



# Digital Native Teacher vs Digital Immigrant Teacher: A Systematic Literature Review and Research Agenda

Halimah Sa'diyah and Wibowo Heru Prasetyo<sup>(✉)</sup>

Faculty of Teacher Training and Education, Universitas Muhammadiyah Surakarta, Surakarta, Indonesia

whp823@ums.ac.id

**Abstract.** This study aims to provide an overview for educators and education policymakers on how to integrate learning technology and improve the skills of digital teachers, both digital immigrants and digital natives. This study used a systematic review method of literature published by research journals from January 2017 to August 2022. This study was guided by the PRISMA review protocol and used four databases: Scopus, Springer, ERIC, and DOAJ. This search focuses on determining areas related to digital competence, TPACK, digital immigrants, digital natives, and teacher digital competence. The results obtained show that there is 33 literatures (only 6%) of the total search results of 513 relevant literature. This study uses thematic analysis to code, organize categories, and develop themes. Based on the thematic analysis, these findings produce two main themes, namely teachers' digital pedagogy and the teachers' digital gap: digital immigrant vs digital native. This review adds to what has already been written by pointing the way for future research and giving ideas for digital skills training and monitoring its sustainability in the application of digital skills training so that teacher competency development can be improved as much as possible.

**Keywords:** Digital Competence · TPACK · Digital Immigrants · Digital natives

## 1 Introduction

The development of information and communication technology (ICT) in the last few decades has grown rapidly, especially in education. Technology and education are inseparable parts of human life. Technology has evolved into a supporting tool in education, making it easier for teachers to teach students and achieve the desired results [1]. Education today is essential in the 21st century because it ensures that students can learn, utilize technology and information media, and work and survive using their life skills [2].

Since the COVID-19 pandemic, there have been significant changes in the use of ICT in learning. That has forced all sectors to switch to the digital world, including education. This condition positively impacts teachers' ability to use ICT to improve learning [3]. Technology integration in education is critical to meeting the challenges of

the twenty-first century. However, school teachers often experience increasing pressure to integrate ICT into teaching [4]. Mukminin et al. (2019) said that incorporating technology into teaching is sometimes seen as an extra responsibility for teachers because they often focus only on their daily tasks, such as managing lesson planning, delivering instruction, conducting assessments, and managing classrooms [5]. As a result, some teachers perceive technology integration as a formidable task [6]. In many cases, it encourages them to continue using technology for learning [7].

The demand for the integration of ICT into teacher education curriculum design in the face of the digital revolution is something that the government can consider [8]. Teachers in the 21st century are expected to be able to integrate technology into all aspects of education, such as curriculum design, implementation, administration, and evaluation [9]. Therefore, a teacher needs to integrate technology, pedagogy, and content knowledge (TPACK) to survive in the education system in the future [10]. The concept of TPACK emerged as a measure of teacher competence [11, 12]. In addition, a more comprehensive range of skills is needed to learn, communicate, collaborate, and solve problems in a digital environment. 21st-century skills have been identified by UNESCO, the Organization for Economic Cooperation and Development (OECD), and others as critically important competencies for developing a sustainable knowledge society [13]. TPACK is a teaching framework for integrating technology into learning [14]. Several studies to date have provided substantial evidence that learning by design in groups has emerged as an effective educational pedagogical approach to encourage the development of TPACK [15]. Habibi et al. (2020) and Mailizar et al. (2021) use the TPACK framework because it effectively predicts how pre-service teachers will utilize digital technology in the classroom [16, 17]. Knowledge of technology and content regarding mastery of TPACK was found to be very influential on the collaborative ability of teachers working in educational institutions [18].

The challenge for teachers in integrating technology is dependent on mastering ICT skills. There are two generations in the digital era: digital natives and digital immigrants [19]. Junior teachers consider themselves representations of digital natives who rely heavily on ICT in their daily lives, especially during learning [20, 21]. Digital native teachers are not ready to integrate learning media with teaching practices [22]. In addition, senior teachers, commonly referred to as “digital immigrants,” are said to lack knowledge and expertise in using the internet in teaching [21, 23]. It is a challenge for teachers, especially those less accustomed to using technology in the classroom. Digital native teachers are often considered to have better skills in ICT mastery. Unfortunately, not all digital native teachers implement their skills in the classroom. On the other hand, digital immigrant teachers have lower ICT usage skills, making it challenging to integrate ICT into teaching practice.

In general, this study investigates the difficulties that digital immigrants and digital native teachers face when integrating TPACK. The results of this study are expected to provide a theoretical attitude that helps teachers, principals, policymakers, and other stakeholders formulate a formula for improving the competence of teachers. The following main questions drive this study: (i) How does the current literature inform us about the implementation of TPACK by teachers?; and ii) How does current research

inform us about the challenges that digital immigrants and digital native teachers face when integrating TPACK?

## 2 Method

The method used in this research is a systematic literature review (SLR). Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) are used in this literature review [24]. Initially, PRISMA was developed by the medical community and then widely used in many research fields, especially for evaluation and intervention studies [25, 26]. Systematic reviews have different characteristics compared to meta-analyses. It is a type of exhaustive literature review that aims not only to synthesize empirical results but also to critically analyze and differentiate selected literature based on specific research questions [27]. In a systematic review, a study is guided by questions formulated “to identify, select, and critically assess relevant research, then collect and analyze data from the studies included in the review” without a statistical approach [26]. This study also emphasizes the role of digital immigrants and digital native teachers in integrating TPACK.

### 2.1 Data Sources

This study uses databases that are familiar to scholars in Indonesia, namely Scopus, Springer, ERIC, and DOAJ. TPACK is often used interchangeably with other terms such as “digital competence,” “digital skill,” and “digital proficiency,” especially to describe the ability to use digital technology. This study determines the search keywords using the following terms: “digital competence,” “TPACK,” “digital immigrant,” “digital native,” and “teacher digital competence.” Therefore, this study uses these keywords in each database with the following Boolean search actions:

(TITLE-ABS-KEY (digital AND competence) AND TITLE-ABS-KEY (tpack) OR TITLE-ABS-KEY (digital AND immigrant) OR TITLE-ABS-KEY (digital AND native) OR TITLE-ABS-KEY (teacher AND digital AND competence)) AND PUB-YEAR > 2016 AND (LIMIT-TO (PUBSTAGE, “final”)) AND (LIMIT-TO (OA, “all”)) AND (LIMIT-TO (DOCTYPE, “ar”)) AND (LIMIT-TO (LANGUAGE, “English”)) AND (LIMIT-TO (SRCTYPE, “j”)).

This literature study found abundant scientific sources. Thus, determining the right keywords is imperative. Each database has features that make the search process easier. This study uses the “Advanced Search” feature to filter findings based on predetermined inclusion criteria.

### 2.2 Inclusion and Exclusion Criteria for Selection of Publication

This study limits the criteria in the database to determine that all articles included are suitable to answer the research question, “What do references say about integrating teachers’ TPACK?” This study uses the following limitations:

- i. Published between 1 January 2017 to 10 August 2022. The selection of this date range is based on the findings of empirical research on TPACK.

- ii. Focusing on the behavior of using technology in education.
- iii. Research is conducted at all levels of education worldwide, including primary, secondary, and higher education.
- iv. Open Access articles.
- v. Published in an academic journal.
- vi. Peer-reviewed.
- vii. Published in English.

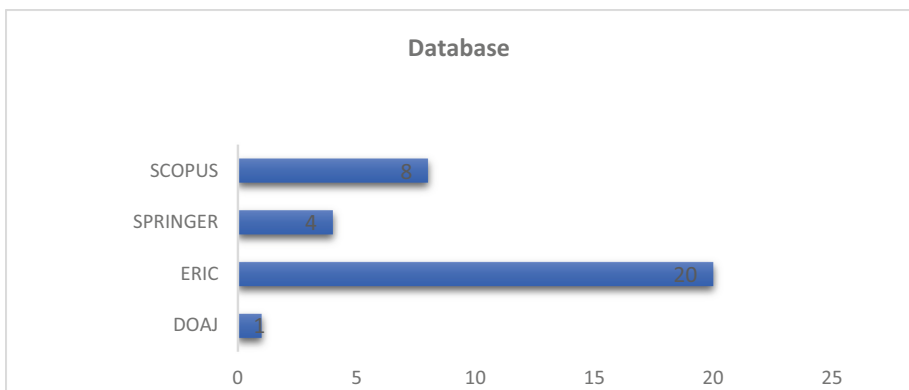
There are several reasons for applying a criterion constraint. First, articles containing discussions about TPACK, digital immigrants, and digital natives were found in many databases. Second, the study of TPACK has, in recent years, become a center for educational technology research and teacher professional development in various disciplines.

### 2.3 Screening and Eligibility Assessment for Data Analysis

This research was conducted based on several stages and inclusion criteria. First, all articles that meet the criteria are screened. Second, abstracts from the article sections were screened to ensure relevance to the research objectives. Third, this research conducts an in-depth reading of the full text of each article. Fourth, analyze the complete components of the article text and conclude the results of the article analysis.

Figure 1 shows the number of articles from each database. The majority of articles are from ERIC, which is a database about education. Based on Fig. 2, 33 articles in the fields of education, ICT, and digital media studies were obtained from 20, 10, and 3 articles, respectively. This study uses a one-year limit for publication between early 2017 and mid-2022. In that time span, the majority of articles were published in 2021.

After being confirmed with the stated criteria, this study develops a thematic code for articles. The review process is continued by conducting a content analysis of the main findings. This stage aims to provide an overview of the general discourse about TPACK. Finally, this study elaborates on the findings to answer the research question in line with highlighting the scope of TPACK (Fig. 3).



**Fig. 1.** Characteristics of included studies: Database

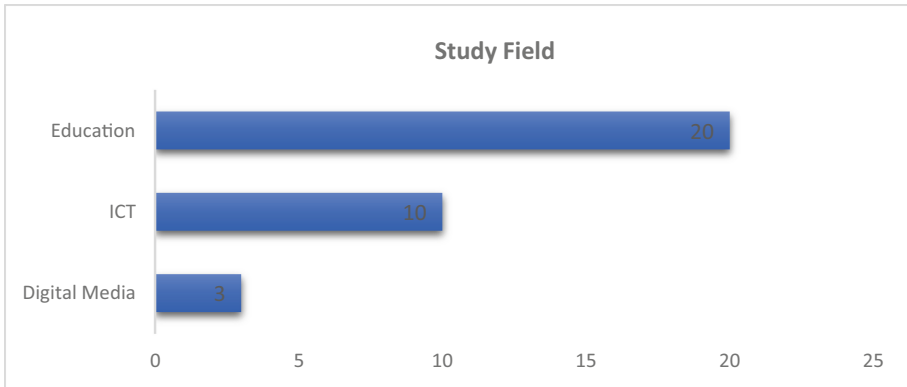


Fig. 2. Characteristics of included studies: Study Field

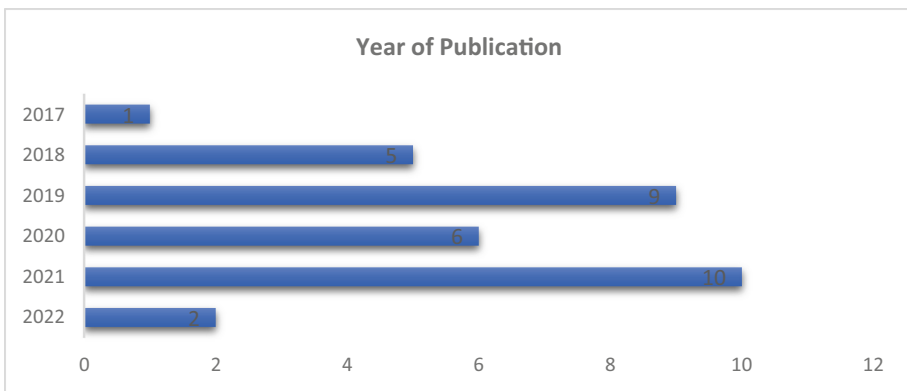


Fig. 3. Characteristics of included studies: Year of Publication

### 2.4 Screening and Eligibility for Data Analysis

Appropriate protocols are essential to maintaining accountability, trust, and transparency in determining what is done, discovered, and reported [24, 26]. The PRISMA flowchart contains a checklist that helps researchers ensure each step follows the guidelines. In addition, it is helpful to reduce selection and conclusion bias. As mentioned earlier, the information management flow consists of filtering and including the various documents found. Figure 4 shows that this study obtained 513 articles consisting of journal articles in most fields of study, such as education and computer science. Of these, 9 articles were published in more than one database, so 504 articles were screened. After removing duplicate publications, the researcher applied the inclusion criteria and excluded studies that did not meet the quality threshold by reading the titles and abstracts and then finding 449 articles that did not meet the inclusion criteria. Therefore, only 55 articles were eligible for the full-text screening process. As a result, this study examines 33 articles using thematic analysis based on several criteria: i) has context on educational issues and the use of technology in teaching practice; ii) contains elements of TPACK

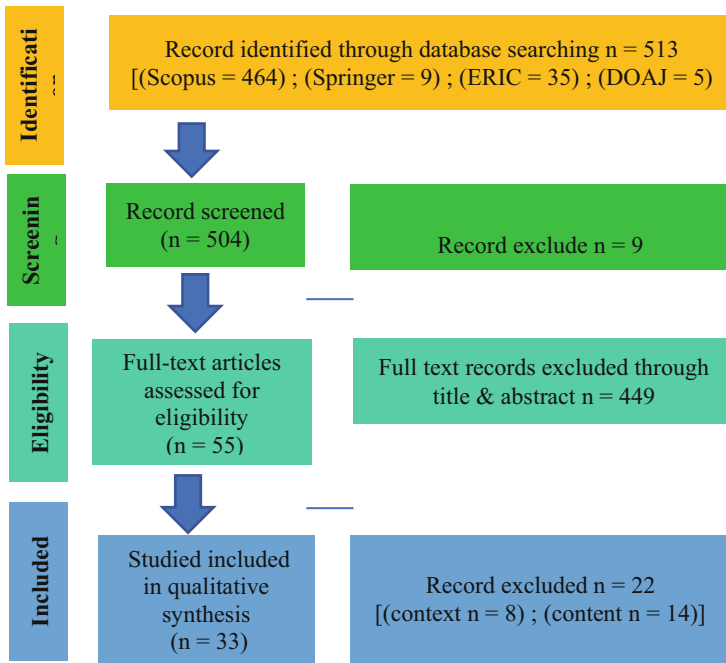


Fig. 4. PRISMA flow diagram for systematic review

or is a digital immigrant or digital native; iii) represents the most recent publication of the respective authors; iv) is a peer-reviewed article. Then, a qualitative assessment was carried out based on the quality of the articles, as suggested by Pettingrew and Roberts (2008). The quality assessment was formulated to evaluate the completeness of the journal articles that were screened using inclusion and exclusion criteria and were favorable for data extraction. All articles were graded to categorize them into three groups: high, medium, and low. This process has categorized eight articles as “high” and 25 articles as “medium.” Thus, 33 articles had to be reviewed.

### 3 Result and Discussion

#### Result

A qualitative content analysis is used in this research to provide an overview of the integration of TPACK. It starts to clarify every major key in the article. One article may have more than one main concept, and there is no limit to the number of articles that can be written on a concept that appears in an article. Each concept illustrates the aspects on which TPACK is developed. Figure 5 shows eleven main TPACK concepts for teachers: digital competence, digital skills, digital proficiency, teacher training, pre-service teacher, technological pedagogy, content knowledge, technology knowledge, technology resources, technology adaptation, and ICT competence. From these results,

content knowledge was discussed the most (eight articles), followed by technological pedagogy (nine articles), and ICT competence (eight articles).

Similar topics were discovered using thematic analysis in several articles and were grouped to create themes. The creation of these topics contributes to the creation of an overview of the TPACK integration. The analysis results show two major themes: teacher digital pedagogy and teacher digital gaps. Figure 6 illustrates the distribution of articles included in each theme.

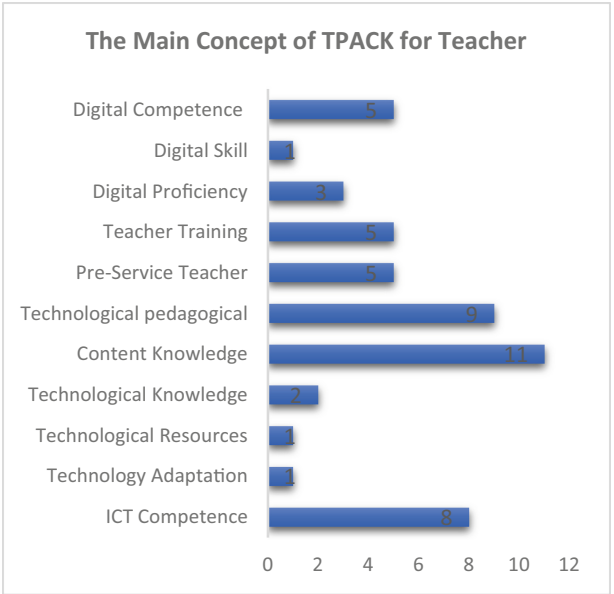


Fig. 5. The main concept of TPACK integration for teachers

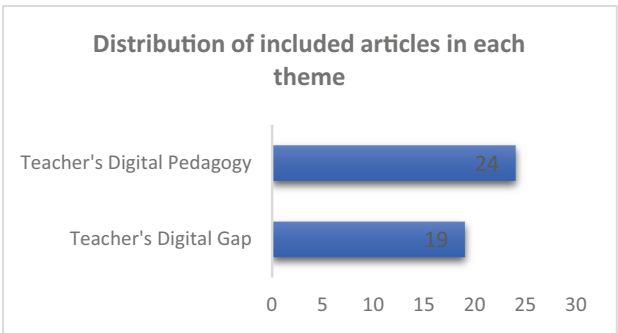


Fig. 6. The main concept of TPACK integration for teachers

### 3.1 Teachers' Digital Pedagogy

Digital pedagogy studies how teachers can integrate digital technology into teaching and learning [28]. The study also revealed that student-teacher knowledge of content, pedagogy, and technology was inadequate to overcome technological disruptions in education. In addition, inadequate training from institutions makes teachers seem unprepared to integrate technology into teaching. Thus, the findings reflect that TPACK is one of the most instrumental components of the framework for improving teaching quality.

The teachers' role in digital pedagogy is essential in responding to the learning needs of students in several disciplines [29]. Technology in the world of education continues to experience rapid development but is not followed by the right response. In comparison, TPACK is often used to test pre-service teachers' knowledge of technology integration [30]. TPACK's competence concerns the art of integrating digital technology into pedagogy and subject matter [31]. The use of ICT in teaching can encourage digital competence, acquire new knowledge, enhance learning and cognitive activity, and enable concrete reflective learning experiences through a peer review process [32, 33]. With good TPACK skills, teachers can quickly use digital pedagogy to help students learn and get around any problems that might be in the way [34].

However, several studies emphasize that the application of TPACK in learning is still lacking. Pre-service teachers have a shallow level of competence in using some ICT software applications, and most show no competence at all in using advanced ICT resources [35]. According to Sentürk et al. (2021), teachers in private schools have a higher level of competence in techno-pedagogical competence and individual innovation than teachers in public schools [36]. In addition, Gou et al. (2020) revealed that men sometimes perceive a higher level of competence than women, especially in regards to digital pedagogy [37].

An important factor in ICT is developing ICT and TPACK competencies [38]. Most teachers' technological and technology content knowledge have increased, and they are encouraged to integrate technology knowledge with pedagogical and content knowledge in developing TPACK; however, none of the teachers in this study demonstrated advanced practice [39]. The knowledge possessed by future teachers is divided into three dimensions of the TPACK model: knowledge of teacher disciplines in pre- and post-course training (CK); knowledge of digital teaching competencies (TCK); and their perception of the importance of manipulative, didactic, and pedagogical (TPK and PCK) competencies [40]. The development of teacher TPACK competencies requires providing opportunities for theoretical and experiential learning from technology-based pedagogical approaches [41]. The concept chosen for the learning strategy must be modified to fit the demands of the educational environment. With a pedagogical perspective on children's learning, the TPACK model is more appropriate in scientific education. [42]. The government and partners should emphasize providing teachers with competencies and skills to teach students in the 21st century through training in developing digital pedagogical knowledge [19, 43]. As the development of digital teaching competencies continues to be a challenge that the education system continues to face, it must be addressed. Promoting innovative teaching strategies is the only option to create a teaching innovation landscape today and be the only way to develop a teaching innovation panorama. Furthermore, it can play an important role in developing TPACK



with administrative and budgetary support, availability of technology in schools, and implementation of advanced programs after training [44, 45].

### 3.2 Teachers' Digital Gap: Digital Immigrant vs Digital Native

Teachers' roles and readiness to integrate technology into teaching are critical to improving learning quality. So teachers are required to have good digital competence, but in reality, many teachers have low digital competence, commonly referred to as the "digital gap" [46]. The digital gap can be caused by several factors, namely age, gender, and facilities that support digital competence [28, 37, 47]. Currently, in life, two generations bridge behavioral patterns in digital technology, namely, digital immigrants and digital natives [48].

Teachers who grow up in an era of rapid digital technology development do not guarantee that the development of digital competencies is superior. Digital immigrant teachers are generally more familiar with conventional teaching and learning methods, but that does not mean they are digitally blind [46]. On the other hand, digital natives are generally more proficient in using technology because, since birth, there has been digital technology, enabling teachers to become more competent in TPACK competencies [49]. Research from Kabakci (2018) also reveals a positive relationship between digital native pre-service teachers and TPACK competencies, and they perceive themselves as high-level digital natives [30]. However, the research of Kurniawati et al. (2018) states differently: native digital teachers are not ready to integrate learning media and digital teaching practices [22].

The rapid advancement of information technology shows the attitude of digital immigrants who are reluctant to experiment with new hardware and software for fear of poor results from their creativity [50]. In contrast to digital natives, who have a high digital level in the dimensions of growing with technology, being comfortable with multitasking, and thriving on instant gratification and rewards [30], Digital immigrant teachers are not a homogeneous group in education, and their experience with digital technology is also very varied. The fact is that digital immigrant teachers are more proficient in implementing digital media and are aware of these benefits and the millennial generation's demands [22]. In addition, Mpungose (2020) said that almost no school has good facilities to support technology integration in learning, so teachers cannot maximize the use of technology in teaching [28].

The older generation of teachers, called digital immigrants, have different experiences in the analog and digital worlds. Teachers with an interactive digital pedagogical educational background and experience develop comprehensive TPACKs and integrate them into the classroom in a significant and interactive way, as opposed to those with formal technology education [51]. In addition, the research of Tomczyk et al. (2017) revealed that the younger generation, who are considered digital natives, will be leaders in promoting innovative educational methods that are integrated with ICT [50]. Because of their different learning styles, adapting to new technology quickly becomes one of the most difficult challenges for digital-gap teachers, both digital immigrants and digital natives. These two generations have different levels of digital mindset, experience, and exposure, leading to varying levels of technology accessibility in learning environments.

However, both digital natives and digital immigrants have the same intention: to try to stay connected and follow the latest trends.

Training can help digital immigrant and digital native teachers improve their digital technology competence. In the current educational context, priority has been given to the gradual inclusion of technology in the in-service training of future teachers and the development of TPACK competencies [52–54]. The use of technology in everyday life should not be the main foundation in teacher development. However, they need to develop digital native skills (such as multitasking, efficient visual communication, and information search strategies) to aid the integration of technology in education [30]. They claim that this era of disruption demonstrates the value of ICT-based education, technologically advanced teaching tools, specialized content, and the integration of general-content technology are effective means of improving the quality of learning. Therefore, the development of digital immigrants and digital native pre-service teachers will benefit the development of their technology integration skills and minimize the digital gap.

### Discussion

This study is directed at answering the research questions, “How does the current literature inform us about the implementation of TPACK by teachers?” and “How does the current literature inform us about the challenges faced by digital immigrant and digital native teachers in integrating TPACK?” “Analysis of the contents of articles published based on the PRISMA systematic review protocol resulted in the following main findings: i) the development of TPACK competencies in learning appropriate responses did not follow that; ii) technological pedagogical, content knowledge, technological knowledge, technological resources, and technology adaptation are the main attributes in developing TPACK competencies; and iii) most digital immigrant and digital native teachers still struggle with developing TPACK competencies.”

All articles included refer to problem statements, which include factors that influence the integration of TPACK and the lack of skills in digital immigrant and digital native teacher technology. If the integration of ICT into learning is lacking, this will have an impact on the development of digital abilities and skills possessed by teachers and students. Several studies reveal that pre-service teachers have deficient levels of digital competence and skills [29, 34, 40] and even no digital competence at all [35].

First, this literature review highlights the lack of an appropriate response to the development of TPACK competencies in learning by teachers, the government, and other stakeholders. Current technological developments are very rapid, but teachers’ responses are lacking in integrating technology into learning, and teachers are considered not ready to integrate digital media [22, 50]. In addition, several studies have also revealed that many schools still do not have adequate facilities to support technology integration into learning [28, 55]. Generally, schools located in urban areas have better learning facilities than those in rural areas [56].

Referring to the second analysis, the development aspects of TPACK consist of (1) technological pedagogy, (2) content knowledge, (3) technological knowledge, (4) technological resources, and (5) technology adaptation. Technological pedagogical content knowledge as a learning framework that generates curriculum concepts referring to teachers’ understanding of how to use various types of technology to teach and assists

teachers in supporting students' knowledge of technology, pedagogy, and content [37, 55, 57]. Technological knowledge is a new knowledge construction that is added to the existing pedagogical content knowledge regarding the basic understanding of ICT for the integration of appropriate digital competencies to complete certain tasks or achieve certain goals and to design alternative ways [45, 53]. Technological resources can help teachers decide which type of technology to incorporate into the learning process [40, 53]. Technology adaptation has an important role in developing the ability of digital pedagogical teachers to integrate technology into teaching [53].

Finally, the third research analysis focuses on the digital divide between digital immigrants and digital native teachers when it comes to integrating TPACK into learning activities. Some researchers assume that digital natives are better at integrating technology into learning than the digital immigrant group [30, 49]. However, Kurniawati et al. (2018) state differently, stating that digital immigrant teachers are considered more reliable in implementing digital media, while digital native teachers are considered not ready to integrate digital learning media [22]. Most of these literature studies discuss ICT competencies, but several other studies also suggest the importance of developing teacher competencies, especially regarding digital competencies. In developing digital competencies, digital training can be carried out so that teachers can adapt to today's technology [19, 40, 44, 50, 53, 58].

Most studies only suggest training, so teachers are not categorized as having a digital gap. However, training alone is not enough to ensure that teachers understand the training that has been carried out, so it is necessary to continue digital training with monitoring [44]. Furthermore, in this study, no research informs the development of students' digital competencies, even though these competencies are as important as teacher competencies so that students can develop their abilities in the field of technology and minimize the negative impact of technological advances.

### **Limitations**

This study has several limitations, including data inclusion techniques that differ from other systematic literature reviews. This study focuses on literature published from 2017 to 2022 from four databases: Scopus, Springer, ERIC, and DOAJ. The criteria listed cannot cover all aspects because most of the literature found comes from the field of education. This literature excludes studies from proceedings, chapter books, dissertations, and books because the peer review process is not as stringent as in research journals. Also, some articles can't be read, so the amount of literature that can be read is small.

### **Implication for Practice**

The literature study on TPACK shows a gap problem in integrating digital immigrants and digital native teachers' technology in learning. Several researchers found several factors, such as the lack of ICT infrastructure, a lack of teacher skills in ICT, unpreparedness in planning, and teaching experience. This study compares digital immigrant and digital native teachers' integration of technology in learning to develop digital competencies. Therefore, the government and authorized partners must hold training on developing teacher skills in digital technology and infrastructure. Facilities and infrastructure in

the field of education should be in accordance with standards to create quality future generations and adapt to current technology.

### **Recommendation for Future Research**

Given the study's limitations, future research should focus on the development of TPACK based on the characteristics of digital immigrant and digital native teachers in integrating technology in learning. It is also important to look for the characteristics of digital immigrants and digital natives to give them digital training according to their skills and abilities. Moreover, because most of the articles published are from the field of education, researchers need to consider the characteristics of digital immigrants and digital natives, which cover broader fields of study such as economics, social science, and culture. Methodologically, the literature search process depends on the features that exist in each database. Future research could also elaborate on the types of challenges teachers face in developing TPACK over a more extended period.

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