningful way. The role of ICT in education demands a paradigm shift from mere substitution to meaningful integration towards fostering dynamic, interactive, and student-centered learning environments.

The idea of understanding ICT and mastering the basic skills and concepts of ICT as part of the core of education, alongside reading, writing, and numeracy, was highlighted two decades ago (Anderson et al., 2002). For effective learning to happen, the use of ICT tools must be well-designed, with appropriate pedagogical principles seamlessly integrated into the school curriculum (Lai, 2008). The focus should not be only on the use of digital tools, but also on how these tools can be utilized to enhance understanding, instill creativity, and nurture critical thinking skills. Teachers should go beyond possessing pedagogical, content, and technological knowledge independently and instead understand how to interweave them meaningfully in their practice. To support this new paradigm of teaching, teachers need to be competent with digital technology and able to effectively integrate it into their teaching and learning (Johnson et al., 2014). Nevertheless, many public universities have yet to provide guidelines on how to effectively utilize pedagogy and technology (Bizami et al., 2023).

In this study, ICT refers to a diverse range of digital tools and resources used to transmit, store, create, share, or exchange information. These technological tools and resources include computers, the Internet (websites, blogs and emails), live broadcasting technologies (radio, television and webcasting), recorded broadcasting technologies (podcasting, audio and video players, and storage devices) and telephony (fixed or mobile, satellite, video-conferencing, etc.) (*Information and Communication Technologies (ICT) | UNESCO UIS, 2021*).

As teachers' practices are based on their own experiences as students (So et al., 2012), teacher-training programs play an essential role in promoting successful integration of technology into the classroom (Ottenbreit-Leftwich et al., 2012, 2010; Resta & Carroll, 2010; Ritzhaupt et al., 2008; Shear et al., 2011). In other words, teacher education programs should keep in pace with the changing needs of the world and create effective teacher candidates for today and for the future (Brown, 2017). It may be assumed that new teachers from the "Net Generation" can help bridge the technology gap (So et al., 2012; Funkhouser & Mouza, 2013), but in reality, they still lack the ability to integrate technology into the curriculum (So et al., 2012). Hence, teacher education programs should keep pace with the changing needs of the world and create effective teacher candidates for today and for the future (Brown, 2017). To support this goal, the current study draws upon two types of frameworks and a model to provide deeper insights into the fundamental principles underlying this research. They include the TPACK framework, 21st-century learning skills, and the SAMR Model.

The overall aim of this study is translated into two specific objectives, which are expressed in the form of research questions:

1. How did teacher educators in a TESL program at an ITE in Malaysia deliver Technological Pedagogical Content Knowledge for 21st-century learning skills (TPACK21cls) to pre-service teachers?
2. What were the TPACK21cls stages demonstrated by teacher educators in a TESL program at an ITE in Malaysia?

2. Literature Review

2.1. TPACK Framework

According to Koehler et al. (2013), TPACK is the intersection of content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK), forming the foundation of effective teaching with technology.

Figure 1 shows the TPACK framework.

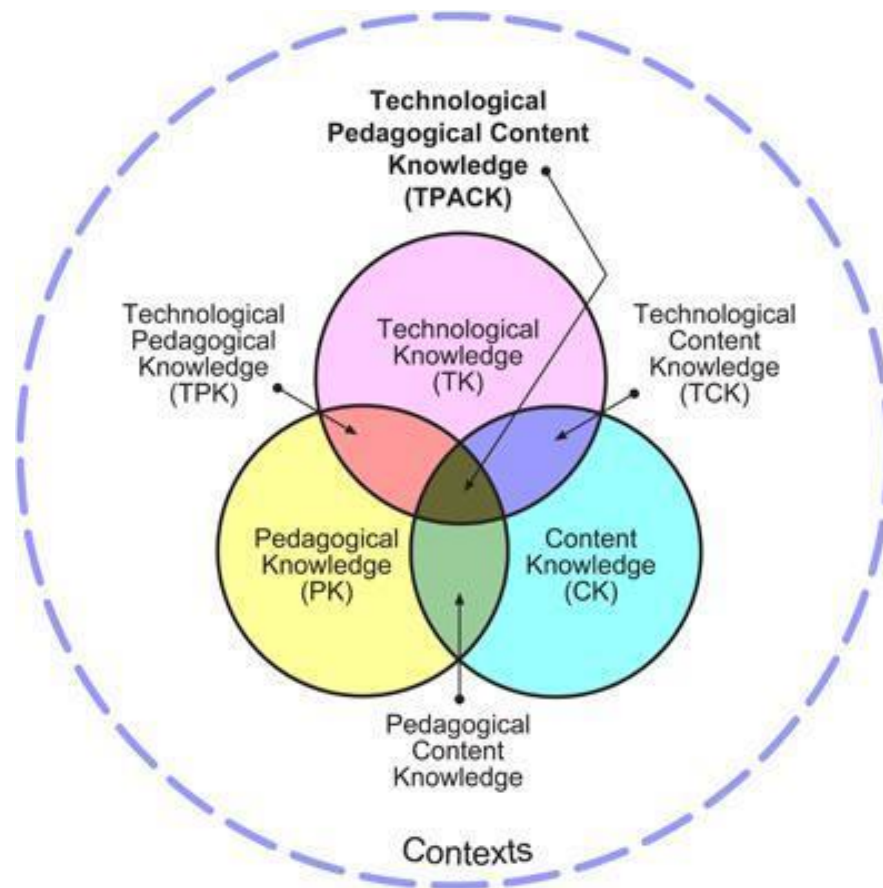


Figure 1. The TPACK Model (Reproduced by Permission of the Publisher, © 2012 by tpack.org)

The development of TPACK by teachers is central to effective teaching with technology, as understanding TPACK is more than just understanding technology, content, or pedagogy in isolation; it involves understanding how these forms of knowledge interact with each other (Mishra & Koehler, 2006). Teachers need to be exposed to technology and deliberate on how to use it in effective pedagogical ways to teach their subject (Harris & Hofer, 2011; Mishra et al., 2009; Mishra & Koehler, 2006). In addition, teachers also need to know how learning can be changed by the application of technology (Jang & Chen, 2010; Mishra & Koehler, 2006; Voogt et al., 2013) as the lack of either content or pedagogy knowledge would have a negative effect on integrating technology into their teaching (Pamuk, 2012). Similarly, Chai et al. (2013) agreed that the TPACK framework aims to facilitate the discovery and description of how technology-related professional knowledge is applied in practice. It has also been found that teaching pre-service teachers to use the TPACK framework can support pre-service teachers' global understandings and information literacy (Cumming, 2020).

The above discussion indicates that the TPACK framework has an important contribution in ICT integration and development in the education field. Therefore, this study focused on the development of TPACK in the TESL curriculum in an ITE in Malaysia.

2.2. 21st Century Learning Skills

The Framework for 21st Century Learning presents a cohesive vision designed to ensure students thrive in a dynamic world characterized by constant change and perpetual learning (Partnership for 21st Century Skills [P21], 2009). This framework emerged through collaborative efforts involving educators, experts, and business leaders, thereby incorporating diverse perspectives. In addition to delivering fundamental knowledge, there is a strong emphasis on providing students with indispensable skills essential for contemporary success. These skills encompass critical thinking, problem-solving, effective communication, and collaboration, collectively referred to as the 4 Cs of 21st-century learning, a classification also endorsed by Stauffer (2020). As education continues to evolve, it is evident that significant attention has been directed towards instilling 21st-century learning skills in students (Saavedra & Opfer, 2012).

One of the important aspects of instilling these skills in schools is to prepare students as they enter the workforce (National Education Association, 2015). Instilling the skills can be implemented through studies in English language classrooms. Sun (2016) presented a study on how to make English speakers competent language users, as well as critical thinkers and constructive agents of social change. In another study, Halverson (2018) proposed incorporating the 4Cs into language skills through activities such as researching topics for discussion, debating with peers, and writing about their findings. He also suggested engaging students in creating short films, conducting interviews, analysing statistical data, participating in plays, crafting presentations, and collaboratively solving specific problems. These activities were planned to enhance their communication, creativity, critical thinking, and teamwork skills within group settings. In this respect, language teachers need to be equipped with the knowledge to incorporate the 4Cs into their lessons.

Teachers must be equipped with various pedagogical approaches and take the opportunity to utilize digital technology for the development of students' twenty-first-century skills (Voogt et al., 2013), thereby enriching their pedagogical processes and instructional practices in integrating the 4Cs into their lessons. With this objective in mind, this study followed the 'Framework for 21st Century Learning' (2009) by the US-based Partnership for 21st Century Learning (P21) and the proposal by Joynes et al. (2019) to develop the 4Cs within the context of teaching core subject areas. This study examined the development of the 4Cs in the TESL program at an ITE in Malaysia. The 4Cs are 'Critical thinking', which involves finding solutions to problems; 'Creativity', which entails thinking outside the box; 'Collaboration', which involves working with others; and 'Communication', which involves talking to others (Stauffer, 2020).

As teaching in the 21st century is becoming learner-centred, investigating only TPACK or the knowledge of using ICT for integration in the classroom is insufficient. As such, this study added the 21st-century learning skills and the SAMR Model to complement TPACK.

2.3. The SAMR Model

The SAMR model or spectrum describes the process of adopting a technology from acquisition to the art of appropriating digital technology into one's teaching practice for targeted outcomes (Puentedura, 2006). The SAMR model comprises four stages: Substitution, Augmentation, Modification, and Redefinition (See Figure 2). The first two stages are 'Enhancement' stages, while the final two are 'Transformation' stages. This model is a useful tool to help teachers gauge their own technology use as they experiment with the implementation of technology-driven learning experiences because it covers the whole spectrum of technology integration.

Figure 2 illustrates the integration stages of ICT using the SAMR model.

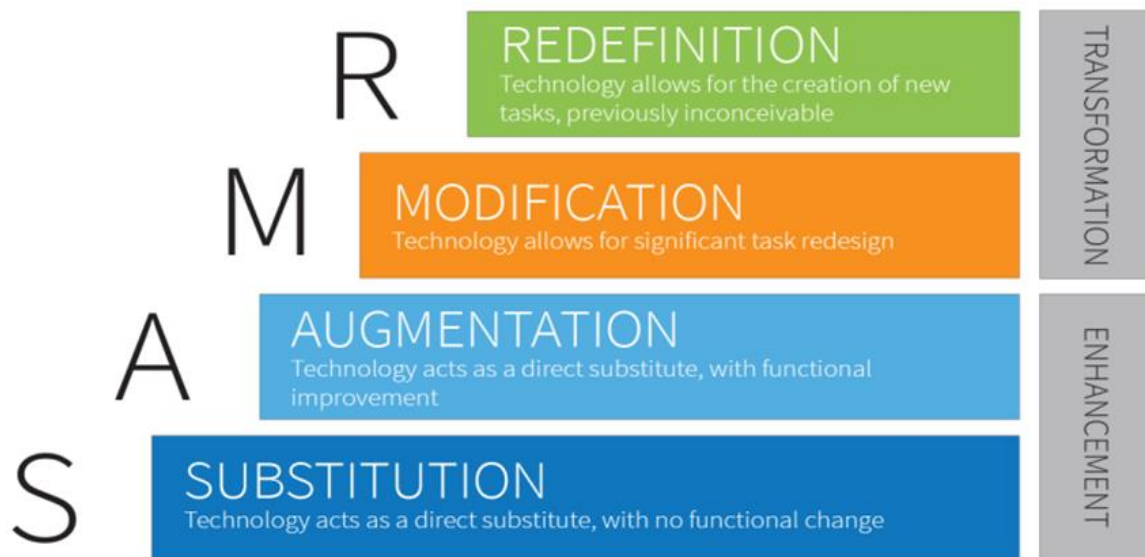


Figure 2. Integration Stages of ICT: The SAMR Model (Developed by Dr. Ruben Puentedura, 2009)

In an ever-evolving technological landscape, the SAMR model has the potential to guide educators in selecting digital technology tools to integrate into their teaching. Therefore, the SAMR model can serve as a guide to achieve transformational learning goals by incorporating additional filters, such as context, creativity, and higher-order thinking skills, into their plans (Hamilton et al., 2016). Along with the SAMR model, educators should consider whether a particular use of technology will improve the learning process and amplify the learning experience. Meaningful learning should be at the centre of teaching and learning (Franco, 2019), not solely technology use. It cannot be denied that the application of technology in classrooms enables us to modify, facilitate, and enhance the process of active learning, but the increasing number of technology options can also make the selection and integration process of classroom technology confusing and challenging. Nevertheless, this confusion can be decreased by the application of the SAMR Model for technology integration.

2.4. Problem Statement

Current language teaching pedagogy cannot merely be ‘computerized’ – instead, new ways of teaching must be created when new technologies are introduced (Lawrence, 2018). In such a situation, teacher educators play a critical role in preparing pre-service teachers with the relevant knowledge (Demirtaş & Mumcu, 2021; Hsu, 2012; Koch et al., 2012; Redmond & Lock, 2019; Thomas et al., 2013). However, ICT integration in training pre-service teachers was rather limited (Tran et al., 2020), and the modelling of ICT integration is lacking (Gill et al., 2015; Sweeney & Drummond, 2013; Tojan Alsharief, 2018; Tondeur et al., 2019). In addition, teacher educators themselves are struggling to keep abreast with current technologies (Reyes Jr. et al., 2017; Tondeur et al., 2016; Uerz et al., 2018; Voogt & McKenney, 2017). For instance, the study by de Los Reyes et al. (2017) found that 27% of teacher educators are using and teaching technology, 31% are users of technology but not necessarily teaching it, and 41% reported uncertainty about using and teaching technology. Teacher educators need to be updated with the latest trends in technology experience (Newton, 2020).

The biggest challenge in using digital technology in Teaching and Learning is not the technology itself but the changes in the way it is being used to teach. Therefore, this study aims to contribute to the development of TPACK for the quality integration of 21st-century learning skills (TPACK21cls) in digital technology by identifying needs and gaps, and making recommendations to serve as a guide for teacher educators.

2.5. Conceptual Framework

The conceptual framework of this present study is presented in Figure 3. This study focused on the intersection of the three core domains of teacher knowledge: pedagogical knowledge, content knowledge, and technological knowledge—a unique knowledge base regarding how technology helps learners master specific subject matter (Brantley-Dias & Ertmer, 2013) —and 21st-century learning skills. It was an attempt to investigate a TESL program in an ITE in Malaysia on how teacher educators delivered TPACK21cls, or the knowledge to utilize ICT to create tasks that foster 21st-century learning skills. The 21st-century learning skills encompass communication, collaboration, critical thinking, and creativity, as proposed by the "Framework for 21st Century Learning" (2009) of the US-based Partnership for 21st Century Learning (P21). Then the tasks are evaluated based on the stages in the SAMR Model: Substitution, Augmentation, Modification, and Redefinition. Data collection was done by drawing on the insights of the pre-service teachers and teacher educators.

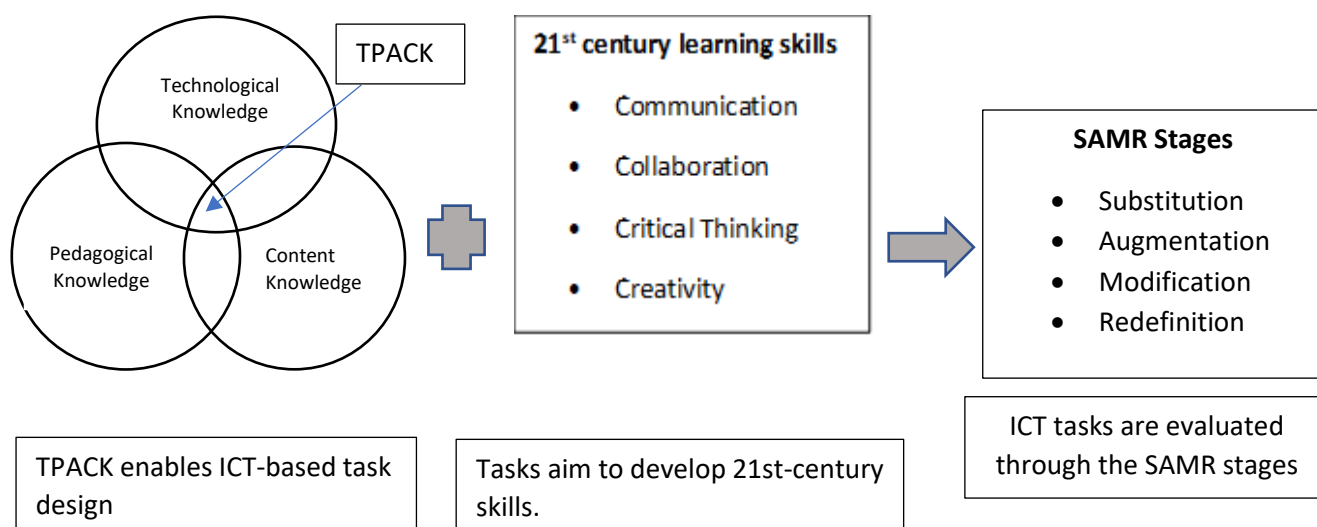


Figure 3. Conceptual Framework of the Study

2.6. Significance of the Study

This study hopes to contribute towards enhancing the understanding and implementation of the concept of TPACK21cls among teacher educators in the TESL program. It is hoped that the findings of this study would be able to inform the effective role played by teacher educators. The researcher hopes to provide guidelines for teacher educators to support the pre-service teachers for improved performance in ICT use for 21st-century learning skills.

Next, it is hoped that this study contributes to the growing body of knowledge of TPACK by enhancing it with 21st-century learning skills and the SAMR Model to teach English. It is anticipated that the findings will help other researchers in this field to continue their research for a more in-depth and comprehensive understanding of how to integrate ICT in the Teaching and Learning (T&L) of English as a Second Language in this millennium. Ultimately, it is hoped to produce pre-service teachers leaving the ITE with sufficient TPACK21cls for quality learning, and raising pre-service teachers' competencies in the integration of ICT for the 21st-century classroom as proposed by Chai et al. (2019).

3. Methodology

3.1. Research Design

This was a holistic single case design since the primary focus of this study was to investigate the TESL program in an ITE in Malaysia on the TPACK21cls stage of the teacher educators and how the

teacher educators delivered TPACK21cls to pre-service teachers, with the aim of knowing which aspects to improve. An exploratory research design was employed to understand the reasons, opinions, and viewpoints of a particular group of people regarding a specific situation.

3.2. Participants

In order to gain the greatest insight into the research questions (Miles & Huberman, 2014), the researcher selected the participants using purposive sampling. This is to provide rich information and also to furnish a better view and deeper understanding through selected respondents who provide the most productive results (Marshall, 1996). Therefore, 11 pre-service teachers and three teacher educators from a TESL program in an ITE were selected for this study.

The sampling was exclusive to pre-service teachers who had completed the TESL programme in June 2023 and the teacher educators who had taught them in the same programme. The students were selected based on the following criteria. They i) have joined the ITE, trained to be English language teachers in the primary schools, ii) have completed their four years of Bachelor of Education degree, iii) were awarded an A for their Practicum 2, and iv) volunteered to participate in this study. Meanwhile the teacher educators have had more than 10 years of service in the ITE. The participants were viewed as individuals who are well-versed in the issues being researched and are able to contribute to the understanding of the situation (Merriam, 2009). Therefore, only pre-service teachers who obtained Grade A during their practicum were selected. They were deemed to be the experts in this study. Details of the research participants are displayed in Table 1.

3.3. Validity and Reliability of the Research Instruments

This study established credibility through certain strategies highlighted by Merriam (2002) and Creswell & Creswell (2018). The strategies were triangulation and member check. Data was triangulated by integrating different methods of data collection, such as interviews and reflections. The data were successfully triangulated as the interview transcripts and reflections yielded similar findings. The next strategy was to use member checking to establish accuracy in the findings (Creswell & Creswell, 2018). This was implemented by returning the interview transcripts to the pre-service teachers to determine whether the information provided during the interview was the same as the information in the transcripts.

To minimize researcher bias, the instruments used in this study (interview questions and reflection guidelines) were validated by a panel of experts in the specific area of research, comprising one representative from Universiti Utara Malaysia, one from Universiti Kebangsaan Malaysia, and one from *Institut Pendidikan Guru Kampus Sultan Abdul Halim*. The interview questions were also validated by three pre-service teachers in the pilot study.

Dependability refers to the consistency of the approach across different researchers (Gibb, 2007). In this study, the internal consistency of the research instruments (interviews and reflections) was established through the evaluation of two coders. The data collected from the study was interpreted for its consistency.

According to Lincoln and Guba (1985), researchers can employ an audit trail and reflexivity to show the neutrality of the research interpretations, while Creswell and Creswell (2018) opine that an external auditor can offer an objective assessment of the study throughout the research. Hence, the researcher appointed a teacher educator from the Language Department to be the external auditor in this study. The audit trail for this study considered the interview transcripts and reflections. The researcher achieved confirmability through the use of an audit trail, member checking, and triangulation techniques.

3.4. Data Collection

Data for this study were collected from individual interviews with 11 pre-service teachers, who also wrote reflections on their experiences learning to use ICT for T&L. In addition, interviews with three teacher educators from the same ITE were conducted.

Firstly, the interview questions for pre-service teachers were developed based on research questions and a related literature review (Basaran, 2020; Harris et al., 2009; Koehler et al., 2013; Mishra & Koehler, 2006; Redmond & Lock, 2019; Wang et al., 2021).

Next, for the second data source, the pre-service teachers were requested to write their reflections on their experience as students in the ITE. As the pre-service teachers only had to write a one-time reflection of their experience at the ITE, the Gibb's Reflective Cycle (1988) was deemed suitable for this study.

The third source of data were collected from interviews with three senior teacher educators from the TESL department who have been lecturing for more than 10 years. There were eight questions on how the teacher educators delivered the knowledge to use technology in class. It is regrettable that researchers were unable to conduct observations due to restrictions imposed by the Malaysian Education Research Application System (eRAS 2.0, 2022), which prohibited the collection of data through classroom observation and recording of teaching and learning activities.

3.5. Data Analysis

Data analysis was based on interviews and reflections by the pre-service teachers and interviews on teacher educators.

3.6. Interviews (Pre-Service Teachers and Teacher Educators)

The researcher audio recorded the interview sessions. This practice preserves the information which is available for use at any time (Merriam, 1998). To avoid participants' uneasiness with the information being recorded, the researcher assured them of its confidentiality. All recordings were then transcribed for analysis. To ensure that correct transcription was done, the researcher listened to the audio recordings for a number of times. Data from the interview transcripts were coded and later sorted out to identify the themes.

This study followed the steps for conducting thematic analysis by Braun and Clarke (2006) on data collected for the interviews which involved a six-step process for identifying, analyzing, and reporting qualitative data using thematic analysis. The first step was to familiarize with the data. After listening to the recordings and transcribing the dialogue, the researcher read and reread the transcripts to look for initial ideas as it provided the foundation for the subsequent analysis. Second, to generate initial codes, the researcher identified preliminary codes that appeared interesting and meaningful as they were more specific than themes. Third, the researcher interpreted the classified codes by sorting out the data according to predominant themes. Fourth, the researcher combined, refined, separated initial themes for a deeper review. Fifth, the researcher defined and named the themes within the data. Finally, the report was produced by interpreting the data. The results of the analysis were supported with empirical evidence that addresses the research questions. Then the researcher compared the findings with previous literature review and theories to confirm past findings or highlight new themes that emerged (Creswell & Creswell, 2018).

3.7. Reflections (Pre-Service Teachers)

In an effort to provide an overall picture of the pre-service teachers' involvement in the TESL program, they were required to write a reflection by answering the questions covered by the 6 stages of Gibbs' reflective cycle (1988): 1) Describe how you were taught to use ICT for the 4Cs

(Communication, Collaboration, Critical Thinking & Creativity) 2) What were your feelings and thoughts about the experience? 3) What was good and bad about the experience? 4) What did things go well/ not well? 5) What else could you have done? 6) What is your action plan for the future?

The reflections were analysed and coded. Common thoughts and feelings of the participants based on the codes were categorised and the emerging themes were used to write the findings. The researcher utilised a qualitative emerging design approach as suggested by Braun and Clarke (2006) to uncover themes that seemed to affect and influence the experience of the students on how they were exposed to the use of ICT in ITE and ways to integrate ICT in their own classes.

4. Results

Research Question 1: How did teacher educators in a TESL program at an ITE in Malaysia deliver Technological Pedagogical Content Knowledge for 21st-century learning skills (TPACK21cls) to pre-service teachers?

Based on the analysis, two main themes were identified:

- Introduction of digital technology tools to enhance pre-service teachers' own learning
- Delivery of TPACK21cls

Theme 1: Introduction of ICT tools to enhance pre-service teachers' own learning

The development of Technological Knowledge (TK) garnered positive feedback from the pre-service teachers. In interviews, these teachers noted their exposure to various digital technology tools for completing tutorial tasks and assignments. An analysis of their responses revealed the introduction of 21 digital technology tools and applications, which were categorized into six groups: online quizzes (such as Kahoot and Quizziz), audio-video resources (like YouTube, own created videos), online learning platforms (including Edmodo, Schoology, Canvas and Padlet), Google Apps (such as Google Classroom, Google Meet, Google Drive, Google Forms, Google Docs, Google Slides & Jamboard), other online tools (like Mentimeter, Wordwall, Powtoon, and Canva), and in-class digital technology tools (such as PowerPoint and interactive board). Notably, these tools were introduced to enhance the pre-service teachers' own learning experiences as students.

Theme 2: Delivery of TPACK21cls

The pre-service teachers had the opportunity to engage in communication and collaboration through online platforms as students, but they lacked experience in performing these tasks as teachers in their assignments and tutorial activities. Interestingly, they indicated there was no memory of the teacher educators guiding them on how to plan lessons using ICT tools for teaching and learning the four skills in English.

Online quizzes like Kahoot and Quizziz were employed by teacher educators for both introducing topics and assessing understanding during tutorial classes. They were used merely as a means for communication between teacher educators and pre-service teachers, primarily to generate enthusiasm among the latter for participating in the game. Unfortunately, there was no formal guidance on utilizing Kahoot for instructional purposes in T&L. Similarly, the pre-service teachers could not recall of any incidences where the teacher educators guided them on planning a lesson using YouTube videos. Although teacher educators encouraged the use of digital technology in the classroom, they did not explicitly provide instructions on its implementation.

Meanwhile, online platforms such as Edmodo, Google Classroom, Schoology, and Padlet were used by some teacher educators only to make announcements and share resources with the pre-service teachers. There were no instances of preparing the pre-service teachers for using the platforms with their pupils. It can be concluded that the teacher educators have modelled various

digital technology tools which could be used for communication and collaboration to the participants. However, the delivery of TPACK21cls by the teacher educators to the pre-service teachers was not explicit.

When asked about using ICT tools to fostering creativity and critical thinking, the pre-service teachers struggled to address questions related to teaching with digital technology to promote these skills. This shows the lack of knowledge about TPACK for creativity and critical thinking.

Despite efforts by teacher educators to support the transition of students' knowledge in using digital technology for communication, collaboration, and task creation, there appeared to be insufficient scaffolding. The management of digital tools was solely handled by teacher educators for the pre-service teachers, who merely utilized them as students, without receiving direct or explicit support on their instructional use.

It can be concluded that the teacher educators have modelled various digital technology tools which could be used for the 4Cs for the pre-service teachers. However, the delivery of TPACK21cls by the teacher educators to the pre-service teachers was obviously not explicit. The students had some knowledge on how to use the various digital technology tools for the 4Cs, for their own preparation for class. However, they did not have any experience to create tasks for their pupils to use the ICT tools at school.

Research Question 2: What were the TPACK21cls stages demonstrated by teacher educators in a TESL program at an ITE in Malaysia?

Based on the analysis, four main themes were identified:

- TPACK for communication
- TPACK for collaboration
- TPACK for critical thinking
- TPACK for creative thinking

TPACK for Communication

The teacher educators have used various ICT tools for communication with the pre-service teachers. The tools encompass online learning platforms (Edmodo & Schoology), online quizzes (Kahoot and Quizizz) and Google applications (Google Docs, Google Drive, Google Meet, Google Classroom).

Videos were used as a digital medium to enhance learning and understanding, to present concepts and ideas, and to motivate pre-service teachers to learn more. Next, videos were usually used during the set induction to attract the pre-service teachers' attention. The second and third tools used for communication were PowerPoint and online quizzes (Yahoo or Quizlet), which replaced old technologies like flash cards and manual quizzes, with the purpose of getting the learners more excited.

Communication was evident between the teacher educator and the pre-service teachers for conveying messages and conducting assessments. TPACK for communication was at the substitution stage, as other digital technologies were not necessary to carry out the learning task, and the digital technology tools were used by the teacher educators only for presenting concepts.

Additionally, the online learning platforms were used as a medium to make announcements and share resources with the participants. This example illustrates the use of an online platform, a digital tool, to replace outdated technology, indicating that ICT use was at a substitution stage for communication between teacher educators and pre-service teachers. The ICT tools were used to

produce something as common classroom tasks, such as making announcements and asking questions.

Nevertheless, it is interesting to note that some teacher educators have taken the initiative to introduce the use of online learning platforms for communication, even before the COVID-19 pandemic, although the teaching of English via an online learning platform was not specified in the curriculum. These teacher educators have actually taken a step towards achieving a functional and updated role to meet the demands of students today (Artacho et al., 2020).

TPACK for Collaboration

The medium used for collaboration was similar to those for communication. They were online learning platforms like Padlet, Google Docs and Google Slides. These platforms were used not only to replace the traditional face-to-face interaction and communication, but to transform learning. All three platforms mentioned have been transformed into avenues for the participants to collaborate, provide feedback, evaluate and give comments. Modification stage of TPACK21cls was evident as the online platforms for virtual communication has been modified for collaboration among the participants. For example, the Google applications, originally used for communication (substitution stage) had been transformed and modified for group discussions.

TPACK for Critical Thinking

Critical thinking calls for cognitive skills such as comparison, classification, sequencing, patterning, webbing, and planning (Partnership for 21st Century Skills, 2009). Thus, TPACK for critical thinking would mean the knowledge to use ICT for the mentioned cognitive skills. In the context of this study, the most popular ICT tool and the closest to promote critical thinking in class was Kahoot. It was used as an ICT tool for assessment by the teacher educators in lectures and tutorial classes. In this online quiz, questions and answers were displayed, and the learners had to select the correct answer from the options provided, thus fostering some critical thinking in the learners.

As for the stage of TPACK21cls spectrum, it can be categorized to be at substitution stage. The digital tool simply provided a digital medium for learning to take place, with no additional use of other ICT tools to complete the task.

TPACK for Creative Thinking

For creativity to happen, many online tools are involved. This clearly indicates that ICT use needs to be in the Augmentation stage of TPACK for creativity. Unfortunately, TPACK for creativity was not evident in the tasks created by the teacher educators.

Table 1 summarises the ICT tools used by teacher educators and the stages of TPACK21cls demonstrated in the TESL program based on the TPACK21cls spectrum.

Table 1. A summary of the ICT tools and stages of TPACK21cls

TPACK21cls	ICT Tool	TPACK21cls Stage
TPACK for communication	Power point	Substitution
	Worksheets	
	Videos	
	Online quiz	
	LMS	
TPACK for collaboration	Google Docs	Modification
	Google Slides	
	Padlet	
TPACK for critical thinking	Online Quiz	Substitution
TPACK for creativity	NA	NA

4.1. Emerging Themes

The emerging themes are presented as a supplement to the study's main findings. The following section reveals the emerging findings obtained.

Challenges Faced by Teacher Educators

The teacher educators confessed to not having the expertise to teach their pre-service teachers how to effectively use technology in teaching, as they were constrained by their own limited knowledge of digital technology. They admitted that they were still learning to use digital technology tools themselves and felt constrained by their own limited understanding of these tools.

They also reported that the integration of ICT tools was not explicitly stated in the Course Summaries of the courses in the TESL program. There were no specific learning outcomes on how to plan a lesson with ICT tools. It was only embedded in the practicum rubrics for assessment that students are to use ICT tools in their lessons.

On top of all these challenges, there were some limitations of basic infrastructure, such as constraints on facilities and slow internet connections. The teacher educators found teaching with ICT tools daunting and troublesome, as time was wasted on setting up the tools and troubleshooting whenever there were technical problems. According to one teacher educator, an effective lesson could still take place without the use of ICT tools.

Suggestions for Improvement

The teacher educators shared some suggestions to improve their own knowledge on integrating ICT tools into their lessons. They recommended that the institution have more courses and workshops for Professional Development for the teacher educators. They also hoped there must be continuity and sustainability whereby the ICT team or experts in ICT would always be on standby to provide support and guidance to the teacher educators. Collaboration with the ICT team could be done through mentor-mentee sessions.

As for a guide to use ICT tools in T&L, they agreed that TPACK21cls is important as the knowledge will assist them to plan and conduct effective lessons with ICT tools. All of them agreed that planning has to start from the Learning Outcomes of the lesson, followed by the methods, techniques, or activities to be conducted to achieve the learning outcomes. To enhance teaching with ICT, the final step is to identify the ICT tools that are suitable to assist in implementing the lesson and achieving the learning outcomes. The rationales of each step taken also takes a central position, especially so to integrate the 4Cs in the use of digital technology tools. Hence, they must be included to the lesson plans too.

In order to improve teacher education to strengthen the support for TPACK21cls, a course on ICT use for all the different skills (listening, speaking, reading, writing) is recommended to be added to the curriculum to expose the TESL pre-service teachers to the tools and guide them on how to plan their lessons with ICT.

5. Discussion

Research Question 1:

There was much evidence that TPACK was not explicitly delivered to the pre-service teachers in the ITE. The teacher educators gave the pre-service teachers tasks which use digital technology to complete for tutorials and assignments. They were not taught how to use ICT for T&L. The findings support the views of Gill et al. (2015), Sweeney and Drummond (2013), Tojan Alsharief (2018) and Tondeur et al. (2019) that scaffolds and authentic technology experiences of digital technology integration are lacking. It is also congruent with studies by Tunjera (2019) and Jamieson-Proctor (2018) who highlighted the absence of a framework to teach with technology and to provide opportunities to develop the 4Cs.

The analysis also shows that the teacher educators constantly encouraged and motivated the participants to integrate digital technology in their T&L during their practicum. However, the teacher educators' effort of scaffolding was only limited to introducing some ICT tools or applications to the participants. They have not specifically taught the participants how to plan their lessons using digital technology. This finding is consistent with the study by Koh and Divaharan (2013) that there was still a lack of hands-on exploration of digital technology tools to better support the initial stages of teachers' TPACK formation, and the views of Tondeur et al. (2020) that there is still not enough of exemplary TPACK lessons and experiences during field practices. This finding is also congruent with the views of Harris et al. (2009), who argue that many current technology integration strategies are techno-centric, often omitting sufficient consideration of the dynamic and complex relationships among content, pedagogy, and technology. Similarly, Mohamad Nasri et al. (2020) also found that there is a lack of TPACK being disseminated by the teacher educators.

Research Question 2:

The teacher educators used technology mostly at substitution stage and admitted that they were constrained by their own knowledge to use ICT in T&L. The findings are congruent with studies conducted by Tondeur et al., 2016; Reyes Jr. et al., 2017; Uerz et al. (2018), and Voogt & McKenney, 2017 that course instructors themselves were still struggling to keep abreast with current technologies and are in need to be updated with the latest trend to add momentum to the job of moving education forward (Newton, 2020). A probable reason could be the lack of institutional support and qualified teacher educators who could successfully use and integrate technology into their teaching, as discovered by Aşık et al. (2019) in their study in Turkey, Portugal, and Poland.

Another reason could be the limited understanding of effective technology integration into their pedagogies (Chigona & Tunjera, 2020).

Many are still using digital technology parallel to the traditional method and not applying innovative teaching strategies (Tondeur et al., 2017), and this is evident in the study conducted. Consistent with this finding is the view by Tunjera and Chigona (2020) who discovered that most teacher educators were still using a low ranking level of digital technology integration, such as substitution and augmentation, as in the SAMR model. Many educators were not even aware of software applications that could add value to early literacy using technology for their students (Voogt & McKenney, 2017).

This finding also resonates with the findings by Dong and Mertala (2019) requesting for more specific ICT policies and curriculum guidelines to reflect the role of ICT in the early years and support of teachers' ICT professional training and development to enable them to harness the potential of ICT for young children (Dong & Mertala, 2019). This can be further investigated in future research studies.

In conclusion, this finding supports the views by Silber-Varod et al. (2019) for the need to promote the awareness of digital learning competencies in educational research literature, which is marginal, and educational research, which seems to lag behind. It is also congruent to the report by Muianga (2019) that the involvement of teacher educators in the change from traditional teacher-centred teaching and learning to innovative pedagogy remains a challenge.

6. Conclusion

The exploratory study was to investigate how TPACK1cls was delivered by teacher educators to the pre-service teachers and the stages of TPACK21cls demonstrated by the teacher educators in a TESL programme in an ITE in Malaysia.

At the outset of this study, based on the literature, it was anticipated that TPACK21cls was missing in the TESL curriculum. Subsequently, the findings of this study were able to confirm some previous findings and also provided a number of new contributions, some of which are actually ground breaking in nature. Besides that, a number of new phenomena and concepts emerged from this study. The emerging concepts are associated with challenges faced by teacher educators and suggestions for improvement.

The study has contributed to the enhancement of teaching English with ICT and to the current literature on the TPACK framework and the 21st century learning skills (4Cs). The findings also provided noteworthy contributions to adapt the TPACK framework to prepare pre-service teachers with the knowledge to use ICT for the 4Cs to teach English.

A major finding of this study is the integration of Mishra and Koehler's (2006) TPACK intersection, the 4Cs in the 21st century learning skills (Stauffer, 2020), and Puentedura's (2006) SAMR spectrum. This new integration is termed as TPACK21cls. The presence of TPACK21cls could help address the issue highlighted by Graham (2011) of the TPACK model's failure to provide a practical, transparent, and overarching theoretical framework for technology integration. This challenge includes implementing the TPACK theory and integrating technology, which is a complex, multifaceted, and ill-structured domain.

This study has increased our understanding of the development of the knowledge to use ICT to teach in the TESL curriculum and the pre-service teachers' experiences at an ITE in Malaysia. Curriculum designers need to acknowledge that there is a problem in the curriculum, particularly in the delivery of planning, teaching, and task design using ICT tools, as well as in preparing pre-service teachers for teaching with 21st-century learning skills. As such, identifying and realizing the problems,

as contributed by the present study, can serve to bring out changes in the curriculum of ITE in Malaysia and to improve the quality of teaching English with ICT in the 21st century.

Teacher educators and pre-service teachers were predominantly using ICT at the substitution stage. None of the pre-service teachers made attempts to use technology at modification and redefinition levels in the preparation of their pupils' tasks and activities. This is very worrying as we are now no longer at the beginning of the 21st century. Stepping into the era of IR5.0, it is pertinent to nurture future-proof talents with constant reviewing of the course curriculum and teaching and learning strategies, especially so in the use of ICT in T&L.

Pre-service teachers and lecturers at the ITE need to realize that the use of ICT is not merely replacing old technology with new digital tools, or simply using videos, PowerPoint, and online games to present and display information to their pupils. Therefore, pre-service teachers and lecturers alike need to be able to create tasks and activities using ICT at the modification and redefinition stage. They need to know what, how, and why they are using the ICT tool.

Having TK is the basis but not the answer to quality teaching. Instead, acquiring the relevant TPACK21cls is just as important, if not more important, in achieving the goal of developing the talents of digital natives who can ride the waves of digital transformation. There must be a continuous effort to break the traditional practice of using ICT just for the sake of doing so. Both lecturers and pre-service teachers must realise the importance of TPACK21cls.

7. Suggestion

This study has placed the framework in a new environment and attempted to break new ground involving the application of the TPACK framework. With the presence of 21st-century learning skills, this study proposes incorporating the 4Cs to further enhance the TPACK framework. In fact, the researcher synergistically combined the enhanced TPACK framework with the SAMR Model to arrive at one new framework – TPACK21cls.

This proposition is depicted in Figure 4.

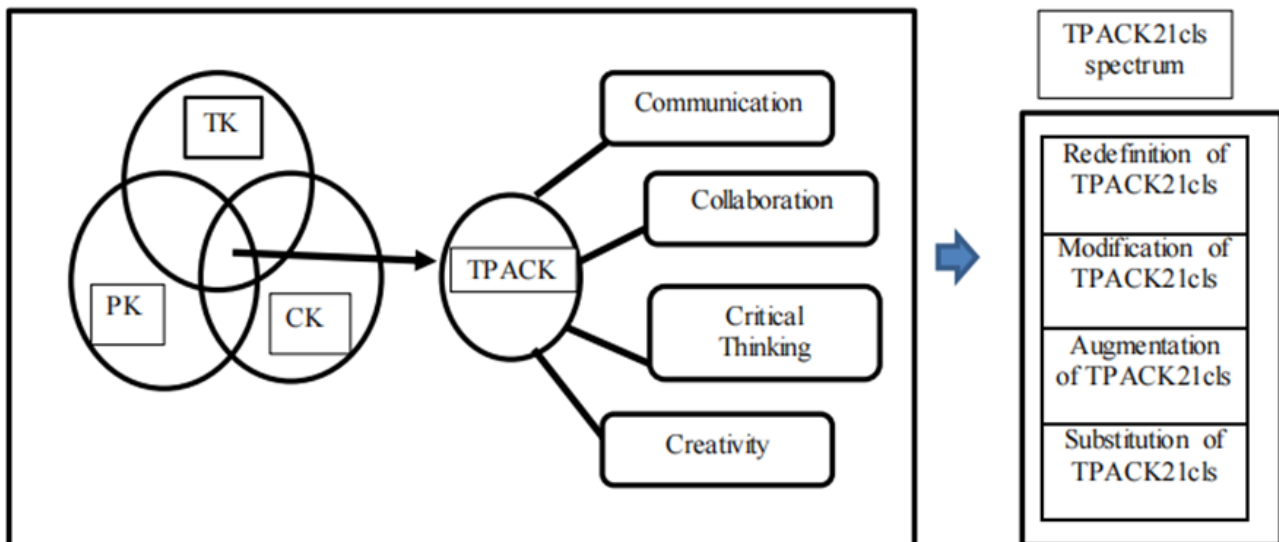


Figure 4. Proposed TPACK21cls Framework

The TPACK21cls framework would serve as an exemplary model on how TESL teachers can create tasks with ICT for their pupils. The TPACK intersection, 21st century learning skills (4Cs) and SAMR model can be integrated in preparing tasks using ICT tools. The study recommends the theoretical model, descriptors and sub-components for TPACK and SAMR to be modified for the development of TPACK21cls. Therefore, this study expands and supports the TPACK21cls model as a

suitable model with added dimension to develop the knowledge to use ICT for teaching English in the ITE. This case study made clear that to evaluate the potential of TPACK21cls framework, there is a need to look at the nature of the task and the use of ICT by the pupils and not the teachers.

The existing TPACK framework and the descriptors for SAMR model need to be modified according to the context. As the descriptors for SAMR are described in general statements, there is a need to modify the descriptors to fit the use of ICT to teach English in the tasks planned. Additionally, as a new spectrum to gauge the ICT tasks created, which involves the use of ICT, research is needed to pursue the idea in this new direction to obtain more conclusive findings. The rubrics for the different stages of TPACK21cls with reference to the SAMR spectrum are described in Table 2.

Table 2 displays the TPACK21cl descriptors.

Table 2. TPACK21cls Descriptors

TPACK21cls Stage	SAMR descriptor (Puentedura, 2006)	TPACK21cls descriptor	Examples
Substitution	"Tech acts as a direct tool substitute, with no functional change."	Teachers/pupils substitute the use of old technology with new technology, without functional change.	<ol style="list-style-type: none"> 1. Pupils write for writing practices using computers instead of writing on papers. 2. The teacher uses PowerPoint to present the lesson instead of the textbook.
Augmentation	"Tech acts as a direct tool substitute, with functional improvement."	Pupils use technology for language learning and also use other ICT tools to help them more efficiently.	<ol style="list-style-type: none"> 1. Pupils practise their writing using Microsoft word (substitution). In addition, they use online thesaurus to look for words to write better, allowing them to learn more knowledge in the process.
Modification	"Tech allows for significant task redesign."	<ul style="list-style-type: none"> - Pupils complete a task on an online platform. - On the same platform, pupils can discuss and give feedback or evaluate the task online. -The application of technologies involves more technological functions and different kinds of learning tasks. 	<ol style="list-style-type: none"> 1. The digital platform is not only for writing (substitution) but modified as a collaborative platform. 2. Pupils make a poster presentation using any ICT tool for writing activities. The task is not only on writing but modified by giving other online learning tasks (e.g., summarising, search for images, etc.)
Redefinition	"Tech allows for the creation of new tasks, previously inconceivable."	Pupils practise their language skills in various forms in real-life contexts, which might be challenging to implement without technologies.	<ol style="list-style-type: none"> 1. Pupils record a video of a storytelling session and upload it to YouTube to reach worldwide viewers. 2. Use of social media for broader access to communicate with others.

The second suggestion on practice is related to the teacher educators. The analysis indicated the quality of the teacher educators entrusted to deliver the curriculum needs to be given attention. Teacher educators entrusted to deliver the curriculum must possess both the necessary TK and TPACK21cls to effectively build pre-service teachers' ability to integrate technology in the classroom and stay current with emerging technological trends. One proposed approach is to have collaboration between teacher educators from the TESL department and lecturers from the ICT department, such as joint discussions on planning lectures. Based on the learning outcomes and planned activities, ICT lecturers can recommend appropriate ICT tools to enhance teaching and learning. As experts in their respective fields, they serve as More Knowledgeable Others (MKOs), in terms of Vygotsky's scaffolding theory. Therefore, establishing collaboration between these departments is proposed to provide pedagogical and technological support to teacher educators.

8. Limitations

As this case study was conducted in only one ITE in Malaysia, the sampling used limits the generalizability of the findings. However, the findings are likely to have some bearing on the TESL programme in general since ITEs in Malaysia implement a centralised curriculum which the ITEM of the Ministry of Education of Malaysia monitors. Similar studies can be conducted on other major courses in the ITEs in Malaysia in order to enhance the understanding of the research and potentially broaden any generalisation. This is pertinent as the use of ICT for teaching and learning activities may differ significantly in different course majors. Future studies could include a more diverse sample across multiple regions to increase generalizability. Additionally, further research employing a mixed method approach could help validate and explore the newly identified spectrum – TPACK21cls, offering both quantitative and qualitative insights into its applicability in diverse contexts. The outcomes of these future studies can further enrich and complement the findings of this study.

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Declarations

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