



Emerging TPACK & Digitalization in Education for Sustainable Development: Voices of Secondary Education Teachers

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ABSTRACT

One of the frameworks used nowadays to incorporate technology into the teaching and learning process is technological pedagogical and content knowledge (TPACK). The investigation of teachers' TPACK, specifically their comprehension, process, and obstacles in a classroom context, has not received much research, though. In order to better understand TPACK and digitalization in the secondary education classroom, this study will examine it from the viewpoints of teachers. The information was gathered from three teachers who were at Thursina IIBS Malang, East Java, Indonesia. The study's methodology included a qualitative study. The researchers used a triangulation of data sources, including interviews, observations, and documents, to collect their responses. The verbatim transcriptions of the interviews data were followed by a thematic analysis. The results of the current study reveal four key issues, including teachers' understanding of TPACK, the acquisition of TPACK, teacher perceived level of digital literacy and teachers' challenges with TPACK. The teachers utilized a variety of ways to acquire TPACK, and they had different perspectives on TPACK. However, applying TPACK presented many benefits for the teachers. The results of this study may have an impact on how teachers should proceed with their professional development.

Keywords: *Digitalization; Perspectives; Secondary Education; Sustainable Development; TPACK*

ABSTRAK

Technological Pedagogical Content Knowledge (TPACK) merupakan sebuah kerangka kerja yang mendefinisikan pengetahuan yang dibutuhkan guru untuk mengajar secara efektif dalam kerangka teknologi. Banyak guru mengimplementasikan kerangka ini di era yang serba digital ini. Penelitian terkait implementasi TPACK yang dilaksanakan guru, khususnya pemahaman, proses, dan hambatan guru kelas belum mendapatkan perhatian yang signifikan. Untuk lebih memahami implementasi TPACK dan digitalisasi di jenjang sekolah menengah, penelitian ini akan berfokus pada pengkajian TPACK dari perspektif guru. Data dari penelitian ini dihimpun dari tiga guru yang berada di Thursina IIBS Malang, Jawa Timur, Indonesia. Penelitian ini menggunakan metode kualitatif dimana peneliti menggunakan triangulasi data yang berasal dari wawancara, observasi, dan dokumen, untuk menyimpulkan perspektif informan. Transkripsi kata demi kata dari data wawancara dilaksanakan dengan analisis tematik untuk menyajikan tema-tema yang muncul dari data. Hasil studi ini mengungkapkan empat isu utama, yakni pemahaman guru tentang TPACK, cara mempelajari TPACK, tingkat literasi digital yang dirasakan guru dan tantangan guru dalam implementasi TPACK. Dalam penelitian ini terungkap bahwa guru menggunakan berbagai

cara untuk mempelajari implementasi TPACK, dan mereka memiliki perspektif yang berbeda tentang TPACK. Namun, secara umum guru mengakui bahwa TPACK memberikan banyak manfaat bagi para guru. Dengan hasil penelitian ini memungkinkan guru untuk merefleksikan implementasi TPACK di kelasnya dan bagaimana guru harus melanjutkan pengembangan profesional mereka.

Kata Kunci: *Digitalisasi; Perspektif; Pengembangan berkelanjutan; Sekolah Menengah; TPACK*

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INTRODUCTION

When it comes to influencing people's behavior to fulfil the objectives of sustainable development, education is a crucial component. The basic goal of sustainable development is, in the words of Gladwin et al. (1995) and Brundtland (1987), "to meet the demands of the present without compromising the ability of future generations to meet their own needs." We can also think about how our actions today will impact our ability to meet future requirements. For instance, if humans exhaust a resource through excessive consumption (i.e., behavior), the resource's requirement cannot be satisfied in the future. Human conduct, on the other hand, can also be seen as the outcome of learning. Therefore, by influencing students' behavior and assessing this behavior change, technology can be utilized to improve education for sustainable development (ESD).

To effectively use technology to promote ESD and to maximize both groups' talents and create synergies through specialization, educators and technologists must work closely together. Collaboration with technologists is advantageous to educators in a number of ways, including accelerating the pace of educational innovation, inspiring new approaches to the classroom, enhancing the learning experience for students, increasing access to resources and skills, etc. Additionally, a partnership creates the chance for both parties to mutually benefit by sharing their knowledge, skills, and accomplishments with one another.

The widespread usage of digital technology in all areas of education has altered the instructional activities for both teachers and students. Today, technology plays a significant role in schooling. The way students learn in classrooms is greatly influenced by technology. Technology use can support the teaching and learning process. Teachers are advised to integrate technology into digital learning because there are so many advantages to doing so. Using a variety of technical tools, such as cell phones, tablets, computers, and others, digital

learning is an unplanned and implicit process with unknown effects (Sousa & Rocha, 2018). Additionally, the phrase "digital learning" is used to describe a variety of educational opportunities made possible by digital technologies (Blundell et al, 2016, p. 536). The use of technology, however, presents some challenges for the teachers. One of the challenges teachers face is a lack of knowledge (Thornberg, 2008).

Furthermore, the presence of technology—such as digital computers or other elements of technology—in different schools does not guarantee that its use would be effective (Yang & Ersanl, 2015). In other words, the teacher's integration of technology tools into the classroom should be balanced (Isler & Yildirim, 2018). To give pupils the greatest educational technology, it is necessary to have sufficient pedagogical expertise of technology integration.

TPACK, or technological pedagogical content knowledge, is one method of integrating technology into the classroom. It was developed by Mishra and Koehler in 2006. The term "TPACK framework" refers to a kind of framework that incorporates the three elements of content, pedagogy, and technical knowledge (Mishra & Koehler, 2006). Additionally, the TPACK framework is not a brand-new idea on its own. The six knowledge elements that make up TPACK are Content Knowledge (CK), Pedagogical Knowledge (PK), Pedagogical Content Knowledge (PCK), Technology Knowledge (TK), Technological Content Knowledge (TCK), and Technological Pedagogical Knowledge (TPK). "TPACK is a specialized, highly applied sort of knowledge that allows content-based technology integration," (Harris & Hoffer, 2001, p. 212). the speedy development of new technologies when used in conjunction with computer-based instruction. As a result, these ideas connected with one another to create a more complete and effective vision of technology integration in a classroom.

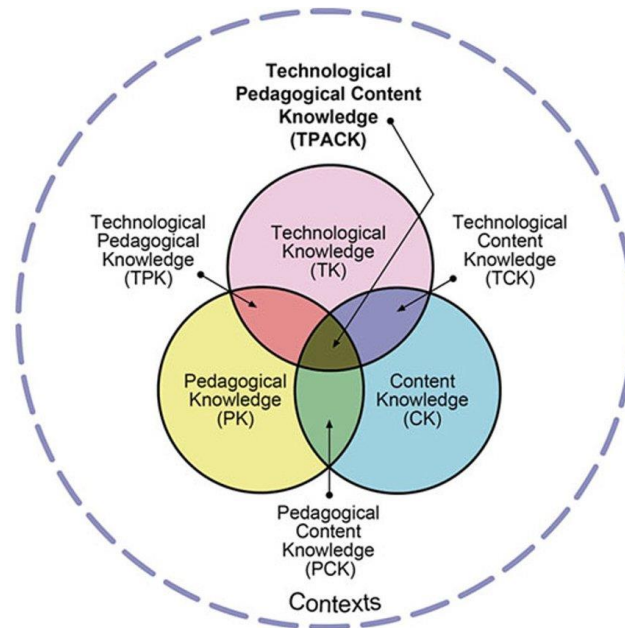


Figure 1. The Technological Pedagogical Content Knowledge (TPACK) framework (taken from tpack.org)

The knowledge that teachers possess at any given time to support their actions is referred to as "teacher knowledge." It does not necessarily follow that every piece of knowledge they possess affects how they move. At every level, teachers' comprehension and expertise are essential. They increase their capacity for identifying opportunities to act in order to advance pupils' understanding. Teachers are more attractive in effective implementation when they use their knowledge to promote student learning. If the goal of expanding teachers' TPACK is to be pursued, it was suggested that how teachers think about their surroundings and the support provided for their teaching using technology should be considered and must be designated (Jen et al, 2016).

Previous studies (Chai et al., 2011; Drajati et al., 2018; Wulandari, 2019) have mainly focused on how TPACK should be implanted and the development of TPACK learning materials, but rarely examined teachers' understanding, process, and challenges in implementing it. In fact, studying the teachers' perspectives can be very helpful in providing meaningful insight into the implementation of TPACK as well as in directing teachers' in their professional development. The study, therefore, aims to examine how teachers perceive TPACK, how they acquire it, the teachers' perceived level of digital literacy and the difficulties they encounter while putting it into practice.

METHOD

The research design used in this study was phenomenology. Phenomenology is a qualitative research design that focuses on the commonality of the living experience of a particular group in a specific community (Creswell, 2013). With this approach, the researcher primarily looked into secondary school teachers' perceptions of how TPACK and digitalization may enhance the teaching of sustainable development. To ensure that the researcher had a complete understanding of the phenomena under discussion in this context, the participants shared their points of view and perspectives regarding the use of TPACK and digitalization in teaching and learning at their schools.

This study was carried out at Thursina IIBS Malang, a private international school in Indonesia. A national curriculum and an international curriculum are combined in this school. It is expected that the students graduated here can continue their education abroad or compete globally in international network. The global minded is internalized not only by the use of curriculum, but also the implementation of digital learning environment. Accordingly, the use of TPACK and digitalization is mandatory for the teacher to accommodate the students' needs and influence their behavior to think globally and sustainably for the future. The goal of this policy is to provide a global learning environment and, more specifically, to develop the technologies needed to improve the teaching and learning of sustainable development.

Three teachers at this school participated in this study as participants. Through the use of purposive sampling, they were picked. In order to obtain the most accurate study sample that captures the phenomenon, the researcher purposefully selected the participants; the most knowledgeable participants who are familiar with and knowledgeable about the digitalization are picked.

Interviews and observation notes were employed to collect the data. Initially, the perspectives of teachers were investigated using in-depth interviews as a method. A more thorough understanding of what transpired in the program and why was provided by using in-depth interviews to elicit specific information about teachers' ideas and feelings or a desire to investigate novel issues in relation to other data (such as outcome data) (Boyce & Neale, 2006). Selected teachers were picked for semi-structured design interviews. According to the criteria of participants who truly mastered and had a thorough understanding of the phenomena researched, the teachers were chosen in an authoritative manner.

Following the interviews, observation to teachers' classes were held to note several important points on the use of TPACK and digitalization in the classroom. Field notes were utilized by the researcher to document the information in this observation. According to Ary (2010), a field note is a brief note that is prepared by a researcher while doing an observation procedure. Based on the researcher's function, there are two forms of observation: participant observation and non-participant observation. The researcher joins the group being observed to conduct participant observation, the researcher only became as an observer. The researcher employed non-participant observation in this investigation. As a result, the researcher sat in on the teachers' classes and examined how they used TPACK and digital learning.

The researcher then transcribed the data. At this stage, she discarded all irrelevant information. The following steps were line-by-line and color-coding. The analysis of the data became more profound as the codes were detailed. Next, she put similar codes into the same categories and moved them around in order to find out a way that reflected the best analysis. The categorization of codes in the previous step reflected themes. The researcher connected the themes in meaningful order to get the coverage of the data or emergent themes.

All the procedures of data collection could be done repeatedly or terminated until the finding reaches the saturation point. The result of interviews and observation notes were analyzed to confirm and make the conclusion.

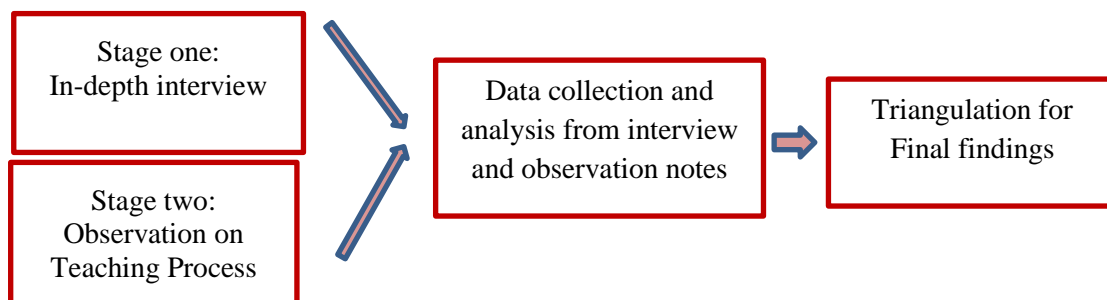


Figure 2: the flow of data collection and data analysis

FINDING AND DISCUSSION

There were four main themes as research findings generated in the study. They were the teachers' understanding toward TPACK, the acquisition process of TPACK, teachers'

perceived level of digital literacy for the implementation of TPACK and the teachers' challenges toward TPACK & digitalization.

Teachers' Understanding toward TPACK

The Association of TPACK on the Use of Technology

The three-part framework that made up TPACK was its definition. Technology, pedagogy, and topic understanding made up those three factors. However, not all of the teachers the researcher spoke with had a thorough comprehension of TPACK. It was evident in the teacher's response:

Oh, I see. As far as I'm aware, TPACK refers to a learning system using a technological method. A teacher can easily use the internet and programs that aid in teaching process. (T.1)

From that response, it showed why teachers frequently believed that TPACK was solely about technology. TPACK, however, covered more than just technology. Other than technology, there were two more factors: pedagogy and subject-matter expertise. In actuality, there was another teacher who did not completely comprehend TPACK. It was evident in the next response:

I am not sure about it. Let me browse from the Internet. (T. 2)

However, one of the teachers had a good understanding towards TPACK:

Hmm I know about TPACK, it is a framework that combines technology, pedagogy, and content. I have learnt during my study in university. (T. 3)

In essence, there were differences in the teachers' perceptions of TPACK. There were some teachers who were unaware of TPACK, but the other teachers were able to explain it to them based on their own comprehensions. On the contrary, based on the observation notes, all teachers have implemented TPACK in their classrooms. It seemed like the teacher know how to create lesson that suit this digital age even though they weren't fully aware that what they have done was in the TPACK framework.

Teachers' Awareness of the Importance of TPACK toward Teachers' Self-image and Identity

Teachers wanted to set a good example for the pupils because they were teachers at a large school. This was evident from the teacher's comments, which included:

It's important to me because I don't want to appear incompetent to my kids in my role as a teacher. I want to be an excellent teacher so that my pupils would comprehend what I have taught them. (T. 1)

Another responder held the opinion that students assessed their teachers' abilities instinctively:

It is essential, of course. Furthermore, for a teacher, correct? There is a ton of stuff, and the scope of the material is enormous. My ability to vary my teaching methods is a testament to my abilities. Additionally, the quality of our teaching must be evaluated by the pupils, and I want to be a certified teacher. (T. 3)

It was discovered in this instance that teachers desired a positive identity and reputation in order to be viewed favourably by their students.

Implementing TPACK as Part of Teachers' Self-sustainable Development

According to the teacher, TPACK use had an impact on teachers' long-term self-development:

It is really important because if we don't keep up with it and don't want to learn, we will remain behind. (T. 3).

He added that if educators did not wish to consistently advance their technology pedagogical subject understanding, their knowledge and abilities would not be enhanced. It was for this reason that teachers continued to learn in order to enhance their TPACK.

TPACK and Teachers' Objectives on Students' Materials Understanding and Interest

The teacher should properly explain the material and have a variety of teaching philosophies in order to produce high learning outcomes for the pupils. As teachers became more conscious of the value of TPACK, they understood how the calibre of their TPACK might impact their pedagogy. According to one of the interviewees:

If my TPACK is poor, it will have an impact on how monotone the variation of activities I give to my students. The kids won't be excited the topic I explained since they'll get bored. (T. 2).

According to this, the pupils would become bored if the teacher continued to educate them using the same manner without TPACK. The pupil would then become bored, which would prevent them from clearly understanding the information.

It was challenging for the teachers to engage the kids in the learning process. The teachers would have a variety of teaching methods if they had good TPACK. One of the professors claimed that TPACK had an impact on how they taught the pupils:

Because we will have so much diversity to teach if our TPACK is great, it has a significant impact on how I instruct. We can employ a variety of technological or educational media, so that the children will be interested in studying using new learning tools. They become enthused because they learn by utilizing anything novel. (T. 1).

One of the teachers explained that it was obvious that when pupils learnt or applied something new, they tended to be more involved in the learning process. It heightened their curiosity and brought out their excitement.

The Acquisition Process of TPACK

Teachers' Forum Programs

For every subject, there was a program for teachers' forums. The forum, according to one of the teachers (T1), offered certain advantages and constructive activities:

All teacher in Thursina have association / group. It is called MGMP. MGMP stands for "Musyawarah Guru Mata Pelajaran". MGMP shares any seminars, workshops, or webinars that can attended by the teachers. Discussing new techniques and application usage. Consequently, in order to stay current as a teacher, I must be active. (T. 1)

The teacher claimed that the forum frequently held beneficial events including webinars, seminars, and workshops. It assisted the instructor in learning technology pedagogical content to advance their abilities.

Thursina Human Resource Development Programs

At Thursina it is often held a training activity for teachers annually based on the result of teacher training need analysis. The teachers went in order to sharpen their abilities. According to one of the responders, it was one of the ways for the instructor to obtain technology pedagogical topic understanding:

Usually there is training activity for the teachers held by HCM of Thursina (Human Resource Management). That training taught us something fresh. so that we can raise the level of our teaching. Particularly for the veteran teacher like me. To complement my teaching style, I need to be willing to learn and stay current with technology advancements. (T.1)

It was evident that instructors, particularly older ones, tended to pick up TPACK through the institution's HRD's training activities.

Colleague Support

As a fellow educator, they had a tendency to seek assistance from other educators whenever they ran into problems. One of the instructors described how she obtained TPACK:

I frequently impart knowledge to other educators. so that I can continuously learn new things and stay up to date. (T. 2).

It was explained that assistance from colleagues might be essential for other teachers.

Independent learning

Independent learning may be used to acquire understanding of technology educational content. It was evident from the instructor's response:

My preference is towards self-learning. Therefore, I search online for new programs or social media that I may utilize as learning tools. For each class, I often complete homework in a different way but with the same grade. The same holds true when creating content or a subject. Although the lesson's subject is the same, I typically change the example question to prevent repetition among classes. I typically do a search for the subject online in addition to in books. I must, however, read it again. Therefore, if there is an error, I can update the reference materials. (T. 3)

It can be concluded that teachers could learn individually from the internet. By exploring it, teacher could learn new things about pedagogy, technology, and subject matter.

The Teachers' Perceived Level of Digital Literacy for the Implementation of TPACK Technology Proficiency

All of the teachers responded that they are adept in using technology when the teachers enquired about their degree of skill. As seen by the teacher's response, they are accustomed to using a smartphone, tablet, or laptop for teaching preparation and execution:

I primarily use a laptop when I'm teaching. It covers the creation of my lesson plan, PPT, and any tests my students might require. (T.2)

The devices such as laptop and tablet are very crucial for all teachers since they have been dependent to all digital material and platform that can help them to teach more effective and efficient.

The Purpose of Accessing Internet

Internet holds very big part to win in a digital age. Due to the rapid pace of technological advancement, the teachers also need to utilize these facilities well for developing education for sustainable development. The purpose of using Internet can be very broad, since Internet provides any information needed by its user. Here several purpose of accessing internet in educational context as stated by the teacher:

I use Internet every day, since Thursina provides the free Wi-Fi for all teachers. I browse additional sources through Internet. Moreover, I always give the students E learning activities through e-learning platform that can be accessed freely in the internet such as Menti.com, quizziz.com and Kahoot. I love using this e-learning platform it can help the students learning more fun. (T.2)

The Teachers' Challenges in Implementing TPACK

Dependable to Technology

One of the teachers demonstrated his difficulties with TPACK by demonstrating how they were overly dependent on technology:

Just like what I have said I always use Internet and technology every time I teach so for example when the electricity is off or the Internet is not running, I will be blank and sometimes don't have the B plan to change my teaching into the conventional one. Once I experienced this, I ended up having chit chat with my students in the classroom because I could display my PPT in TV (T. 2).

Adapting with new Variety of Technology for Teaching

The teacher's adaptation to the new technology was another response to their challenges with technological pedagogical topic understanding:

It is actually not challenging, but I must adjust to the large number of programs and learning resources that must be employed. Technology is required for every step of the learning process, especially in this pandemic. (T. 3)

Additionally, it was evident from the findings of the field observation that the instructor used a variety of media when instructing the pupils. Additionally, the lesson plan research document revealed that the teacher employed standard tools for several tasks, including YouTube videos & E-learning platforms (Mentimeter, Quizziz & Kahoot) to share knowledge.

Based on the findings displayed above, we can see different teachers had different levels of understanding of TPACK. Each educator has a unique perspective on technology pedagogical content knowledge. Some teachers had a thorough understanding of TPACK, whereas other educators just had a cursory understanding. In other words, according to the teachers' explanations of TPACK that were based on their personal viewpoints, TPACK was seen as involving the use of technology. TPACK, on the other hand, includes not simply the use of technology but also the integration of pedagogy and content.

This outcome is inversely related to the research of Aniq and Drahati (2019), which revealed that teachers believed they knew more about PK, CK, and PCK than TK, TCK, and TPK. The definition of PK (pedagogical knowledge) focuses on pedagogical knowledge as a knowledge domain that includes full information about the teaching process, practices, and approaches (Mishra & Koehler, 2006). They also demonstrated an understanding of technical content knowledge, which is the body of knowledge regarding how technology and content interact. It demonstrates that teachers frequently lack comprehension of both pedagogical and material issues.

Knowledge of technological pedagogical content was essential to teachers since it affected how they were perceived as teachers and whether they were of excellent or terrible quality. They believed that their students were silently evaluating them, therefore they wanted to project a positive image in the eyes of their pupils. They were motivated to keep learning because they wanted to become qualified teachers who could pass along their knowledge to others. They had a variety of teaching methods because they were qualified teachers. It had an impact on students' learning because it might spark enthusiasm in the subject matter, which helped students comprehend it better. Their learning outcomes would be improved if the students had a better knowledge of the content that the teachers were teaching.

Each teacher developed their understanding of technology pedagogical content in a unique way. One instructor gave an explanation of how he joined the Musyawarah Guru Mata Pelajaran (MGMP) teachers' forum program. That forum offered free webinars,

seminars, and workshops for teachers that included information on new technology for the classroom learning process and other topics. The WhatsApp group was informed of the webinar, seminar, or workshop schedule. One strategy to raise the quality of teachers might be through that forum. The level of activity of the teachers varied. All of the teachers were given training opportunities through the institution, including workshops and seminars. Typically, it took place in a specific city to assemble the teachers.

Colleague support was crucial in learning TPACK in addition to webinars, seminars, and workshops since they could impart knowledge or provide assistance as fellow teachers. Every time a given teacher learned something new about the learning process, they would pass it along to another instructor so that the two of them could continue to learn. For autonomous learning, teachers can make the most of the internet. It might also be one of the strategies for teachers to obtain TPACK. Teachers can resort to the internet to gain their TPACK because it has comprehensive knowledge of both the materials and the technology. They can look up any information they require regarding TPACK. There were several publications, theses, and even electronic books that offered the teachers the trustworthy sources they required. Teachers researched new resources that would aid in the learning process as they learned about new technology.

The teachers' dependence on technology and technical issues was one of their challenges. Teachers were overly reliant on technology, making it difficult for them to switch to more traditional methods of instruction when there were technological difficulties like an LCD that wasn't working or an Internet outage. Some people were also uncomfortable using certain media in their teaching activities, especially the elderly teachers. It was consistent with the study of Taopan, Drajiati, and Sumardi (2020), which described how IT literacy had become one of the difficulties teachers faced. They acknowledged that they lacked that capacity and occasionally still need assistance with technological problems. Support from coworkers was crucial in this situation since they could assist one another in case of difficulty.

Teachers' need to adjust to the range of new technologies that is emerging every day presented another problem for TPACK. For the purpose of the learning process, they had to become accustomed to the new technology. Not all teachers, especially those teaching younger students, reported having problems with TPACK. Some teachers said they had no problems. The findings of this study are consistent with those of Chuang and Baran (2011), who found that the use of the TPACK framework and survey for assessing and establishing

teacher knowledge in numerous international teacher circumstances is a clear indication of the impact of TPACK as an emerging field of study and evolving teaching tool.

CONCLUSION

The findings showed that there were differences in the teachers' understanding of technology pedagogical topic knowledge. Although the majority of teachers saw TPACK as utilizing technology, they realized that doing so reflected teaching capacity, professional growth, and of course increased knowledge and enthusiasm among students.

Even though they used a variety of tactics to acquire TPACK, such as participation in teachers' forums and training, peer support, and self-learning, they encountered a number of difficulties when putting TPACK into practice, notably in terms of adapting technology in their classroom. When considered as a whole, this research highlighted the significance of comprehending and applying TPACK in secondary education schools.

This study can be used as a preliminary overview of teachers' perceptions of how TPACK and digitalization are being used at the moment in an Indonesian secondary school. However, from a critical standpoint, TPACK research is relatively underdeveloped, particularly in Indonesia. More thorough critical investigations are required to question the status quo because teachers and pupils are most impacted by the policy decision. To promote change for the better, it is necessary to raise awareness of the negative consequences that TPACK and the digitalization policy may have on students' learning experiences and academic achievement.

Through in-depth analysis, future research may examine the opinions of both instructors and students on the potential application of TPACK and digitalization at the national level. Future quantitative research in the same topic is advised because this was a qualitative study in order to obtain comprehensive data. Future research in the context of Indonesia and comparable contexts should use more effective research techniques like survey, document analysis, observation of actual classes, and ethnography to further explore the complexities involved in the use of TPACK and digitalization to make Indonesian education sustainable for the future.

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