The Profile of Technological Pedagogical Content Knowledge (TPACK) for Vocational High School Accounting Teachers

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Abstract. The 21st century has had a significant impact on the world of education. The learning paradigm has undergone a transformation, with conventional teaching evolving into ICT-based learning. Learning must be able to integrate technology at every stage of the learning process. Teachers are required to create a learning environment that is adaptive to technology while still paying attention to the pedagogical elements inherent in the teaching materials when delivering them to students. The TPACK framework introduces the relationship and complexity between the three core knowledge areas (content, pedagogical, and technology), resulting in four new types of knowledge. This research used a descriptive research design. The study population consisted of vocational high school accounting teachers in East Java. The research results showed that the TPACK capabilities of vocational high school accounting teachers in East Java are good. TPACK capabilities demonstrate the teachers' ability to integrate technology, pedagogy, and content knowledge into the learning process..

Keywords: Technological Pedagogical Content Knowledge (TPACK).

1 Introduction

The 21st century has had a significant impact on the world of education. The learning paradigm has undergone a transformation, with conventional teaching evolving into ICT-based learning. Learning must be able to integrate technology at every stage of the learning process. Technology serves as a tool, process, and learning resource in the learning process [1]. Research results have shown that technology has the capacity to enhance students' understanding and complex thinking skills [2]–[4]. Technology can also boost students' motivation to learn [3] and develop 21st century skills [5]. Technology can enhance students' abilities to conduct scientific research [6]. In light of the necessity for technological synergy in education, the government has implemented various policies. Minister of Education and Culture Regulation No. 23 of 2015 on the Cultivation of Character serves as the basis for the School Literacy Movement. There are five aspects of the School Literacy Movement: (1) basic literacy; (2) library literacy; (3) media literacy; (4) technology literacy; and (5) visual literacy. Additionally, Minister of Education and Culture Regulation No. 22 of 2016 explains that one of the principles of the 2013 Curriculum aligning with global developments is the use of ICT

IRCEB 2023, September 26, Malang, Indonesia

DOI 10.4108/eai.26-9-2023.2350710

to enhance the efficiency and effectiveness of learning. Based on this, teachers are required to involve technology in their teaching processes. Teachers are tasked with creating a learning environment that is adaptive to technology while still paying attention to the pedagogical elements inherent in the teaching materials when delivering them to students [7]. Teachers face the challenge of utilizing various technological resources in the classroom.

One of the frameworks for integrating technology into education is the Technological Pedagogical Content Knowledge (TPACK) framework. The TPACK framework introduces the relationships and complexities among three core knowledge areas (content, pedagogy, and technology), resulting in four new types of knowledge. The TPACK framework can be used to assess the level of a teacher's knowledge in integrating technology into the learning process [8]–[10]. TPACK demands that teachers possess comprehensive and holistic knowledge and skills related to content, pedagogy, and technology. With TPACK, teachers have effective and efficient knowledge in using technology to enhance the effectiveness and quality of learning, starting from planning, through the learning process, and to evaluation.

The facts show that many teachers are still unable to comprehensively and holistically integrate content, pedagogy, and technology into their teaching processes. The results of the 2021 Teacher Competency Test (UKG) indicated that the average teacher's ability in the pedagogical and professional aspects had a score of 58 out of 100. Additionally, teachers' ability to use technology in their teaching is still low [7], [11], [12]. Studies on TPACK have been conducted extensively for science subject teachers, but TPACK studies for vocational high school (SMK) accounting teachers have not been found. From an academic perspective, Accounting in SMK is a subject that should ideally be taught adaptively with technology. However, existing studies indicate that the level of technology integration in accounting education in SMK is still low. Social science subject teachers still predominantly use the Pedagogical Content Knowledge (PCK) approach, resulting in limited technology integration in their teaching [13], [14]. In the 21st century, the demand to integrate technology into the teaching process is not limited to science teachers but also applies to social science teachers [15].

The novelty of this research is the research subjects. Many TPACK studies have primarily focused on science subject teachers [16]–[20]. However, this study examines TPACK in vocational high school (SMK) accounting teachers. This is an interesting area of investigation because technological advancements have a significant impact on accounting education in SMK.

2 Literature Review

2.1 *Technological Pedagogical Content Knowledge (*TPACK)

The TPACK framework is constructed based on Shulman's description, which explains how a teacher's understanding of educational technology and Pedagogical Content Knowledge (PCK) interact with each other to produce effective teaching with technology [21], [22]. TPACK serves as the foundational framework for designing effective learning by integrating technology, pedagogical techniques that use technology constructively to impart knowledge, usage of technology to be able to help address students' challenges, and knowledge of how

technology can be used to build on existing knowledge and develop new epistemologies or strengthen old ones [9]. TPACK is a strategic way of thinking when planning and organizing specific knowledge content in line with the needs of learners and specific classroom situations, involving various technologies in the digital era to support student learning. In the current digital era, it is of utmost importance for teachers to integrate technology into their teaching processes [23].

TPACK is a learning approach that encompasses three knowledge domains: content knowledge (CK), pedagogical knowledge (PK), and technology knowledge (TK). CK refers to the mastery of a subject area or learning material. PK is the knowledge of the teaching process and strategies. TK represents the knowledge of how to use digital technology. These three forms of knowledge (CK, PK, and TK) combine to develop secondary forms of knowledge, including pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), and technological content knowledge (TCK). The synthesis of these three secondary forms of knowledge (PCK, TPK, and TCK) ultimately forms TPACK (Dong *et al.*, 2015). PCK is the pedagogical knowledge that teachers possess when teaching a particular subject. The transformation of PCK occurs when teachers interpret the subject matter, discover multiple ways to represent it, and adapt and adjust instructional materials to accommodate alternative conceptions and students' prior knowledge [22]. TPK is an understanding of how teaching and learning can change when specific technologies are used in specific ways. This knowledge includes pedagogical skills in recognizing the constraints of various technological tools used in the design and pedagogical strategies that are appropriate for the development of a specific discipline [9]. TCK is the ability to understand how technology can be effectively used to represent content within a specific learning domain or topic area.

2.2 *Content Knowledge* (CK)

Content knowledge refers to a teacher's understanding of the subject matter to be learned or taught. Knowledge of the subject matter is crucial for teachers and includes knowledge of concepts, theories, ideas, organizational frameworks, evidence of knowledge, established practices related to that knowledge, and approaches to further developing that knowledge. Knowledge and the nature of inquiry across disciplines differ, and a teacher should have a deeper understanding of the foundational knowledge of the discipline they teach [9]. In the field of science, knowledge encompasses information about scientific facts and theories, scientific methods, and evidence-based reasoning. In the field of the arts, knowledge includes information about art history, famous paintings, sculptures, and artists and their historical context, as well as knowledge about aesthetic and psychological theories used to evaluate art.

2.3 *Pedagogical knowledge* (PK)

Pedagogical knowledge is a teacher's in-depth understanding of the process and practices or methods of teaching and learning. This knowledge encompasses the goals and values of education as a whole. This general knowledge applies to understanding how learners learn, classroom management skills, lesson planning, and student assessment [9], [24]. It also includes knowledge of the techniques or methods used in the classroom, the characteristics of the target audience, and strategies for evaluating students' understanding. A teacher with deep pedagogical knowledge can understand how students construct knowledge, acquire skills, and develop thinking habits and a positive disposition toward learning.

2.4 *Pedagogical Content Knowledge* (PCK)

Pedagogical Content Knowledge (PCK) is the transformation of knowledge about a subject area or learning material through the teaching and learning processes. This transformation occurs when a teacher interprets the subject matter, discovers multiple possibilities of its representation, and adapts and adjusts instructional materials while accommodating alternative conceptions and students' prior knowledge [22]. PCK includes the core elements of teaching, learning, curriculum, assessment, and reporting, focusing on the relationships between curriculum, assessment, and pedagogy.

2.5 *Technological Knowledge* (TK)

Technology knowledge (TK) is knowledge about various technologies, ranging from traditional tools such as pencils, paper, and chalkboards, to digital technologies such as the internet, digital video, interactive whiteboards, computer software programs, and more. TK involves an understanding of how to use technology in an educational context.

2.6 *Technological Content Knowledge* (TCK)

Technological Content Knowledge (TCK) is the knowledge of how technology can create new representations for specific content and influence practices and knowledge within a particular discipline. This implies that if teachers understand how to use specific technologies in teaching and learning, they can change the way students practice and understand concepts in a particular subject area [12], [24].

2.7 *Technological Pedagogical Knowledge* (TPK)

Technological Pedagogical Knowledge (TPK) is an understanding of how the teaching and learning process can change by using technology in specific ways. This knowledge includes pedagogical skills in understanding technology that aligns with the design and pedagogical strategies suitable for the development of the discipline. The concept of TPK provides a deeper understanding of the constraints and affordances of technology within the context of the discipline where technology is required [9].

3 Methods

This research used a descriptive research design and was conducted among vocational high school (SMK) accounting teachers in East Java. The research population consisted of SMK accounting teachers in East Java. Samples were selected through simple random sampling. The research instrument is a questionnaire designed to explore the components of TPACK, covering Pedagogical Knowledge (PK), Technological Knowledge (TK), Content Knowledge (CK), Pedagogical Content Knowledge (PCK), Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), and Technological Pedagogical Content Knowledge (TPACK). These seven variables were further elaborated into 38 self-assessment questionnaire items using a Likert scale ranging from 1 to 4.

4 Results and Discussion

4.1 Pedagogical Knowledge (PK)

Table 1. Distribution Frequency of the Pedagogical Knowledge (PK) Variable

Intervals	Frequency	Percentage	Category
15-17	3	3%	Very Low
18-20	20	17%	Low
21-23	46	39%	High
24-28	48	41%	Very high

Based on Table 1, it is evident that three teachers had a very low Pedagogical Knowledge (PK), 20 teachers had a low PK, 46 teachers had a high PK, and 48 teachers had a very high PK. The data in Table 1 indicates that the majority of vocational high school (SMK) accounting teachers in East Java possessed good PK. The PK indicator with the lowest score was the use of teaching strategies that can cultivate reflective thinking skills. Reflective thinking is meaningful thinking based on reasons and purposes [25]. Reflective thinking involves problem-solving, formulating conclusions, considering what to do, and making decisions when someone uses meaningful and effective skills for a specific context and type of thinking task. The PK indicator with the highest score was knowledge of teaching strategies that can motivate students to convey their ideas and concepts.

4.2 Technological Knowledge (TK)

Table 2. Distribution Frequency of the Technological Knowledge (TK) Variable

Intervals	Frequency	Percentage	Category
7-8	6	5%	Very Low
9-10	16	14%	Low
11-12	46	39%	High
13-16	49	42%	Very high

Table 2 shows that six teachers had a very low Technological Knowledge (TK), 16 teachers had a low TK, 46 teachers had a high TK, and 49 teachers had a very high TK. The TK indicator with the lowest score was the use of word processing, video, and animation applications. This result reflects that not all SMK accounting teachers in East Java are maximizing the use of word processing, image, video, and animation applications in accounting education. On the other hand, the TK indicator with the highest score was the use of new technology tools in education. In today's learning era, technology plays a crucial role in the teaching and learning process. High levels of technology usage by teachers can equip students with digital skills. Moreover, teachers who master the use of technology effectively according to the current conditions will facilitate a smooth learning process with students [26].

4.3 Content Knowledge (CK)

Table 3. Distribution Frequency of the Content Knowledge (CK) Variable

Intervals	Frequency	Percentage	Category
7-8	4	3%	Very Low
9-10	20	17%	Low
11-12	44	38%	High
13-16	49	42%	Very high

Table 3 shows that four vocational high school (SMK) accounting teachers in East Java had a very low Content Knowledge (CK), 20 teachers had a low CK, 44 teachers had a high CK, and 49 teachers had a very high CK. The CK indicator with the lowest score was knowledge of recent research in accounting. This result demonstrates that the level of teacher literacy regarding recent research in accounting is still low.

4.4 Pedagogical Content Knowledge (PCK)

Table 4. Distribution Frequency of the Pedagogical Content Knowledge (PCK) Variable

Intervals	Frequency	Percentage	Category
12-14	9	8%	Very Low
15-17	24	21%	Low
18-20	57	49%	High
21-24	27	23%	Very high

Table 4 shows that nine vocational high school (SMK) accounting teachers in East Java had a very low Pedagogical Content Knowledge (PCK), 24 teachers had a low PCK, 57 teachers had a high PCK, and 27 teachers had a very high PCK. The PCK indicator with the lowest score was teachers' knowledge of accounting teaching strategies that can guide students' reflective thinking. This condition can impact the suboptimal development of students' reflective abilities. The success of teachers in the learning process is significantly influenced by the appropriateness of their choice of teaching strategies.

4.5 Technological Pedagogical Knowledge (TPK)

Table 5. Distribution Frequency of Technological Pedagogical Knowledge (TPK)

Intervals	Frequency	Percentage	Category
11-13	7	6%	Very Low
14-16	12	10%	Low
17-19	61	52%	High
20-24	37	32%	Very high

Table 5 shows that seven vocational high school (SMK) accounting teachers in East Java had a very low Technological Pedagogical Knowledge (TPK), 12 teachers had a low TPK, 61 teachers had a high TPK, and 37 teachers had a very high TPK. The TPK indicator with the lowest score was the use of information and communication technology (ICT) in teaching as a means for students to solve problems during group discussions. TPK is the knowledge of how various technologies can be used to facilitate learning and teaching. Teachers must have the ability to choose the right and appropriate technology to support the smooth flow of the learning process.

4.6 Technological Content Knowledge (TCK)

Table 6. Distribution Frequency of Technological Content Knowledge (TCK)

Intervals	Frequency	Percentage	Category
5-7	7	6%	Very Low
8-10	38	32%	Low
11-13	57	49%	High
14-16	15	13%	Very high

Table 6 shows that seven vocational high school (SMK) accounting teachers in East Java had a very low Technological Content Knowledge (TCK), 38 teachers had a low TCK, 57 teachers had a high TCK, and 15 teachers had a very high TCK. The data above indicates that the majority of SMK accounting teachers in East Java possess good TCK skills. The TCK indicator that needs improvement is teachers' knowledge of the information and communication technology (ICT) applications commonly used by professionals in the field of accounting. TCK is the knowledge of the interaction between technology and content (material). Proficiency in TCK indicates that teachers can effectively use technology to create new representations for specific content.

4.7 Technological Pedagogical Content Knowledge (TPACK)

Table 7. Distribution Frequency of Technological Pedagogical Content Knowledge (TPACK)

Intervals	Frequency	Percentage	Category
14-18	24	21%	Very Low
19-21	63	54%	Low
22-24	8	7%	High
25-28	22	19%	Very high

Table 7 shows that 24 vocational high school (SMK) accounting teachers in East Java had a very low Technological Pedagogical Content Knowledge (TPACK), 63 teachers had a low TPACK, eight teachers had a high TPACK, and 22 teachers had a very high TPACK. Based on these calculations, it is evident that the majority of SMK accounting teachers in East Java do not yet possess strong TPACK skills. TPACK is the teacher's ability to integrate technology, pedagogy, and content (material). Teachers need to master TPACK to ensure that the teaching process can be effective and efficient. Teachers with a strong grasp of TPACK can seamlessly integrate technology into the learning process according to the lesson content and appropriate teaching strategies based on student characteristics.

5 Conclusion

The research results indicate that the abilities of accounting teachers in vocational high schools (SMK) in East Java in each element of TPACK are good. TPACK abilities reflect the teachers' capacity to integrate technology, pedagogy, and content knowledge in the teaching process. This study has several limitations. 1) The measurement of content knowledge variables was conducted using a questionnaire, which could have been better measured by administering a test to assess prospective teachers' knowledge in the field of accounting. 2) Data collection through questionnaires may result in answers that do not always reflect the

actual conditions. 3) The research instrument indicators were based on studies in different countries with different backgrounds and cultures. This study also has several implications. 1) Future research should consider using a qualitative research design, and for the content knowledge variable (Content Knowledge), it may be better assessed by conducting tests related to the accounting field. 2) For teachers, understanding TPACK helps them improve how they integrate technology into their teaching. Teachers can design more effective learning experiences by combining their subject knowledge, pedagogy, and technology.

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