STUDENTS' RESPONSES TOWARDS TEACHER'S IMPLEMENTATION OF TPACK IN SENIOR HIGH SCHOOL AFTER PANDEMIC

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Abstract

Technological Pedagogical and Content Knowledge TPACK) is the knowledge that should be mastered by the teacher nowadays. The primary objective of this research is to investigate students' perceptions and reactions regarding the integration of Technological Pedagogical and Content Knowledge (TPACK) in a Senior High School setting. The study specifically targets twelfth-grade students enrolled in the Science Class at a selected Senior High School in Pontianak. The participants consist of a cohort of XII-grade students who provided their feedback by responding to a set of 35 statements pertaining to the teacher's utilization of TPACK. The collected data were subjected to analysis using SPSS Statistics 16.0. The findings reveal that the mean score for the teacher's TPACK is 3.57, with scores for Pedagogical Content Knowledge (PCK) at 3.75, instructional objectives content at 3.66, instructional representations and strategies at 3.62, and knowledge of students' understanding at 3.50. Additionally, nearly 100% of the students expressed strong agreement with statements highlighting the teacher's proficient pedagogical knowledge in implementing TPACK within the classroom. Consequently, the data analysis demonstrates a positive response towards the implementation of TPACK, indicating the successful integration of each element of TPACK among the XII Grade MIPA students.

INTRODUCTION

The advent of the pandemic has prompted a shift in Indonesia's educational landscape, necessitating a transition to online learning. Consequently, technology has emerged as an indispensable tool for engaging in remote education from the confines of home. The

incorporation of technology in teaching and learning holds significant promise for enhancing educational activities, enabling effective participation by both students and teachers and facilitating the successful accomplishment of diverse tasks across various sectors (Kouser and Majid, 2021). Furthermore, the application of technology has yielded positive outcomes, including notable improvements in teaching performance. Nevertheless, teachers must consider the appropriate pedagogical approaches that integrate innovative learning with technology, ensuring a seamless and effective educational experience (Basri et al., 2020).

The Ministry of Education has implemented regulations regarding online learning activities. However, during the teaching process, the focus of the teacher lies on delivering the educational content to the students. Puspitarini and Hanif (2019) emphasized the importance of using media as a tool for delivering materials and information to students, highlighting the necessity of integrating learning methods. When utilizing media, teachers should take into account the effectiveness of the material being conveyed in the classroom (Ulfa & Purnamaningsih, 2022). Additionally, technological devices such as laptops, tablets, projectors, and various learning platforms like Padlet, Quizziz, Plickers, and Edmodo can enhance student engagement and active participation (Boonmoh et al., 2021). Therefore, in today's era, teachers must possess technological, pedagogical, and content knowledge, integrating these aspects to foster innovation and creativity in classroom teaching and learning activities (Mishra & Koehler, 2006).

TPACK is known as the recent framework used to teach by integrating technology. It includes material content, pedagogical skills, and proficiency in using technology (Akhwani, 2020). TPACK is the fundamentals of effective technology-enhanced learning and teaching, idea representation through technology, pedagogical strategies that include technology, and technological use to help students develop new understanding from their prior knowledge. Mishra & Koehler (2006) have proposed seven elements which are Content Knowledge (CK), Pedagogical Knowledge (PK), Technology Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), Technological Pedagogical and Content Knowledge (TPACK).

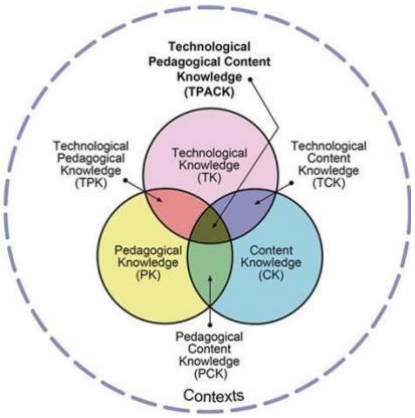

Figure 1. TPACK Frameworks

- Content Knowledge is the mastery of a subject, such as the theories underlying a body of work.
- Pedagogical Knowledge is the way a teacher applies a technique or method for teaching
- Technology Knowledge is the instructional tools used by the teacher, such as a laptop, flash drive, and projector screen.
- Pedagogical Content Knowledge is the standard approach to teaching and learning
- Technological Content Knowledge is the various forms of learning media, including movies, videos, and music, that can be utilized to convey information.
- Technological Pedagogical Knowledge is some technologies employed, for example, when a teacher uses social media for educational purposes, such as Instagram and Twitter, the teaching and learning are improved.
- Technological Pedagogical and Content Knowledge is the combination that contributed to excellent technology-based learning.

Moreover, technology should be used wisely in the classroom. The role of teachers cannot be "replaced" by technology, as their primary responsibility is to teach and educate students about the value of goodness (Indira et al., 2020). Furthermore, teachers need to consider their proficiency in teaching methods and the educational concepts of the fourth Industrial Revolution era. They should strive to be creative and innovative in their teaching approach, collaborating with other teachers to think critically and solve problems encountered during the teaching and learning process. In the present day, teachers are expected to possess knowledge of effective classroom management techniques that create a comfortable environment and foster student engagement and mutual support. Consequently, students can successfully transition from an era of disruption to an era of abundant information, media, and educational resources.

The government's school regulations encompass a range of tools that facilitate enhanced learning activities for both teachers and students. These tools include projectors, HDMI cables, speakers, whiteboards, stable internet connections, and more. Notably, the school also assigns technicians to guide teachers and ensure the proper operation of these tools. Furthermore, the practice of gathering and sharing knowledge through Teacher Subject Discussion (TSD) sessions among English teachers will serve to enlighten educators in the design, planning, and implementation of instructional materials within the classroom.

The efficacy of Technological Pedagogical Content Knowledge (TPACK) implementation has been explored by various researchers. For instance, Radiyah Alim and Nur Alim (2022) discovered that students were able to directly access assignment documents, gather resources, and benefit from multiple modes of material delivery, which enhanced connectivity, and engagement, and provided flexible scheduling. These findings were based on respondent assessments of TPACK implementation in hybrid learning. Additionally, Nurina et al. (2019) revealed that the learning environment for students is influenced by variations in pedagogical approaches and technology utilization, as well as the professionalism of teachers. Social and personal competencies are deemed as supportive factors for pedagogy and professional competency, while professional

competence encompasses the skills and abilities necessary for effective teaching and learning (Azhar et al., 2020).

TPACK implementation has been observed both prior to and during the pandemic. However, in the context of online learning, technology played a crucial role, with activities such as Google Meet and web browsing being frequently utilized by students. As the pandemic subsides and teaching activities resume in a face-to-face setting, teachers must take into account the TPACK strategies previously employed during online classes and apply them directly in the classroom. Therefore, this study aims to provide an overview of how TPACK dimensions were addressed during post-pandemic implementation, assisting the teacher in identifying challenges and adjusting their lesson plans to better accommodate the diverse learning styles of their students.

METHOD

Research Design

The research design employed in this study is descriptive quantitative. The researcher evaluated the students' perceptions regarding the implementation of Technological Pedagogical Content Knowledge (TPACK). An online survey consisting of 35 questions was administered to all students in XII MIPA. The survey focused on assessing how effectively teachers engaged and led classroom activities by integrating knowledge pertaining to technology, pedagogy, and content. Each question pertained to Subject Matter Knowledge (SMK), Technological Knowledge, Knowledge of Students' Understanding (KSU), and Technological Pedagogical and Content Knowledge (TPACK). As suggested by J.D. Brown (2015), the Likert Scale was utilized to gauge the respondents' opinions concerning a set of statements. The Likert Scale included four response options: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). In order to prevent respondents from selecting a neutral response, it was not included in this study. The scoring of each response was determined based on the positive or negative nature of the statements.

Setting and Participants

The researcher selected a public school in Pontianak and specifically targeted the XII MIPA classes. This decision was made to emphasize classes where teachers implemented technology, pedagogy, and content knowledge in a simultaneous manner. The questionnaire statements also inquired about the students' classes, which aided the researcher in identifying obstacles and facilitating further inquiries regarding their chosen 263 responses.

Data Collection Method and Analysis

The researcher employed a questionnaire as the primary data collection instrument. The questions were adapted from previous studies conducted by Oumnia and Nesrine (2022) and Shih and Chuang (2013). These questions covered various aspects of Technological Pedagogical and Content Knowledge (TPACK), Pedagogical Content Knowledge (PCK), Instructional Object Content, Response Instructional Representation and Strategies, and Knowledge of Students' Understanding. Modifications were made to ensure the questionnaire aligned with the specific classroom situation and conditions. The collected data were categorized based on the discussed aspects. To ensure validity and reliability, the researcher conducted an analysis using SPSS calculations.

The validity tests revealed a significance level (Sig.) ranging from 0.00 to 0.03, with a threshold of 0.05. This indicates that the 35 questionnaire statements, with values ranging from 0.000 to 0.003, were deemed statistically significant. Therefore, it can be concluded that the data obtained from the questionnaires are valid within the scope of the study.

Once the questionnaire data was collected, it underwent analysis using the SPSS 16.0 program. Various statistical measures such as percentages, means, and standard deviations were calculated as part of the data processing procedure. These measures were employed to interpret the data and draw meaningful inferences. Furthermore, the researcher ensured that the instrument used in the study exhibited high reliability. Prior to analysis, the researcher discovered that the critical value of r (r table) was 0.113. It is considered acceptable if the calculated value of r (r count) is greater than the critical value (r table r count). The data analysis revealed a r count of 0.953, confirming the validity of the questionnaires (r table r count). The trustworthy test results obtained from the SPSS 16.0 program are presented in the table below:

Table 1. Reliability Table

Reliability Statistic	
Cronchbach's Alpha	**N of Items**
.953	35

FINDINGS AND DISCUSSION

Findings

After the data were analyzed, the result of Students' Response toward the Implementation of TPACK in Senior High Schools after the Pandemic can be seen in the table below:

Table 2. Percentage of Mean and Standard Deviation of Students' Response towards TPACK (Technological Pedagogical and Content Knowledge)

No	Items	Frequency / Percentage				Mean	Std.
		SA	A	D	SD		
1.	Visual aids are used by the teacher to teach specific abstract concepts	109	148	6	-	3.39	.533
2.	Video clips (e.g., from YouTube) are used by the teacher to teach specific abstract concepts.	85	155	21	2	3.22	.618
3.	Different modes of media are integrated to help me understand the subject content easily.	109	149	5	-	3.39	.527
4.	The teacher permits me to engage in online conversations with peers who are located at a distance.	127	126	10	-	3.44	.569
5.	Appropriate technologies are selected by the teacher to teach specific matter	151	111	1	-	3.57	.503
6.	Online materials are integrated into teaching the subject matter by the teacher.	94	154	14	1	3.29	.582
7.	To promote my learning outcomes my teacher allows me to use technology.	156	93	10	4	3.52	.646

The data reveals students' perceptions of the implementation of Technological Pedagogical and Content Knowledge (TPACK) by their teacher, with mean scores ranging from 3.22 to 3.57. Item 5 received the highest mean score, indicating that 57.42% of students agreed on the use of appropriate technologies for teaching specific subjects. Similarly, item 7 had a relatively high mean score, with 59.31% of students acknowledging the allowance of technology for improved learning outcomes. However, items 2 and 6 had lower mean scores, showing that fewer students agreed on the use of video clips for abstract concepts (32.36%) and integration of online materials (35.73%). Items 1, 3, and 4 received moderate mean scores, indicating mixed perceptions regarding the use of visual aids, various media modes, and online discussions. Overall, these results demonstrate diverse student perceptions of TPACK implementation, varying across different aspects.

Table 3. Percentage of Mean and Standard Deviation of Students' Response towards Pedagogical Content Knowledge

No	Items	Frequency / Percentage				Mean	Std.
		SA	A	D	SD		
8.	The teacher demonstrates a high level of proficiency in the subject matter they teach.	201	61	-	1	3.75	.455
9.	The content of the course is explained clearly by the teacher.	154	107	2	-	3.57	.510
10.	The teacher has mastered knowledge about the theories and principles related to the subject matter.	167	96	-	-	3.63	.482
11.	The teacher chooses appropriate content for students.	132	129	2	-	3.49	.515
12.	The teacher understands how to answer the questions we ask about the subject	177	86	-	-	3.67	.470
13.	The teacher explains the importance and usefulness of the subject matter in the real world.	110	148	5	-	3.39	.528
14.	The teacher relates the information to one another	109	151	3	-	3.40	.514

The data indicates that students generally held positive perceptions of their teacher' pedagogical content knowledge. The highest mean score was obtained for item 8, where 76.43% of students strongly agreed that their teacher mastered the content of their teaching. Similarly, items 9, 10, and 12 received mean scores above 3.5, indicating that a significant majority of students agreed that their teacher effectively explained course content, had a good command of theories and principles, and provided satisfactory answers to questions. However, items 11, 13, and 14 received relatively lower mean scores, indicating that a smaller proportion of students agreed with these statements. These items pertained to the teacher's ability to choose appropriate content, explain the real-world importance of the subject matter, and establish connections between different concepts.

Table 4. Percentage of Mean and Standard Deviation of Students' Response towards Instructional Objectives and Context

No	Items	Frequency / Percentage				Mean	Std.
		SA	A	D	SD		
15.	I can understand the objectives of this course explained by the teacher.	134	126	3	-	3.49	.523
16.	The teacher manages appropriate interaction and maintains a good classroom atmosphere.	178	83	2	-	3.66	.487
17.	The teacher is aware of students' reactions during class and adjusts their teaching methods.	143	114	6	-	3.52	.544
18.	The teacher organizes a classroom environment that promotes my interest in learning.	139	116	8	-	3.49	.558
19.	The teacher prepares additional teaching materials.	103	150	10	-	3.35	.552
20.	The teacher manages the classroom appropriately	148	111	4	-	3.54	.528
21.	The teacher can decide where the teaching and learning should take place	144	119	-	-	3.54	.498

The data in Table 4 reveals students' perceptions of instructional objectives and the classroom context, with mean scores ranging from 3.35 to 3.66. Item 16 received the highest mean score, indicating agreement from 66.08% of students regarding appropriate interaction and a good classroom atmosphere. Items 17, 20, and 21 also received high scores, suggesting agreement on teacher awareness, classroom management, and decision-making. However, items 15, 18, and 19 had lower scores, indicating less agreement on course objectives, classroom organization, and additional teaching materials. Overall, students generally had positive perceptions, although agreement varied across different aspects.

Table 5. Percentage of Mean and Standard Deviation of Students' Response towards Instructional Representations and Strategies

No.	Items	Frequency / Percentage				Mean	Std.
		SA	A	D	SD		
22.	The teacher chooses suitable examples to explain concepts related to subject matter	121	142	-	-	3.46	.499
23.	The teacher contextualizes the concepts of the subject matter	78	171	14	-	3.24	540
24.	The teacher implements teaching methods appropriately to keep me interested in this subject	122	137	4	-	3.44	.528
25.	The teacher gives us opportunities to express our views during class	120	140	3	-	3.44	.520
26.	The teacher demonstrates the main concepts to explain related subject matter	94	158	11	-	3.31	.548
27.	The teacher applies various teaching approaches to transform the subject matter into comprehensible knowledge	121	134	7	1	3.42	.567
28.	The teacher involves multimedia or technology (i.e., PowerPoint) to express the concepts of the subject.	168	91	4	-	3.62	.515

Table 5 shows students' perceptions of instructional representations and strategies (mean scores: 3.24 to 3.62). Item 28 scored the highest mean, with 62.98% of students agreeing on the use of multimedia (e.g., PowerPoint) to convey subject concepts. Items 22, 24, 25, and 27 also received high mean scores, indicating agreement on suitable examples, engaging teaching methods, opportunities for expression, and diverse teaching approaches. In contrast, items 23 and 26 had slightly lower means, suggesting less agreement on contextualizing subject concepts and demonstrating main concepts. Overall, students had a positive perception of instructional representations and strategies, although certain aspects were more agreed upon than others.

Table 6. Percentage of Mean and Standard Deviation of Students' Response towards Knowledge of Students' Understanding

No	Items	Frequency / Percentage				Mean	Std.
		SA	A	D	SD		
29.	The teacher starts the class by recalling students' prior knowledge at the beginning of the lesson	109	147	7	-	3.38	.540
30.	The teacher knows students' learning difficulties regarding the subject matter.	113	145	5	-	3.41	.530
31.	The teacher evaluates my understanding by giving tests.	89	166	8	-	3.30	.524
32.	The teacher chooses appropriate assessment methods to evaluate my understanding of the subject.	95	164	4	-	3.34	.507
33.	The teacher implements different approaches (e.g., questions, group work) to help me understand the lessons.	133	129	1	-	3.50	.508
34.	My teacher facilitates me by giving assignments to check my understanding of the subject.	94	166	3	-	3.34	.500
35.	The test given by the teacher help me realize the purposes of the course	100	156	6	1	3.34	.544

The results from Table 6 provide insights into students' perceptions of their teacher's knowledge about their understanding. Mean scores range from 3.30 to 3.50. Item 33 received the highest mean score, with 57.84% of students agreeing that the teacher used different approaches to facilitate understanding. Items 29, 30, and 35 also received relatively high mean scores, indicating agreement on the teacher's recall of prior knowledge, recognition of learning difficulties, and use of tests to convey course purposes. However, items 31, 32, and 34 obtained slightly lower mean scores, suggesting that a smaller percentage of students agreed with these statements. Specifically, 53.55% agreed with the teacher's evaluation through tests, 55.64% agreed with the choice of appropriate assessment methods, and 53.09% agreed with the use of assignments to check understanding. Overall, the results suggest that students generally have positive perceptions of their teacher's knowledge about their understanding, although agreement varies across different aspects.

Discussion

The analysis of students' perceptions of Technological Pedagogical and Content Knowledge (TPACK) implementation by their teachers provides valuable insights into instructional practices. The findings reveal mixed perceptions among students across different aspects of TPACK implementation. While students generally agree on the use of appropriate technologies and recognize their positive impact on learning outcomes, there are specific instructional strategies that may not resonate as strongly with students. For example, Ginting et al. (2022) highlighted the importance of considering the way students engage in learning activities and how various teaching approaches can affect their engagement. This suggests that certain instructional strategies may need further examination to ensure they effectively align with students' needs and preferences. Additionally, Sulaiman (2021) emphasized the significance of examining TPACK practices in the context of English as a Foreign Language (EFL) instruction, highlighting the need to foster successful integration of technology into EFL teaching.

In terms of pedagogical content knowledge, students hold positive perceptions of their teacher's understanding of the subject matter. They acknowledge that their teacher effectively explains course content and demonstrates a strong command of theories and principles. However, areas of less agreement emerge, particularly concerning the selection of appropriate content and the establishment of connections between different concepts. Widodo (2017) stated that PCK may not have a direct impact on students' learning enhancing teachers' PCK can lead to a better understanding of effective lessons that facilitate students' learning. These findings highlight potential areas for improvement in teacher pedagogical content knowledge to enhance student learning experiences.

During the evaluation of instructional objectives and the classroom environment, students generally hold positive perceptions. They recognize effective interaction and a positive atmosphere in the classroom, acknowledging their teacher's attentiveness, classroom management, and decision-making abilities. However, there are certain areas where students show less agreement, specifically in terms of understanding course objectives and the overall organization of the classroom. To enhance the learning environment, it is crucial for teachers to understand the needs and preferences of their students (Munna, 2021). By designing lesson plans that cater to the learning objectives of all students and improving communication of these objectives, teachers can further enhance the overall learning experience in the classroom.

Regarding instructional representations and strategies, students generally hold positive perceptions. They appreciate the use of multimedia, suitable examples, engaging teaching methods, and diverse approaches. However, there is less agreement when it comes to contextualizing subject concepts and effectively demonstrating key concepts. These findings emphasize the importance of creating meaningful connections between theoretical concepts and real-world applications, as well as ensuring that key concepts are effectively conveyed to students. Teachers must prioritize the implementation of effective strategies and ensure the overall quality of the teaching process (Jančič &Hus, 2019).

In terms of the teacher's knowledge of students' understanding, students generally perceive their teacher to employ different approaches to facilitate comprehension, recall prior knowledge effectively, recognize learning difficulties, and utilize tests to convey course purposes. However, there is less agreement on evaluating understanding through tests and selecting appropriate assessment methods. This highlights the need for further exploration of assessment practices that align with students' learning needs.
Overall, the results demonstrate variations in agreement across different dimensions of instructional practices. Continuously evaluating and refining teaching strategies are crucial to meeting the diverse needs and preferences of students. By considering student feedback and making necessary adjustments, educators can enhance the effectiveness of their teaching practices, ultimately fostering a more engaging and impactful learning environment.

CONCLUSION

This study examines how TPACK is perceived by 12th-grade MIPA students after the epidemic. The findings indicate that English teachers have slightly more experience in implementing TPACK, highlighting the identified discrepancies across the categories. However, the perception of teachers' effectiveness has only a minimal impact on student's motivation. To ensure an optimal learning experience, teachers should strive to enhance their understanding of TPACK and its components.

While the study demonstrates students' positive views on face-to-face interaction, educators need to be fully aware of potential negative consequences and unforeseen psychosocial phenomena associated with excessive screen usage and limited social engagement. Due to varying levels of readiness and proficiency in technology-based teaching, as well as the rapid transition to online mode, teacher's ability to adapt to technology varies greatly. Students consider it crucial to elevate instructional, content, and pedagogical standards. Therefore, teachers must engage in self-reflection, remain attentive, and maintain the integration of all TPACK components. Additionally, given the limited number of research samples used, caution should be exercised when interpreting the results of this study.

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