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Technological Pedagogical Content Knowledge (TPACK) and Digital E-Scaffolding for Special School Teachers

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ABSTRACT

21st century learning requires Special School teachers to have knowledge and skills in implementing technology-based learning strategies to facilitate and facilitate student learning and improve learning outcomes. This study aims to analyze the ability of Technological Pedagogical Content Knowledge (TPACK) and digital e-scaffolding in Special School teachers. This type of research used descriptive quantitative. The sample in this research is Special School teachers. Data collection using a questionnaire. Data analysis using descriptive statistics. The results showed that the ability of Special School teachers to integrate and utilize TPACK and computer and internet-based digital e-scaffolding for learning students with disabilities was in the good category. The results of this study show that 78% of Special School teachers have been able to utilize TPACK and digital e-scaffolding in learning for students with disabilities. TPACK skills and digital e-scaffolding are needed by Special School teachers to integrate and utilize technology that supports the learning of students with disabilities. The novelty of this research is to simultaneously analyze TPACK and e-scaffolding because much research has been done on TPACK but research on TPACK and digital e-scaffolding is still limited.

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INTRODUCTION

The rapid development of technology in the 21st century has an impact on all fields including the field of education, teachers are required to keep up with the times, including by implementing TPACK in learning in accordance with the demands of the 21st century which utilizes technology in learning, as well as Special School teachers. Many studies have been conducted on TPACK but linking TPACK with digital e-scaffolding is still lacking. Special School teachers are required to master technology and digital skills as an integrated part of learning in the 21st century (Ng et al., 2023). TPACK (Technological Pedagogical Content Knowledge), a combination of material knowledge, pedagogy and skills and use of technology. Learning in the 21st century requires Special School or *Sekolah Luar Biasa* (SLB) teachers to master TPACK, including those related to digital e-scaffolding making it easier for students with disabilities to learn, also providing support and opportunities for students with disabilities to be independent, construct knowledge and linking this knowledge to real contexts in everyday life with computer-based digital e-scaffolding, online, internet, video, social media, digital images, digital audio, mobile learning, powerpoint, and so on. In this regard, it is important for Special School teachers to improve their knowledge and skills of TPACK and digital e-scaffolding. Learning for students with disabilities is also related to TPACK and digital e-scaffolding. When teaching Special School teachers are expected to integrate technology, content knowledge and pedagogy simultaneously, they also apply digital e-scaffolding. Current learning can utilize technology so that the use of students' senses can be carried out thoroughly,

learning can accommodate a variety of student learning abilities so that learning outcomes increase (Tekege, 2017). TPACK and digital e-scaffolding can be developed by teachers in creating content and learning support that is varied and still educative. Teachers must actively participate in the process of technology integration and have several competencies to use available technology in the learning environment appropriately and effectively (Akturk & Ozturk, 2019).

Teachers are the key to the success of education and learning so they must be prepared professionally. TPACK makes it possible to improve teacher performance in teaching effectively, explaining knowledge to students and using technology (McGraw Hill Canada, 2019). TPACK means to improve education and learning, helping students learn (Ruggiero & Mong, 2015). TPACK in the 21st century plays an important role for teachers in delivering learning content and helping students learn (Ali & Hernandez, 2023; Rosenberg & Koehler, 2015). Effective learning for students with disabilities allows interactive between teachers and students, students work together. Teachers also learn to provide computer-based, online, internet (digital e-scaffolding) support and effective guidance for students with disabilities. Professional Special School teachers must master TPACK competencies and digital e-scaffolding which is important because it makes it easier for teachers and students to achieve learning goals.

The fact that was found from the results of interviews with Special School teachers, there are still many teachers who have not implemented TPACK and digital e-scaffolding which are varied and diverse in learning with disabilities, the ability to make programs or lesson plans by utilizing TPACK and digital e-scaffolding according to their characteristics as well the needs of students with disabilities are still not optimal, many disabilities receive digital e-scaffolding but do not match the characteristics and needs of disabilities, this is due to a lack of knowledge in integrating and utilizing TPACK competencies and digital e-scaffolding. Students with disabilities also like internet-based learning so they don't get bored and bored. The fact is that currently students prefer learning by utilizing the internet than other learning (Mbegani et al., 2023; Tanjung & Rajab, 2017). This can be combined with digital e-scaffolding. TPACK competence requires teachers to be able to integrate all aspects of TPACK into learning. It is hoped that the use of technology and digital e-scaffolding in learning will improve student learning outcomes and improve the quality of education. Creative teachers can apply TPACK and various learning strategies. Learning strategies related to TPACK, including digital e-scaffolding (online, internet, computer-based scaffolding). TPACK competencies and digital e-scaffolding can be a solution to existing problems and solutions for facing the challenges of 21st century learning. TPACK is an interaction between content knowledge (material), pedagogic, and technology for pedagogical needs and teaching content (material) that is appropriate in a particular context (Schmid et al., 2020).

TPACK guarantees the implementation of learning that is in accordance with the demands and changes that occur (Nevrita et al., 2020). TPACK consists of three types of knowledge, namely technology, pedagogy, content which are considered important in integrating technology into the teaching and learning process (Kim, 2018; Angeli & Valanides, 2015). TPACK can be an alternative for increasing teacher competence and professionalism, especially the use of technology for learning and learning (Blevins, 2018). TPACK includes integration between subjects (content), technology, and learning (pedagogy) (Brinkley-Etzkorn, 2018). Online learning is very closely related to the use of technology so it requires competency and knowledge regarding the integration of technology, pedagogy, and content that needs to be improved (Mulenga & Marbán, 2020). TPACK is a framework that integrates the relationship between components of technology, pedagogy and knowledge content (Cilesiz & Spector, 2014). Teachers needed in the 21st century are teachers who have competence in harmony between technology, pedagogy and content.

TPACK as teacher professionalism knowledge for integrating technology in learning (Koh, 2019). TPACK can be interpreted as the involvement of various technological domains, material content, and pedagogy to support teacher professionalism in presenting effective and efficient

learning (Huang & Lajoie, 2021). Digital e-scaffolding is computer and internet-based support and can be combined with e-learning or other online-based learning that can help students who are skilled or able to complete tasks that are beyond their abilities so as to gain better knowledge than before. Digital e-scaffolding adapted from e-learning can improve student performance and motivation (Çebi, 2023; Chen, 2014). ICT-based digital e-scaffolding based on the concept of e-learning can improve learning outcomes (Phumeechanya & Wannapiroon, 2013). Scaffolding can help develop better problem solving skills and to achieve better mental function (Ismail et al., 2015). Effective scaffolding helps students overcome reluctance in learning to develop thinking skills so that learning outcomes increase (Weinstein & Preiss, 2017). Scaffolding can improve experience and learning outcomes as well as group work results (Lange & Han, 2016). Scaffolding can increase motivation and thinking power (Belland et al., 2013).

Based on the opinions of the experts above, digital e-scaffolding needs to be implemented to improve learning outcomes and learning quality. These findings also further confirm that digital e-scaffolding strategies in learning really help students achieve better learning outcomes. Disabilities include impaired activities related to bodily functions, participation, individual involvement in limited life situations (WHO, 2019). Disability is an obstacle experienced by individuals related to mental function, health, functional body disorders so that it affects activities, work, capacity and participation in disadvantaged communities (Muschalla et al., 2012). Disability is an obstacle, difficulty related to physical, sensory, cognitive, developmental, learning, intellectual, emotional and behavioral functions (Alnaim & Alsarawi, 2023; Turner, et al, 2011). The research was conducted with the aim of uncovering the ability of TPACK and digital e-scaffolding of teachers in implementing the teaching and learning process. The novelty of this research is to simultaneously analyze TPACK and e-scaffolding because much research has been done on TPACK but research on TPACK and digital e-scaffolding is still limited.

RESEARCH METHOD

This research is a descriptive research with a quantitative approach. The flow of this research is as shown in Figure 1.

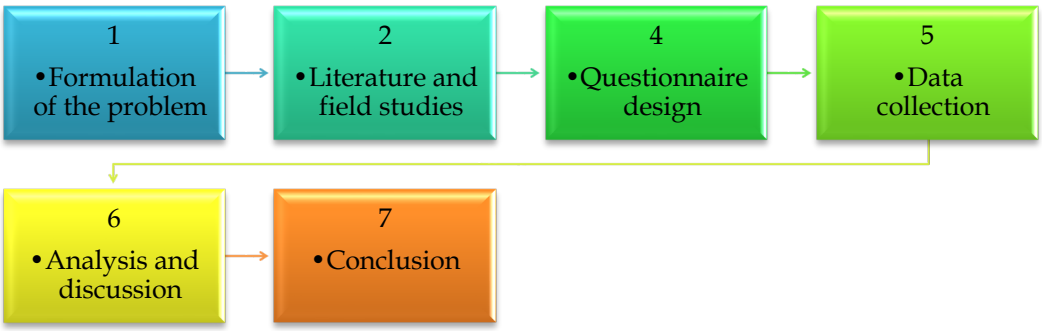

Figure 1. Research flowchart

The research presents descriptive data in the form of numbers related to the TPACK and digital e-scaffolding abilities of Special School teachers. Quantitative descriptive research describes, examines, and explains something that is studied as it is, and draws conclusions from observable phenomena using numbers (Matović & Ovesni, 2023). Quantitative descriptive research is research that only describes the contents of a variable in research with data (numbers) as they are, not intended to test a particular hypothesis (Nag & Malik, 2023).

The sample in this study were 15 special school teachers. The determination of the sample used a purposive sampling technique, namely the sample was chosen deliberately by the researcher with certain considerations or criteria, namely teachers who teach in special schools. Data collection uses a questionnaire or questionnaire with a Likert scale. The instrument used is a questionnaire sheet with eighteen indicators related to TPACK and digital e-scaffolding. Data were analyzed using descriptive statistics with percentages. The calculation used in this

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analysis is as follows: $P = F/N \ x \ 100\%$ (Remarks: P = Percentage, F = number of responses from respondents, N = number of respondents. The results of the analysis of TPACK capabilities and digital e-scaffoding are in the form of percentage ranges, which are then changed based on a range of qualitative assessment criteria, as follows: qualitative criteria range values (1: 0 – 20: very poor), (2: 21 – 40: lacking), (3: 41 – 60: sufficient), (4: 61 – 80 : good), (5: 81 -100: Very good) (Sugiyono, 2013).

RESULTS AND DISCUSSION

The results of the research based on data related to the ability to use TPACK and digital e-scaffolding from Special School teachers were analyzed using descriptive statistics. The results of data analysis using percentage descriptive statistics show that the ability of Special School teachers to integrate TPACK and computer and internet-based digital e-scaffolding for learning students with disabilities is in the good category. The results of this study show that 78% of Special School teachers have been able to utilize TPACK and digital e-scaffolding in learning for students with disabilities as shown in Figure 2.

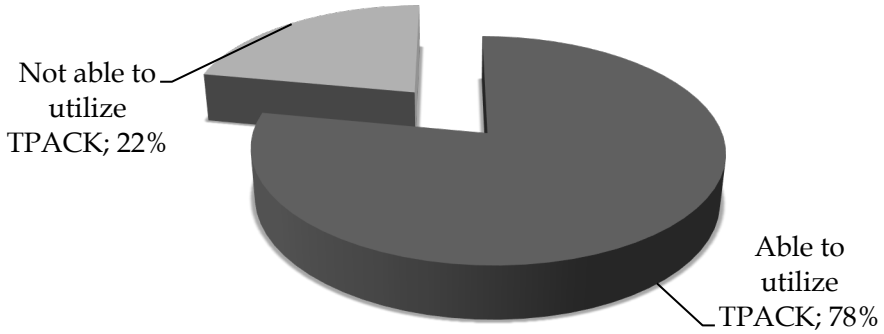

Figure 2. The ability of special school teachers to integrate TPACK and computer

The teacher's TPACK and e-scaffolding abilities greatly support the quality and quality of learning. Based on the results of the questionnaire and data analysis, the TPACK's understanding, knowledge and abilities related to digital e-scaffolding from Special School teachers are in the good category. The use of TPACK and digital e-scaffolding by Special School teachers is in the form of lesson plans or learning programs using digital e-scaffolding (online, computer, internet-based scaffolding), PowerPoint, learning videos, digital images, and so on. Various types of digital e-scaffolding can attract and arouse interest, curiosity and optimal student learning activities, helping students understand the material more easily. Digital video e-scaffoding makes it easier for students to absorb information in the form of moving images and sound (Kamelia, 2019).

Learning in the 21st century requires teachers to be professional and keep abreast of developments in science and technology. TPACK as a basic framework for 21st century learning is the foundation for teachers to achieve learning goals. TPACK is aligned with the teacher's pedagogic, personality, social and professional competencies. TPACK's ability is also related to the ability to design and use digital e-scaffolding. Digital e-scaffolding related to digital technology is an important factor in the implementation of education to face the challenges of changing times that are increasingly developing, which includes information and communication technology. Technology is driving reform in education, as a means of developing education in all elements of society (Burbules et al., 2020). Digital e-scaffolding related to information and communication technology can now be accessed via computers, internet, smart phones, and so on. Digital technology is developing rapidly because of the internet network which makes it easier to get information (Santos et al., 2019). TPACK integrates technology in delivering material, including pedagogical skills in delivering material. TPACK is divided into seven knowledge domains which include Content Knowledge (CK); Pedagogical Knowledge (PK); Technological Knowledge (TK); Pedagogical Content Knowledge

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(PCK); Technological Content Knowledge (TCK); Technological Pedagogical Knowledge (TPK); and Technological Pedagogical Content Knowledge (TPACK). TPACK Component Framework can be seen in Figure 3.

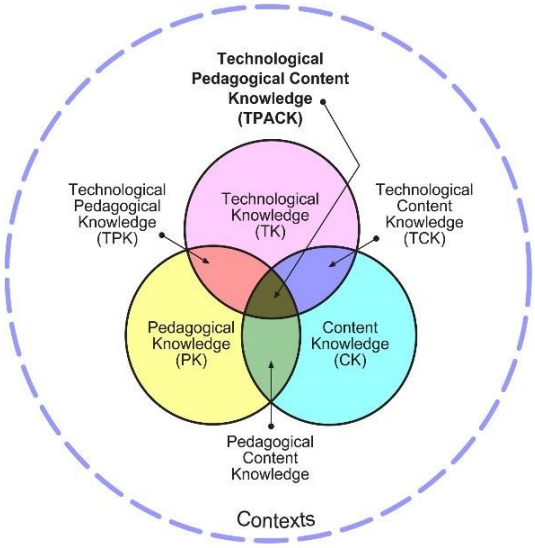

Figure 3. TPACK component framework

This TPACK component framework emphasizes the types of knowledge that lie at the intersection of three main forms, namely Pedagogical Content Knowledge (PCK), Technology Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technology Pedagogical Content Knowledge. Effective technological integration of pedagogy around specific subject matter requires developing a sensitivity to the dynamic, transactional relationships between components of knowledge located in unique contexts. Explanations for each component are described below: Content Knowledge (CK), the teacher's knowledge of the subject matter that students will learn. Pedagogical Knowledge (PK), a teacher's in-depth knowledge of processes and practices as well as learning methods or strategies. Technology Knowledge (TK), knowledge of certain ways of thinking about knowledge and working with technology, tools, and various other resources (Dhendup & Sherab, 2023). This includes understanding a wide range of information technologies for productive use at work and in everyday life.

Utilization of TPACK and digital e-scaffolding can increase student involvement and motivation to explore learning content, explore content knowledge that integrates with technology so that learning is effective and innovative. Teachers' understanding of TPACK can help increase the efficiency of integrating technology during learning (Habibi et al., 2020). TPACK as an effective way of delivering lessons so that teachers from the start understand the effective use of technology in learning (Mahato & Sen, 2023; Voogt & McKenney, 2016). TPACK is an efficient way to apply technology-rich classrooms (Koehler et al., 2014). TPACK is the way needed to learn in the digital age (Chai et al., 2013). TPACK forms the basis of 21st century learning with three main components of using technology in learning contexts including technological knowledge, pedagogical knowledge, and content knowledge.

TPACK is needed to teach effectively with technology (Redmond & Peled, 2018). TPACK facilitates teachers' understanding and knowledge of the interactions of technology, pedagogy, content in learning (Koh et al., 2014; Porras-Hernandez & Salinas-Amescua, 2013). The TPACK strategy addresses the challenges faced by teachers to align the demands of technology in learning and the delivery of content in learning (Olofson et al., 2016). TPACK relates to teachers' opportunities to use technology in efficient teaching and learning processes (Cheng & Xie, 2018). These findings indicate that TPACK plays an important role in facilitating teachers in implementing technology in 21st century learning. TPACK's capabilities encourage teachers to carry out learning innovations so as to increase student motivation and learning outcomes

(Afwan et al., 2020). Utilization of TPACK, including related to digital e-scaffolding. Interesting and varied use of e-scaffolding can support successful learning and learning for students with disabilities. The basis of e-scaffolding is scaffolding, a large amount of assistance to individuals during the early stages of learning and then reducing this assistance and providing opportunities for children to take on greater responsibility as soon as they are able to work on their own (Fani & Ghaemi, 2011). Scaffolding to enhance independent learning that focuses on developing thinking power (Devolder et al., 2012; Munshi et al., 2023).

E-Scaffolding facilitates learning via the internet, can train and improve students' abilities, supports students to learn independently. Computer-aided e-scaffolding can improve student performance (Kim et al., 2017). Scaffolding supports students in learning activities and improves student learning outcomes (Yu et al., 2013). Online-based e-scaffolding can increase student understanding and help students complete assignments (Hsu et al, 2015). Scaffolding can increase the depth of learning content, strengthen motivation, improve thinking skills (Lin & Singh, 2015). Scaffolding helps students increase engagement in learning and successfully complete assignments that are beyond their current abilities (Bakker et al., 2015; Huang, 2019; Prediger & Pöhler, 2015). Scaffolding support assistance tailored to students' learning needs (Bakker et al., 2015). Computer-based e-scaffolding shows effectiveness on student performance and thinking skills (Belland & Evidence, 2016). Computer-based scaffolding can help students generate solutions to complex problems and are fully provided by computer-based tools (Zheng, 2016). ICT-based e-scaffolding and digital technology can support learning strategies and have a positive effect on student achievement (Ormond, 2016). These various conclusions indicate that digital e-scaffolding can improve performance and student learning outcomes so that the TPACK abilities of Special School teachers, including regarding digital e-scaffolding, are important to master and improve. In addition, online, computer, internet-based digital e-scaffolding strategies make it easier for students to understand learning material.

CONCLUSION

Based on the research results, the ability of TPACK and digital e-scaffolding for Special School teachers is in the good category. This is also based on the results of data analysis with a percentage showing a score of 78%, meaning it is in the good category. TPACK plays an important role in contributing to innovation in the field of education. Many things from TPACK can be utilized in the education sector, for example in the learning process, digital e-scaffolding, technology-based learning media, and so on. Digital e-scaffolding can also take advantage of technology, the learning content that will be conveyed by the teacher can be packaged in the form of digital content, digital media, and so on. The current presence of TPACK is expected to be put to good use by educators and education implementers. TPACK requires alignment of technological, pedagogical, and content knowledge aspects.

The implication of this research is that it can be useful in providing information related to TPACK and e-scaffolding, especially for Special School teachers and policy makers. The limitation of this research is that it has not analyzed the various components of TPACK and types of digital e-scaffolding. Future researchers can complete the research by analyzing various components of TPACK and types of digital e-scaffolding that can be applied in the learning process of students with disabilities according to the type of disability. In addition, it can increase the number of samples of individuals with disabilities according to the characteristics and needs of disabilities.

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