IMPLEMENTATION OF TPCK IN DEVELOPING LEARNING TOOLS: A CASE STUDY OF HIGH SCHOOL BIOLOGY TEACHERS IN KUWUS SUB-DISTRICT

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ABSTRACT

TPCK is knowledge that can be used by teachers in integrating technology appropriately in the learning process based on the description of material character and pedagogical aspects. This study aims to describe the ability of Technological Pedagogical Content Knowledge (TPCK) Teachers. The method used is descriptive with a qualitative approach. The sampling technique used in this study was purposive sampling technique. Therefore, the schools used as samples in this study were SMAN I Kuwus, SMAN 2 Kuwus (Hawe) and SMAN 1 About. Data were collected by observation, interview, and documentation. Data analysis techniques used in this study include data collection, data reduction, data presentation, and conclusion drawing. Teachers' TPACK ability can be seen through the six TPACK indicators that have been previously determined. Nevertheless, there are still obstacles in implementation such as the lack of sequential application of learning model strategies and the number of devices owned by the school. This constraint is utilised by teachers to remain more creative in the teaching process.

INTRODUCTION

In a teaching and learning process, teachers must be able to convey the information they know correctly and purposefully, that is, the correct subject matter content through good pedagogical activities. According to Vindo & Heni (2018) cited from Shalman (2014), the subject matter content teaching knowledge is defined as content and pedagogical knowledge (PCK). Shulman (1986) defines the subject matter content teaching knowledge as content and pedagogical knowledge (PCK). Content and pedagogical knowledge identifies a specialised body of knowledge for teaching. PCK is the combination of content and pedagogy in the understanding of how specific topics and problems or issues are organised, presented, adapted to the interests and abilities of diverse learners and explained in the form of instruction. Content

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and pedagogical knowledge are the categories that most easily distinguish the understanding of content specialists from educators (Kocoglu, 2009).

As time goes on and the needs of students increase, teachers need to have more than PCK skills. However, teachers need to be able to teach more than just PCK using technology. This is because the current teaching and learning process reflects the increasing integration of computers and technology applications into the curriculum. The ideals of integrating subject knowledge, teaching or learning and technology have been around since the increasing need for students to use and learn with technology. Accordingly, technological, pedagogical and content knowledge have become an integral part of teacher education programmes to prepare future teachers to use technology in the classroom.

The research knowledge needed to integrate technology into the learning process is called TPCK. TPCK includes six components, namely technology knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK) and technological content knowledge (TCK) (Hayati et al., 2020; Purwoko, 2017). It can also be interpreted as a form of knowledge that can be used by pre-service teachers to integrate technology appropriately in the learning process based on the description of material characteristics and pedagogical aspects (Agustina et al., 2023; Herizal et al., 2022; Sholihah & Yuliati, 2016). According to Simbolon & Kondios, (2023), the ability of TPCK can be seen from their own learning tools. The ability of TPCK can be the design of learning implementation because in it there are pedagogical components, namely the methods used, content components, namely the material taught, and technology, namely the media used (Maharani et al., 2021; Pulungtana & Dwikurnaningsih, 2020). Thus, learning tools should include the components that make up TPCK, as the tools are a reflection of the way of teaching.

Some teachers have only just realised the importance of technology for teaching/learning but have not tried to use it (Wasito Hadi, 2009). Teachers are one of the determinants of success in the learning process. The quality of teachers is an important factor in improving the quality of education, as noted in the McKinsey report, which states that "the quality of the education system cannot possibly exceed the quality of its teachers" (Barber & Mourshed, 2007). A teacher is responsible for planning and implementing the learning process, assessment, conducting research and studies, and opening communication with the community.

As educators, teachers are required to have pedagogical skills, including curriculum development, syllabus and lesson planning. In the process of technological development in learning, the government issued the Minister of Education and Culture Regulation No. 22 of 2016 on learning process standards. Charismadji (Yurinda & Widyasari, 2022) said that the Minister of Education and Culture regulation number 22 of 2016 also emphasizes the standards of educational experience standards such as 1) learners can search for subject matter, 2) educators as learning facilitators, 3) project-based learning towards skill-based mastery, 4) meaningful experiences from learning between teachers and students, 5) innovation in the learning process will improve learning. As a result, teachers need to have quality teaching in order to achieve the learning objectives. Teacher quality is one of the factors that affect the quality of education in a nation. Therefore, it is expected that there will be several efforts to balance the ability of teachers so that it will have an impact on the quality of schools. Teachers must have basic abilities and special skills that include personal, educational, pedagogical and social abilities (Aspi & Syahrani, 2022; Dalyono & Agustina, 2016). Therefore, teachers must be able to develop learning tools based on abilities and personalities as a tool to achieve national educational goals. It can be concluded that teachers have a role in education as a learning resource, facilitator, manager, demonstrator, guide and motivator (Sanjaya, 2013).

When planning lessons, teachers often make the mistake of not knowing how to integrate technology, pedagogy and subject knowledge. For example, four students were not provided with teaching materials on the application of concepts in learning using contemporary and traditional media as supporting resources. Therefore, the ability of teachers to impart knowledge in one direction becomes more important in 21st century learning.

Based on the results of the interviews with some of these teachers, it was found that most of the biology teachers in the upper secondary school are certified educators and some are not certified educators. In this case, teachers who are certified can enhance the quality of learning through good teacher-student interaction, diversified learning and the use of technology-based learning media. The TPCK he is familiar with relates to technology, content and pedagogy. Teachers need to combine their knowledge of the concept of material, pedagogy and the use of technology in carrying out their duties as educators and teachers. However, teachers have not maximised their knowledge of TPCK. Some teachers still use the lecture system in every learning activity in the classroom. There are also teachers who are confused when it comes to using interactive Power Point, filling in report cards online, then there are teachers who are old and leave tasks related to technology to young teachers or their children at home, even though they are officially recognised as professional teachers through teaching certificates. It can be seen that during the online learning process, many teachers complained about using the online system, one of whom had to learn from zoom and google meet. Because of the lack of technological knowledge, learning does not use technology. Teachers in the 21st century should not only be able to use interesting models and methods, but also understand how to combine content, pedagogy and technology to create the learning that is needed.

The combination of technology, content and pedagogy is called TPCK. Based on Shulman's idea of PCK, Mishra & Koehler (2006) added technology to PCK and described TPCK as the relationship between technology, pedagogy and content. TPCK is a structure that can combine mechanics and content perspectives, so TPACK leads to a different world view of how to teach or deliver learning materials using innovation, pedagogy and great substance to support innovation. Teachers who have mastered TPCK skills can use technology to teach according to materials, methods and ways of teaching (Hariati et al., 2022; Saddam & Djakaria, 2023; Tiwan & Tutuk, 2022). Therefore, teachers need to be prepared to become professional teachers, i.e. teachers who are able to manage a learning process, master subject matter and master technology.

According to the above conditions, learning should be based on what students know and can do, as well as how they think and learn, in order to align the learning process with the required performance in accordance with the individual needs of the students. Given this reality, it is clear that teachers must have truly excellent qualities to be able to fulfil their new role in the educational process. The creation of teachers with excellent characteristics must be done both when the teacher goes through the teacher education process and when the teacher has carried out his/her position as an educator (Suryadi P, 2008).Therefore, the author raises the issue of problems related to pedagogical technology and content knowledge where the author will conduct an analysis of biology teachers in high schools in Kuwus district.

Considering this condition, it is necessary to conduct an evaluation study of biology teachers in senior high schools in Kuwus sub-district. The evaluation was conducted to find out how much the biology teacher's ability to use technology in learning. The capacity in question is the mastery of technology, pedagogy and content by prospective teachers as described in the TPCK framework. This assessment can then be used as an input for prospective teachers' activities in the use of technology.

Research on the ability of TPCK has been conducted by (Erlina & Maria, 2022) with the title Profile of Technological Pedagogical Content Knowledge (TPACK) Ability of High School Chemistry Teachers. This study focused on the technological skills of high school teachers. This research is important because teachers in the 21st century need to be able to keep up with technological developments. To know the level of technological pedagogical content knowledge (TPACK) ability of high school chemistry teachers in West Kalimantan. This research is expected to add value to the body of scientific knowledge in the field of education. In addition, it can also provide information on the TPACK ability of high school teachers in West Kalimantan. Another study was conducted by Sa'adah, S & Rahayu Kariadinata (2018) with the title of Technological Pedagogical And Content Knowledge Profile of Biology Teacher Candidates. The results showed that the technological pedagogical and content knowledge (TPACK) of prospective biology teachers from the Biology Education Study Programme, Faculty of Tarbiyah and Kegurun UIN SGD Bandung was in the good category with an average score of 3.6. This shows that the pre-service biology teachers have understood aspects related to technological pedagogical and content knowledge in the learning process.

METHODS

This research was conducted in Kuwus sub-district, West Manggarai Regency. This research adopted a descriptive qualitative approach. The research design can be explained as follows:

1) Data Collection; Data collection from the results of interviews with biology teachers in Kuwus district, which includes the use of technology, teaching skills and ability to master ICT material.

2) Data reduction; data reduction means summarising, selecting the main things, focusing on the important things, looking for themes and patterns and discarding the unnecessary. In this way, the reduced data will provide a clear picture and make it easier for researchers to carry out further data collection and retrieval when needed.

3) Presentation of data; after the data have been reduced, the next step is to display or present the data. In this study, the presentation of data is done with a brief description that is narrative in nature. By presenting the data, it will be easier to understand what is happening and to plan further work based on what has been understood.

4) Conclusion; The third step is to draw conclusions and review. The initial conclusions presented are still tentative and will change if no strong evidence is found to support the next stage of data collection. However, if the conclusions drawn at an early stage are supported by valid evidence when the researchers return to the field to collect data, then the conclusions drawn are credible conclusions.

5) Population and Sample; The population in this study were the Biology teachers in Kuwus sub-district spread over 5 schools. The sampling technique used in this study was purposive sampling technique. Therefore, the schools used as samples in this study were SMAN I Kuwus, SMAN 2 Kuwus (Hawe) and SMAN 1 Ndoso.

6) Data collection techniques; The techniques used in this research are indirect communication, direct communication and documentary studies. The data collection tools used are questionnaires, interview guidelines in this study in the form of profile data of the biology teachers of each school as well as audio recordings of the results of the interviews of the biology teachers.

Table 1: Technological Pedagogical Content Knowledge Indicators Indicator Aspect

Aspect	Indicator
Technological Knowledge (TK)	Teachers' ability to understand and use technology in learning
Pedagogical Knowledge (PK)	Teachers' skills in the process of teaching and learning activities
Content Knowledge (CK)	Teachers' ability to master learning materials
Technological Content Knowledge (TCK)	Teachers' ability to use technology to present learning materials
Technological Pedagogical Knowledge (TPK)	Teachers' ability to use technology in teaching/learning activities to achieve learning objectives.
Pedagogical Content Knowledge (PCK)	The ability of the teacher to teach the learning material using strategies that can make it easier for the students to understand the learning material.
Technological Pedagogical Content Knowledge (TPACK)	The ability of teachers to use technology in their teaching and learning activities in order to teach the material that they have mastered.

Procedures for analysing data generated from research instruments using a Likert scale in accordance with the criteria set out in the TPACK Capability Assessment Rubric are shown in Table 2.

Table 2 Likert Scale Categories

Interval	Criteria
$3,25 < $ score $ \leq 4,00$	Very Good (SB)
$2,50 < $ score $ \leq 3,25$	Good (B)
$1,75 < $ score $ \leq 2,50$	Poor (K)
$1,00 < $ score $ \leq 1,75$	Very Poor(SK)

(Sumber: Sugiyono, 2013).

The formula for converting scores into percentages is as follows

Persentage$= \frac{achieved\ points}{Maximum\ Points}$x 100%

The data obtained was then converted into qualitative criteria in Table 3.

Table 3. Percentage Ranges And Qualitative Criteria

Value	Range	Criteria
2	0 – 20	Very Poor
3	21 – 40	Poor
4	41 – 60	Fair
5	61 – 80	Good
2	81 -100	Very Good

(Sumber: Sugiyono, 2013)

Data validity in this research uses source triangulation and technical triangulation. Source triangulation means that different sources use similar methods, while technical triangulation means that different methods use the same source. The data analysis techniques

used include data collection, data reduction, data presentation and conclusions. Data collection is the gathering of data through observation, interviews and documentation. Data reduction is the grouping and sorting of data that is important and usable. Data presentation is the presentation of reduced data in the form of tables or narratives. Drawing conclusions is the author drawing conclusions about the Technological Pedagogical Content Knowledge (TPCK) knowledge of high school biology teachers in Kuwus District.

RESULTS AND DISCUSSION

The results of the analysis of the data from the TPCK questionnaire for biology teachers are summarised in Table 4.

Table 4. Recapitulation of the results of the analysis of the questionnaires on each aspect of the TPCK

TPCK aspects	M	SD	Criteria
Tecnological Knowledge (TK)	3.88	0.48	Very Good
Conten Knowledge (CK)	3,85	0,43	Very Good
Pedagogical Knowledge (PK)	3,85	0,43	Very Good
Teknological Conten Knowledge (TCK)	3,85	0,43	Very Good
Pedagogical Content Knowledge (PCK)	3.65	0.15	Good
Technological Pedagogical Knowledge (TPK)	3,80	0,40	Very Good
Technological Pedagogical Content Knowledge (TPCK)	3,78	0,35	Good
Mean	3,8	0,40	Very Good

The data presented in Table 4 show that the average TPCK ability of biology teachers is in the excellent category, with the highest score in the technological knowledge (PK) aspect or knowledge of technology. This can be understood because the respondents who completed the questionnaire were Generation Y/Gen Y or also known as the millennial generation. Generation Y is a generation born in the 80s to late 90s. Furthermore, the ability to understand and use technology in learning can be seen from (1) teachers who design learning media to be used in the learning process. Learning media is a tool used by teachers to convey material from teachers to students during the learning process. Learning media is very important because it can facilitate teachers in the learning process. The media used by teachers during the learning process are interactive Power Point media, image media related to the material studied, concrete media, learning videos that teachers adopt from the YouTube application as revealed by the following sources.

> *"Media is a tool used by teachers in the learning process. The role of media is very important for teachers to facilitate the learning process. Many alternative media are used such as picture media, learning videos taken from YouTube applications and PPT. It is hoped that with the existence of learning media, students will understand the concept of biology subject matter more easily. This is one of the factors that can increase students' learning demands. The obstacle is time, because in daily life teachers are more focused on preparing the administration of the school'.*

Magdalena et al, 2021 explain that the use of media in educational experiences can have three effects, including educators, students and educational experiences in the learning space. (2) Teachers have used Ms. Word in creating learning administration such as teaching modules,

LKPD and recording students' grades. According to the opinion (Ismail et al., 2021), teachers must be able to use Microsoft Office applications to coordinate the organisation and learning tools. The types of programming applications used by teachers are Microsoft Word, Microsoft Success and Microsoft PowerPoint. (3) Teachers already understand and can access the Internet. This can be seen during the learning process in class, at the beginning of the lesson the teacher plays a song that he/she has taken from the YouTube application.

Teachers' ability to access the Internet is also supported by school facilities, namely WIFI, which can be used by all teachers. The Internet is a network that serves to connect an electronic medium with other media. In line with the opinion (Nevrita et al., 2020), the movement media used are activeness media obtained through web searches. Some educators who use activity media reveal that with these activity media the presented material feels authentic, because the movement is equipped with developments not only in the form of slides, so that the presence of these activity media is interesting and can stimulate. The attractiveness of the media presented aroused the interest of the students. In particular, the visual perspective introduced in the activity media can help students to understand the material better without constraints. (4) The presentation of the material as a focus of power has been done by educators, but not yet implemented by all educators. The teacher prepares the teaching module using a computer application, namely Ms. Word. The teacher uses technology to facilitate the preparation of teaching management, especially the teaching module that will be used during the learning process. In the teaching module prepared by the teacher, all the lesson plans have been included, including the learning media and the facilities and infrastructure to be used".

Technological knowledge (TK) is related to the dominance of innovation that teachers should possess. Teachers need to understand information related to innovation and have what it takes to use that innovation (Mustika et al., 2022). The use of technology in education can benefit students by improving their concentration, attention, motivation and independence. For educators, it offers the benefit of enjoyable learning experiences, encourages them to develop their knowledge and inspires more inventive lesson designs. Therefore, there is a need to improve the ability of future teachers to use technology.

"The teacher's ability in the learning process is demonstrated and observed through the following actions: (1) The teacher conducts the lesson by applying learning models that emphasise the empowerment of students' abilities (student-centred), such as the problem-based learning model. This can be seen in the learning process carried out by the teacher according to the syntax of the problem-based learning model, where at the beginning of the lesson the teacher presents a problem to the students by playing an educational video that the teacher has taken from the YouTube application, as stated in the following source".

> *"Yes, I use learning models to make lessons more engaging and to increase student interest. There are problem based learning models as well as contextualised teaching and learning. I also use teaching strategies that involve a series of activities to be carried out and use differentiated learning strategies. Teaching methods are also used as tactics to achieve the chosen learning model. The methods used include discussion and exploration".*

After the students have watched the video, the teacher asks them to respond to it. After the students have given their answers and received reinforcement from the teacher, the teacher asks the students to work in groups on the worksheets (LKPD) prepared by the teacher. When the students have finished working on the LKPD, the teacher asks each group to present their work to the class. After all the groups have presented their work, the teacher reinforces the students' work. In practice, however, some teachers do not follow the steps of the model in sequence. (2) The teacher uses a teaching strategy that serves as a guide, consisting of a series of steps designed for the learning process. The current 'Merdeka Curriculum' uses differentiated learning which is adapted to the lesson material. (3) The teacher has already used teaching methods in the learning process. The methods used include discussion and exploration.

"A learning model is a carefully considered example that outlines a systematic approach to coordinating growth opportunities to achieve learning goals. The power of a learning model serves as a source of perspective that guides both creators and teachers in the delivery of instruction. The choice of a learning model is heavily influenced by the nature and type of material to be taught, the goals to be achieved in learning, and the level of students' abilities or skills (Djalal, 2017). Teachers can encourage students to ask questions and express their opinions by involving them in group activities. Educators strive to implement various techniques and training methods to coordinate classroom activities in a way that significantly supports students' learning and knowledge development. The way in which teachers plan group activities for pupils involves the creation of very stable learning groups which are not entirely determined by the class teacher. In addition, teachers form new learning groups and focus on keeping students engaged in different groups to prevent boredom with the previous revision groups (Janah, 2022; Subhan, 2020). A procedure is a structured arrangement that outlines the planned progression of exercises by an individual in educating, teaching and guiding to achieve instructional objectives. Before deciding on a system, it is important to set clear objectives because progress can be measured and objectives serve as the essence of applying a technique (Sa'adah, S., & Kariadinata, R., 2018). Meanwhile, a teaching technique is a strategy used by an educator to create educational experiences for students to achieve these goals.

The teacher's ability to master the learning material is evident in the presentation of the material given to the students. The learning material presented by the teacher is in line with the teaching module designed by the teacher, i.e. the module contains a summary of the learning material to be presented, as stated by the following source.

> *"What I do is create a summary of the learning material, which is placed in the appendix of the teaching module I create, making it easier for me to present to the students."*

The documentation results show that in order for teachers to master the learning material, they create summaries of the learning material that are placed in the appendices of the teaching module. According to Rochaendi et al. (2021), teachers must make every effort to improve their ability to master the subject by constantly updating their knowledge. These educators, regardless of their orientation, age, length of service, school status or the region in which the school is located, tend to have similar tendencies, especially since both are indeed good at mastering the subject. The teacher's ability to use technology to present learning material is demonstrated by the appropriate technology used to deliver the material to the students. The teacher uses technology-based learning media such as educational video

presentations, the song "Garuda Pancasila" and interactive PPT presentations, as indicated by the following source".

> *"I use educational videos and interactive PPTs as media. However, when selecting learning media, we have to adapt it to the learning material and the available facilities and infrastructure in the school and classroom".*

However, there are teachers who have not used technology-based learning media because the material they teach can use media based on a lottery board. The results of the documentation analysis show that the teacher uses learning media in the form of educational videos. The learning material presented in the educational video used by the teacher is titled 'Let's introduce ourselves politely', taking into account the characteristics of media that meet the students' needs. This is in line with Supriyono's (2018) view that there are several stages to consider when planning learning media: (1) the media should be designed in such a way that it achieves a level of thickness that is clear and easy for students to understand; (2) the media should be constructed according to the content to be taught; (3) the learning media should be planned in such a way that it avoids confusion and does not confuse students; (4) the media should be planned in such a way that it avoids confusion and does not confuse students; and (4) the media should be planned with simple and easily accessible material, without diminishing the significance and true capabilities of the media; (5) the planned media should incorporate innovations such as learning recordings; (6) the media can be planned in the form of models, pictures, organised graphics, etc.).

The teacher's ability to use technology in teaching activities is aimed at achieving learning objectives. An example of an intended learning objective is for students to be able to identify parts of a plant and their functions. The teacher's ability is demonstrated by the following actions: (1) The teacher uses technology as a process to strengthen students' cognitive skills, such as displaying learning media to help students explain the material and make the information they have received clearer. The teacher then shows a PowerPoint presentation containing the material, which makes the students more interested in the learning process. (2) When looking for references to achieve the learning objectives, the teacher uses technology, such as using the YouTube application to find educational videos that match the learning material. (3) During the learning activities, the teacher uses technological devices to support the learning process and achieve the learning objectives, such as using a projector, laptop and speakers to display educational videos, as expressed in the following source.

> *"Of course, I use technology to find references that match the learning material I am going to present to ensure that the learning objectives are met. Then I use technology-based learning media as cognitive tools for students to enhance their knowledge of the material I present. When I use technology-based learning media, I certainly need support equipment such as a laptop, projector and speakers."*

However, the use of this technology is still challenged by the number of technological devices in the school. The teacher's approach to complementing the developing experiences is to integrate and use innovative media such as projectors, PCs and mobile phones. In addition, the teacher uses hardware and software ICT (internet, video, games, laptops, projectors, mobile phones) as learning resources (Ananda et al., 2022). The ability to teach the learning material

using strategies that can facilitate students' understanding of the material is expressed by the following source.

> *"At the beginning of the learning activity I use stimulating questions related to the material to be studied. I also provide concrete examples related to the material. For example, in the topic of rights and duties, a concrete example that can be provided by the teacher through a question and answer strategy is when students buy a loaf of bread in the canteen; this loaf of bread becomes the student's right because it was bought according to the price set by the canteen."*

Strategies that teachers can use include: (1) The teacher can use analogies in learning. Analogies in learning involve a reasoning process that compares two objects with similarities to generate new knowledge based on students' prior knowledge. This process can be initiated at the beginning of the learning session, e.g. through stimulating questions. In line with Erwinsyah's (2017) opinion, this approach focuses on all the content within a limited environment related to the topic. Analogical information, for example, not only explains the subject under discussion, but can also be persuasive. (2) The teacher provides concrete examples of the learning material to facilitate students' understanding of concepts that are close to everyday life. For example, in the topic of rights and duties, a concrete example that can be given by the teacher through a question-and-answer strategy is when students buy a loaf of bread from the canteen; this loaf of bread becomes the student's right because it was bought at the price set by the cantee.

TPCK refers to technological pedagogical content knowledge, a type of knowledge that teachers need to teach effectively. In addition, Technological Pedagogical Content Knowledge (TPCK) includes knowledge about integrating technology into the teaching of specific content areas (such as biology) (Schmidt & Mishra, 2009; Kohler et al., 2014). It is therefore hoped that teachers understand the complex relationships between pedagogical knowledge, technology and content. Teaching material effectively, using appropriate pedagogical approaches and technology, requires all these elements. The combined TPCK expertise of teachers and learning design are expected to enhance the relevance and effectiveness of learning. Choi & Young (2021) state that 'teachers' TPCK will be evident in the preparation of learning materials' because TPCK identifies important information that can be examined through the learning materials prepared by the teacher.

CONCLUSION

Teachers of biology at SMAN Kuwus have demonstrated proficiency in the integration of technological pedagogical content knowledge (TPCK), which enables them to employ a range of learning devices in a manner that aligns with educational objectives. However, this remains a work in progress and further development is required. The results of the interviews indicate that the teachers are able to strike a balance between the use of the internet and other media when implementing lessons in biology, while simultaneously creating lesson plans. The content of the learning devices is satisfactory, but still requires further development and evaluation. The teachers demonstrate a comprehensive understanding of the processes involved

in forming action groups and utilising diverse training techniques and methodologies. The teachers' proficiency in content knowledge (CK) is evidenced by their ability to present material in alignment with the teaching module. Additionally, the teachers evince a commendable commitment to mastering the learning topics. Moreover, the teachers are proficient in conveying the subject matter through the use of analogies, thought-provoking inquiries, and tangible examples, thereby exhibiting their grasp of Pedagogical Content Knowledge (PCK). Their capacity to employ technology for material presentation (Technological Content Knowledge/TCK) is evident in their incorporation of digital learning resources such as educational videos, music, and interactive PowerPoint presentations. However, challenges persist in technology utilization due to the limited availability of devices within the academic institution.

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