



Analyzing Teachers' Technological Pedagogical Content Knowledge (TPACK) in Teaching Reading Comprehension in Fifth-Grade Elementary Schools

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Abstract. This study aims to analyze the Technological Pedagogical Content Knowledge (TPACK) of teachers in teaching reading comprehension in fifth-grade elementary schools. A quantitative design was used in this experiment, with the population and samples containing 194 and 50 fifth-grade elementary school teachers in Barru City, South Sulawesi Province, Indonesia. These samples were randomly selected from the population using a simple random sampling technique. Furthermore, the instrument used for data collection was a closed-ended questionnaire. Further, the obtained data were analyzed descriptively using a mean score formula and categorization of value ranges. The results showed that the mean score of teachers' TPACK was 77, subsequently belonging to the good category, indicating teachers' good TPACK in teaching reading comprehension.

Keywords: TPACK · Framework · Reading · Comprehension

1 Introduction

The challenges encountered by students during the inception of the 21st Century are increasingly complex, unknown, and unpredictable, with technology learning being subsequently considered and suggested by teachers. In education, the use of technology has many benefits, such as (1) encouraging teachers to develop creative and interactive classrooms, (2) providing students with access to innovative resources, (3) helping teachers teach effectively, (4) ensuring enjoyable experience and interesting design materials for students, and (5) encouraging teachers to improve their computerized knowledge and skills. Technology has also been selectively adjusted to the learning design and implementation. In this case, teachers should be able to select suitable technology for learning materials and strategies. The integration of these three aspects is known as the Technological Pedagogical Content Knowledge (TPACK) framework [1]. This framework educationally integrates technological, pedagogical, and content knowledge. Technological knowledge emphasizes the use of technology as a learning aid. Pedagogical knowledge prioritizes the learning designs where teachers use appropriate and creative models

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and methods to encourage the creation of a more effective academic process. Meanwhile, content knowledge represents the learning material to be taught [2].

In education, the use of the TPACK framework improves learning activities [3] due to the provision of guidance for teachers to develop academic innovations [2, 3]. This framework ensures a more effective and efficient learning process through the combination of technology in learning. Therefore, the use of TPACK aims to essentially improve and assess educational qualities as a reference and material. Reliable teachers often understand the benefits of integrating technology in the classroom while determining new methods to ensure meaningful lessons. Additionally, international trends in the literacy context, especially reading, indicate the need to integrate technology in RC (reading comprehension) lessons [4]. In this case, technological utilization is believed to contribute to students' RC skills [4, 5] significantly. The TPACK framework is considered new in the Indonesian educational sector, especially in reading courses in elementary schools. Accordingly, the literature reviews and empirical studies of this framework in elementary school reading courses have not been widely carried out. Therefore, this study aims to analyze teachers' technological pedagogical content knowledge (TPACK) in teaching reading comprehension in Indonesian fifth-grade elementary schools.

As defined by Mishra and Koehler in Lee Shulman's PCK [11], the TPACK framework is a combination of technology, methods, and learning materials. In this framework, technological, pedagogical, and content knowledge are three inseparable elements. TPACK also aims to (1) provide learning opportunities and experiences for students, (2) determine appropriate teaching methods to enhance student learning opportunities and experiences, and (3) ensure a more effective and efficient learning process [9]. This is because technology integration is closely related to teaching and is covered in PCK [13]. Furthermore, TPACK emphasizes the relationship between three types of knowledge (technology, pedagogy, and content) needed by teachers in a conceptual framework. In this context, content entails the information conveyed in learning, while pedagogy prioritizes teaching patterns during educational processes. Technology then encompasses all the tools needed in sustainable learning activities [14]. TPACK also covers the knowledge of appropriate technology usage required by teachers regarding the analyses of material nature and teaching aspects [15]. Based on the interactive relationship between content, pedagogy, and technology, TPACK is a form of knowledge used to develop good teaching. This is in line with [18], where teachers with a high level of TPACK can accurately select suitable pedagogical approaches to support students' content learning process through appropriate technology [18]. This framework contains the following seven elements of knowledge. First, content knowledge represents the actual learning material that should be taught, including the main facts, concepts, theories, and procedures. Second, pedagogical knowledge (PK) is the process and practice of teaching methods, as well as the classroom management, development, and implementation of lesson plans. It also entails an understanding of learning theory and cognitive development. Third, pedagogical content knowledge (PCK) contains the approaches appropriate to the learning content and patterns that are arranged for better teaching. Fourth, technology knowledge (TK) prioritizes standard and more advanced technologies, such as digital technology. Fifth, technological content knowledge (TCK) is the pattern by which technology and content are interrelated. Sixth, technological pedagogical knowledge (TPK), the existence,

components, and capabilities of various learning technologies. This entails the learning methods that can be implemented along with technology. Seventh, technological pedagogical content knowledge (TPACK) originates from the complex interaction between the three components of basic understanding (content, pedagogy, and technology). It is also effectively integrated into teaching and learning activities [19].

TPACK is complexly developed from the intersection of various content, pedagogy, and technology knowledge components [19]. The interactive relationship between these components subsequently emphasizes the development of good teaching compared to their individual implementation. TPACK knowledge is also best applied in reading skills [22], although Indonesia is reported to have a low category of RC (reading comprehension) ability [21]. This is in line with various reviews reporting students scored lower than 400 in reading literacy skills in the country. Reading comprehension is an activity carried out by readers to obtain deep thoughts and personal satisfaction [25]. According to Prihatsanti [21], reading comprehension ability is carefully and thoroughly practiced by the reader to hone critical skills toward in-depth understanding. This skill needs to be developed to increase students' scientific and informatics knowledge, which is constantly evolving. Furthermore, it is also necessary to understand the reading contents comprehensively. This is in line with a previous study describing that reading comprehension involves motor skills, eye movements, and thinking or reasoning to determine or understand the conveyed information [26]. This indicates that RC (reading comprehension) is cognitively performed to understand the reading content. In this context, the reader needs to understand the reading content, be able to pronounce the letters, as well as string the sounds of language into words, phrases, and sentences [27].

To help students in learning to read, teachers need to select appropriate strategies for achieving the goal. These educators need to develop a pleasant learning atmosphere, for example, by using attractive educational techniques and media. They should also be able to adopt innovative methods toward ensuring changes in their teaching practices, which majorly influence the improvement of students' language skills and knowledge. This is often performed through media literacy, using TPACK for quick and easy access to various sources of knowledge [28]. In this context, teachers need to use many technological advances to guide their language learning skills. TPACK-based applications and tools should also be used to answer their learning needs and desires, such as Quizziz, YouTube, Email, online dictionaries, PowerPoint, WhatsApp, and others. One of the primary advantages of the TPACK-based learning program is the easy accessibility of technological devices, which are provided and implemented to improve students' independent education. In this case, modern technology reportedly dominates all life aspects, with students consistently using it anytime and anywhere [29]. Besides, the TPACK model emphasizes its relevance to new and non-traditional patterns of learning to read. From this context, the students are specifically instructed to read relevant materials such as magazine articles, videos, and different slideshows posted to their classroom accounts before the class is started. When reading or watching these materials, they can connect their ideas, improving their understanding of the utilized reading text [29].

However, the available studies have not reviewed the effects of the TPACK framework on reading lessons, which is a core phenomenon in elementary institutions.

Therefore, this study aims to analyze the teachers' technological pedagogical content knowledge (TPACK) in teaching reading comprehension in fifth-grade elementary schools.

2 Method

This study used a quantitative approach involving 194 fifth-grade teachers in Barru Regency, Indonesia, as the population. A total of 50 samples were then randomly obtained from this population using a simple random sampling technique. Data was also obtained through a closed-ended questionnaire, emphasizing the teacher's understanding of TPACK components commonly used in learning reading comprehension. This instrument was widely used to assess teachers' TPACK knowledge [17]. Besides, this instrument also attained high validity and high reliability after being examined by various experts, indicating that this instrument emphasized the assessment of all seven components [30]. To measure the teacher's TPACK through self-assessment, a total of 30 responses were obtained using a 5-point Likert scale, indicating VP (Very Poor; 1), L (Less; 2), FG (Fairly Good; 3), G (Good; 4), and VG (Very Good; 5).

Data analysis was subsequently carried out after the collection of data using descriptive statistical analysis. In this process, learning outcomes were calculated to analyze data by describing the obtained information without aiming to provide public or generalized conclusions. The initial stage of processing the data obtained from the questionnaire was (1) transforming the answers into scores and tabulating the answers in the form of positive statements, as presented in Table 1.

Further, we calculated the total score of each questionnaire item and then determined the percentage of each TPACK competency using the following formula. Lastly, we converted the obtained scores into percentage and interpreted the data using categories presented in Table 2.

$$NP = \frac{R}{SM} \times 100\%$$

Table 1. Likert Scale Description

Category	Score
Excellent (VG)	5
Good (G)	4
Average (FG)	3
Poor (P)	2
Very Poor (VP)	1

Table 2. Interpretation of TPACK Score

Value Intervals (%)	Interpretation
81–100	Very Good
61–80	Good
41–60	Fairly Good
21–40	Poor
0–20	Very Poor

Where

NP = Value Percentage

R = Raw scores obtained by the teacher

SM = Ideal maximum score

3 Results and Discussions

In learning reading comprehension, the description of fifth-grade elementary school teachers' technological pedagogical content knowledge consisted of PK, CK, TK, PCK, TCK, TPK, TPACK, and total TPACK descriptively analyzed.

3.1 Technological Knowledge of Fifth-Grade Elementary School Teachers in Reading Comprehension Course

Technological knowledge emphasizes various technologies from the oldest to the newest level. In this context, the use of technology needs to be periodically adopted and continuously developed. In the educational sector, this component prioritizes the patterns of computer software and hardware usage. It also includes the ability to adapt and learn about the latest technology. These capabilities are essential due to the rapid improvement and change in technology.

Table 3 shows that 6 (12%), 29 (58%), and 15 (30%) of the 50 teachers have fairly good, good, and very good technological knowledge, respectively. This signified that in the technological knowledge, our participants attained a 78% score, categorized as good. These results are in line with previous relevant reviews reporting similar good technological knowledge (TK) [18–20].

3.2 Fifth Grade Elementary School Teacher's Pedagogical Knowledge in Reading Comprehension Course

Pedagogical knowledge (PK) involves various skills, including managing classes, providing assessments, as well as developing lesson plans, and guiding student learning processes [17]. This describes the general aim of teaching knowledge. In this context,

Table 3. Analysis Results of Teachers' Technological Knowledge

Value Intervals (%)	Interpretation	Statement	
		TK	
		F	%
81–100	Very Good	15	30
61–80	Good	29	58
41–60	Fairly Good	6	12
21–40	Poor	0	0
0–20	Very Poor	0	0
TOTAL		50	100

Table 4. Analysis Results of Teachers' Pedagogical Knowledge

Value Intervals (%)	Interpretation	Statement	
		PK	
		F	%
81–100	Very good	13	26
61–80	Good	31	62
41–60	Fairly good	6	12
21–40	Poor	0	0
0–20	Very Poor	0	0
TOTAL		50	100

teachers need to develop their teaching ability to manage and organize classes, as well as achieve predetermined goals. The expected pedagogical knowledge includes understanding classroom management activities, the role of student motivation, formulation of lesson plans, and teaching assessments. PK skills also describe teachers' comprehension of different teaching methods, including the knowledge about organizing conducive classroom activities.

According to Table 4, there are 6 (12%), 31 (62%), and 13 (26%) of the 50 teachers have fairly good, good, and excellent pedagogical knowledge. This confirmed the teachers' excellent ability to master the learning pedagogy. From the results, the teachers' TPACK score in the pedagogical category was 78% in the good category. This finding supports previous relevant reviews that reported teachers' good Pedagogical knowledge (PK) [18–20].

Table 5. Content Knowledge Analysis

Value Intervals (%)	Interpretation	Statement	
		CK	
		F	%
81–100	Very Good	8	16
61–80	Good	35	70
41–60	Fairly Good	7	14
21–40	Poor	0	0
0–20	Very Poor	0	0
TOTAL		50	100

3.3 Content Knowledge of Fifth-Grade Elementary School Teachers in Reading Comprehension Course

Content Knowledge (CK) emphasizes the learning topic [17], following the specifics of disciplines or lessons. In this case, a teacher needs to master content knowledge in the teaching process. Besides, CK is also important due to being the determining factor for unique thinking patterns of the scientific discipline in each study.

Based on Table 5, the teachers' TPACK content knowledge is 78% in the good category. This finding is in agreement with previous relevant reviews discovering good Content Knowledge (CK) [18–20].

3.4 Technological Pedagogical Knowledge of Fifth Grade Elementary School Teachers in Reading Comprehension Course

Technological Pedagogical Knowledge (TPK) prioritizes the patterns of technology usage in teaching processes. This technology helps to transform a teacher's teaching method [17]. This knowledge emerges due to the reciprocal relationship between technology and pedagogy. Moreover, TPK ensures the understanding of appropriate technology use to achieve pedagogical goals. It also allows teachers to select suitable and feasible media based on a specific pedagogical approach. In this case, technology provides new methods used in the teaching process and ensures more accessible learning applications. Further, online learning systems require teachers and instructors to be more innovative and creative.

As presented in Table 6, the TPK of teachers in learning reading comprehension in elementary schools is 77% in the good category. This reinforced previous relevant reviews, revealing good TPK [18–20].

3.5 Technological Content Knowledge (TCK) of Fifth Grade Elementary School Teachers in Reading Comprehension Course

TCK focuses on the development of a new picture of specific materials. This describes the interrelationships between technology and content (material). In this context, technology

Table 6. Analysis Results of Teachers' Technological Pedagogical Knowledge

Value Intervals (%)	Interpretation	Statement	
		TPK	
		F	%
81–100	Very Good	10	20
61–80	Good	34	68
41–60	Fairly Good	6	12
21–40	Poor	0	0
0–20	Very Poor	0	0
TOTAL		50	100

Table 7. Analysis Results of Teachers' Technological Content Knowledge

Value Intervals (%)	Interpretation	Statement	
		TCK	
		F	%
81–100	Very Good	7	14
61–80	Good	33	66
41–60	Fairly Good	10	20
21–40	Poor	0	0
0–20	Very Poor	0	0
TOTAL		50	100

affects understanding and the introduction of new elements, affecting someone's pattern in presenting a content (material) overview [17] (Table 7).

Based on the quantitative analysis, the teachers' TCK was 77%, categorized as good. This corresponded with previous relevant studies reporting good TCK [18–20].

3.6 Pedagogical Content Knowledge (PCK) of Fifth Grade Elementary School Teachers in Reading Comprehension Course

Pedagogical content knowledge emphasizes teaching specific content and understanding suitable learning approaches. It also covers the patterns of content arrangement for good learning [19]. Moreover, effective teaching requires more than a separation of material and pedagogical knowledge [12], in which PCK aids the identification of suitable teaching patterns for different content. Besides focusing on a content expert or general pedagogical guideline knowledge, PCK also discusses the special relationship between content and pedagogy knowledge (Table 8).

Table 8. Analysis Results of Teachers' Pedagogical Content Knowledge

Value Intervals (%)	Interpretation	Statement	
		PCK	
		F	%
81–100	Very Good	9	18
61–80	Good	35	70
41–60	Fairly Good	6	12
21–40	Poor	0	0
0–20	Very Poor	0	0
TOTAL		50	100

From the quantitative analysis, the pedagogical content knowledge of the teachers was 78% in the good category. This is in line with several previous reports discovering good pedagogical content knowledge (PCK) [18–20].

3.7 Technological Pedagogical Content Knowledge (PCK) of Fifth Grade Elementary School Teachers in Reading Comprehension Course

TPACK focuses on the complex interaction between the domains of knowledge principles (content, pedagogy, technology). In the modern era, common learning demands teacher understanding towards collaborating with technology. This indicates that learning content and technology aspects are essential in the implementation of modern and innovative classroom learning. In this case, teachers need to understand the complex interactions between the three basic components of PK, CK, and TK, along with teaching the material using appropriate educational methods and technology [19].

The TPACK framework also functions as a theory and conceptual reference for experts and educators in measuring the readiness of prospective teachers to use technology effectively. This framework influences teachers to consider the inseparable relationship between technology, pedagogy, and content. In this context, teachers need to develop and design learning and curriculum actively (Table 9).

From the quantitative analysis, in the technological pedagogical content aspect, the teachers obtained a 74% score in the good category. This signified teachers' excellent ability to use technology accurately in the learning and preparation process. The results are in line with previous relevant research reporting good Technological Pedagogical and Content Knowledge (TPACK) [18–20].

Table 9. Analysis Results of Teachers' Technological Pedagogical Content Knowledge

Value Intervals (%)	Interpretation	Statement	
		TPACK	
		F	%
81–100	Very Good	5	10
61–80	Good	34	68
41–60	Fairly Good	11	22
21–40	Poor	0	0
0–20	Very Poor	0	0
TOTAL		50	100

4 Conclusions

Teachers' technological pedagogical and content knowledge (TPACK) in reading comprehension courses in fifth-grade elementary schools obtained an average value of 77%, categorized as good. In the seven components of this framework (TK, PK, CK, TPK, TCK, PCK, and TPACK), the teachers attained 78%, 78%, 78%, 77%, 77%, 78%, and 74%, respectively. This indicated that the teachers perceived that they had good TPACK. Since the utilized data collection instrument was a self-assessment scale, subsequent future reports should be conducted to observe the implementation of teachers' TPACK.

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