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Exploring Teachers' Technological and Pedagogical Knowledge: A Case Study in Semarang Excellence School

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Abstrak

Penelitian ini bertujuan untuk menggambarkan pengetahuan teknologi (TK), pengetahuan pedagogis (PK), dan pengetahuan pedagogis teknologi (TPK) guru sebagai bagian integral dari TPACK yang diperkenalkan oleh Koehler dan Mishra (2005). Penelitian ini dilakukan di Sekolah Unggulan Semarang (SES), khususnya di kelas Olimpiade. Dengan menggunakan pendekatan deskriptif kualitatif, hasil penelitian menunjukkan bahwa pengetahuan teknologi guru mencapai tingkat kemahiran yang tinggi, terutama dalam hal pentingnya integrasi dan penggunaan teknologi dalam praktik pembelajaran. Begitu pula, pengetahuan pedagogis guru menunjukkan tingkat pemahaman dan praktik yang baik, terutama karena guru mengenal berbagai metode dan teknik pembelajaran serta tahu cara menggunakannya dengan tepat dalam situasi tertentu. Selain itu, pengetahuan pedagogis teknologi guru, yang mewakili persimpangan dan akumulasi dari dua domain keterampilan guru sebelumnya, menunjukkan tingkat penguasaan yang tinggi. Misalnya, ketika guru secara kolaboratif menerapkan metode pembelajaran konvensional dan berbasis teknologi, hal ini dapat meningkatkan prestasi akademik siswa di kelas Olimpiade.

Abstract

This research aims to illustrate teachers' technological knowledge (TK), pedagogical knowledge (PK), and technological pedagogical knowledge (TPK) as an integral part of TPACK introduced by Koehler and Mishra (2005). The research took place in Semarang Excellence School (SES), specifically in the Olympiad class. By employing a descriptive qualitative approach, the research results indicate that teachers' technological knowledge shows an advanced level of acquisition, particularly regarding the importance of integrating and using technology in learning practices. Likewise, teachers' pedagogical knowledge demonstrates a good level of understanding and practice, mainly because teachers are familiar with a variety of learning methods and techniques and know how to use them appropriately in specific circumstances. Furthermore, teachers' technological pedagogical knowledge, which represents the intersection and accumulation of the two previous domains of teachers' skills, suggests a high level of mastery. For instance, when teachers collaboratively implement conventional and technology-based learning methods and techniques, it enhances student academic achievement in the Olympi-ad class.

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INTRODUCTION

Technology is anything that can facilitate work or can also be interpreted as a solution to a problem. The term "technology" comes from the Greek word "technologia," which, according to Webster's Dictionary, means the systematic treatment or handling of something. Technology can also be traced back to a combination of two words, namely "techne" and "logos," which generally mean knowledge of techniques, methods, or devices (Selwyn, 2010). From the understanding of technology above, it can be seen that the emergence of technology originates from increasing human needs and work, but when there is no tool available to carry out the work, technology emerges as a solution to problems that need handling or management. Technology has helped in many areas of life, including education. Operationally, educational technology can be said to be a systemic process that helps solve learning problems. Technology, which was originally just a tool, has evolved to play a broader role, resulting in changes in the way students learn (Yusuf et al., 2019).

The challenges of 21st century learning and the changes to the 2013 Curriculum demand that teachers as educators have better pedagogical abilities to design effective and innovative learning. The development of various information technology media is one of the main foundations for the development of 21st century learning (Daryanto, 2017). Additionally, teachers are required to improve their ability to master ICT to facilitate learning and enhance learning outcomes (Rahmadi, 2019). The demands in developing this assignment are increasingly complex, not only regarding intellectual abilities but also the skills to use and utilize technology in the learning process (Tarihoran, 2019).

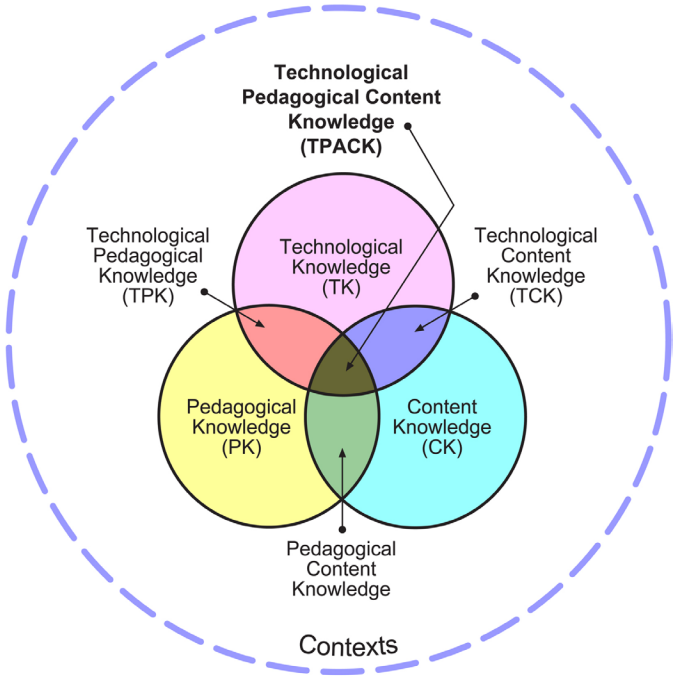
The integration of technology in learning by teachers is crucial to ensure that learning continues to develop in line with the changing times. Teachers, being at the forefront, play a pivotal role in determining the direction of learning, ensuring that it aligns with the context of the subject matter being taught. However, practical implementation in the field still faces challenges, as indicated by the initial study conducted by Putrawangsa & Hasanah (2018), revealing that teachers still have concerns regarding the integration of technology in their teaching. According to them many teachers still hold the assumption that digital technology in learning may have a negative impact. For instance, they fear that the introduction of calculators as tools for calculations will lead to students becoming overly dependent on such devices, resulting in a decline in their ability to perform calculations.

Moreover, the use of digital technology is often feared to be misused by students, diverting their attention from the intended learning outcomes. Furthermore, the role of teachers in supporting the integration of technology in learning raises concerns, necessitating clarity on what teachers should do and how to go about it. Koehler and Mishra (2005) describe the challenges faced by many teachers in integrating technology in learning as a "complex and unstructured problem involving the interaction of various factors." Therefore, they proposed Technological Pedagogical Content Knowledge (TPACK) to identify the type of knowledge required by teachers for effective integration of technology in their teaching. TPACK recognizes the intricate, multifaceted, and contextual nature of teacher knowledge. Shulman (1986) first introduced Pedagogical Content Knowledge (PCK) to explain the teacher's comprehension of educational technology and the interplay of PCK with technology in creating effective learning experiences.

In this regard, TPACK framework extends Shulman's notion of pedagogical content knowledge (PCK) (Shulman, 1986). In this model, there are three main components of knowledge: content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). The framework also explains the intersections between these three domains, resulting in a complex relationship known as pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and finally, technological pedagogical content knowledge (TPACK) (see Figure 1).

In teaching, educators need to possess various key areas of knowledge. Content Knowledge (CK) encompasses understanding the subjects taught, including concepts and procedures. Pedagogical Knowledge (PK) involves employing techniques and strategies to enhance student understanding. Technological Knowledge (TK) relates to proficiency in operating digital tools and software. Technological Content Knowledge (TCK) integrates technology with subject matter. Technological pedagogical knowledge (TPK) involves understanding technology components for effective use in teaching. Pedagogical Content Knowledge (PCK) emphasizes effective teaching approaches for specific content. At

Figure 1 Technological Pedagogical Content Knowledge (TPACK) (source Koehler & Mishra, 2005)



the intersection of these knowledge areas lies Technological Pedagogical Content Knowledge (TPACK), which integrates technology to enhance teaching strategies and create engaging learning experiences (Koehler & Mishra, 2005).

The TPACK framework has been the subject of development and study, as argued by Koehler and Mishra (2005). They suggest that this framework facilitates the reconstruction of experiences and the development of teacher professionalism by emphasizing the integration of technology in learning design. One of its components, Technological pedagogical knowledge (TPK), was further explained by Harris et al. (2009), who described it as an understanding of how teaching and learning change when specific technologies are used. Heithink et al. (2017) also highlighted the important role of TPK for teachers in integrating technology to facilitate various pedagogical strategies, including differentiation, classroom management, and student self-regulated learning.

According to Graham et al. (2009), TPK involves the integration of technology with pedagogical strategies, focusing on how to manage technology integrated classrooms, engage learners in technology-based learning, and deliver effective presentations. The application of TPK requires an understanding of the potential benefits and limitations of different technologies, which can be applied to specific learning activities and educational contexts. Additionally, TPK emphasizes the creative flexibility in utilizing available tools to achieve specific pedagogical goals. For example, even non digital technologies like blackboards can assist teachers in writing down concepts and supporting teaching practices.

In a specific context in senior high school in Indonesia, several studies have shown that TPACK has a positive impact on learning practices. For example, in his research, Sumarto (2020) concluded the importance of pedagogical content knowledge in contributing to teachers' TPACK competencies, which can enhance their students' academic achievement. Similarly, Rian's (2018) study, with a similar research design, arrived at a different conclusion. Despite the importance of TPACK for teachers, Rian found that content knowledge contributes much more to teachers' TPACK, particularly influencing their understanding of learning development strategies. Fatoni and Baqi's research (2022), which used TPACK as a framework for teachers' competencies, also showed a positive impact, particularly in relation to teachers' perception of online learning and their readiness for online teaching and learning.

Furthermore, in a different line of study, Irmita and Atun's (2017) research demonstrated the potential of TPACK not only in enhancing teachers' teaching competencies but also in

improving the quality of learning materials development, particularly through the use of the discovery learning approach in the chemistry subject. Recent research by Waluyo(2023) further strengthens this notion, suggesting that TPACK has a positive impact as a platform or framework for developing learning materials and media.

Despite the positive impact of TPACK on enhancing the quality and results of learning practices, other research has shown that in certain contexts, teachers may have a low level of TPACK. This fact has been identified by Lestari's study (2016). Similarly, research conducted by Putri (2019) revealed that despite teachers' problems with their technological content knowledge, the overall learning processes conducted by teachers who tried and supported by the TPACK framework, showed a positive influence, particularly in promoting student activity and understanding of the subjects they learned. Therefore, more studies are needed to identify teachers TPACK's competencies, especially with respect to the varieties of subjects taught, school context, and other influential factors.

In this regard, researchers decided to study a very specific class using the TPACK framework, namely the Olympiad class. This type of class differs from other classes in general through which the students have been oriented to compete and win such Olympiad or academic competition. The purpose of this research is to focus on the Olympiad class to analyze and describe the Technological Knowledge (TK), Pedagogical Knowledge (PK), and Technological Pedagogical Knowledge (TPK) of teachers in the learning process in that class. For this study, a renowned senior high school in Semarang city was selected as the research site. This school is widely recognized for its vision of becoming the best international high school in Indonesia by fostering good student personalities based on national culture and environmental sustainability. To avoid any negative stigma associated with the school, the researchers decided to refer to it as Semarang Excellence School (ES) throughout this paper. The school is situated in the heart of Semarang city, the capital city of Central Java province, Indonesia. Semarang Excellence School officially adopts class divisions for its students, with changes in grouping Class regulations and policies occurring in the 2019/2020 academic year. The school divides its students into three class categories: Smart Quick Class (KCC), Olympiad class, and Regular class.

Smart Quick Class (KCC) is a class for students who have above-average knowledge potential to undergo accelerated education for 2 years. Students who enter this class have passed the Test of Academic Potential (TPA) and Psychological Test in the new academic year. The Olympiad Class is a class for students who have high scores in the previous level and have passed the TPA test. These students are prepared by the school for school-level and international competitions. The Regular Class is a class for students who come from the zoning system based on government regulation, according to Minister of Education and Culture Regulation No. 14 of 2018 concerning the Zoning System for New Student Admission (PPDB).

According to preliminary research at Semarang Excellence School, integrating technology in the Olympiad class is a method used by teachers to deliver learning material alongside traditional methods such as lectures and hands on practice. Technology integration includes virtual laboratories, online based learning platforms, and other online resources. However, researchers have observed challenges in handling technical constraints and limited utilization of technology due to various factors from both students and teachers. Based on these findings and existing research gaps, the researchers aim to investigate teachers' technological pedagogical knowledge (TPK) in the Olympiad class at Semarang Excellence School. In sum, researchers do not encompass the overall aspects of TPACK, but only the TPK aspect. The research was conducted only on three components out of the seven components of the overall TPACK (Technological Pedagogical Content Knowledge) framework due to the research's specific focus on gaining deeper insights into these three components, namely technological knowledge, pedagogical knowledge, and technological pedagogical knowledge, in the context of the Olympiad class. This research will hugely contribute to educational technology as a field of studies, especially its integration and role in supporting teacher professional development.

METHOD

This study aims to describe the teachers' technological pedagogical knowledge in the practice of learning in the Olympiad class at Semarang Excellence School. The research utilizes a descriptive research design with a qualitative approach (Creswell, 2013; Miles & Huberman,

1994). The focus is on exploring how teachers apply technological pedagogical knowledge (TPK) in the Olympiad class at Semarang Excellence School. The research was conducted from January 2020 to May 2020, at Semarang Excellence School. The study included four teachers: two Chemistry teachers, one IT teacher, and one Mathematics teacher, all teaching in grade X and XI Olympiad classes. Data collection involved observations, interviews, and documentation of lesson planning, learning processes, and learning evaluation in the Olympiad class for Chemistry, Mathematics, and IT subjects. To ensure data validity, the researchers employed the Credibility Test with a triangulation technique, utilizing source triangulation and technique triangulation. Data analysis included data reduction, data display, and drawing/verifying conclusions (see more in Miles & Huberman, 1994).

RESULT AND DISCUSSION

TThe research was conducted at Semarang Excellence School for five months. The results of the research and discussion consist of three parts (1) teacher's technological knowledge (TK), (2) teacher's pedagogical knowledge (PK), and (3) application of teacher's technological Pedagogical Content Knowledge in learning practices in the Olympiad class. The description of each section is as follows.

A.Technological Knowledge in Learning Practices

From the data obtained by the researchers, teachers' technological knowledge (TK) ability in learning practices involves the use of various technological devices such as LCD projectors, laptops, netbooks, PCs/computers, and Android devices to support classroom activities. Technological knowledge encompasses a deep understanding of standard technologies like books, whiteboards, chalkboards, as well as more advanced technologies such as the internet, instructional videos, and digital tools including word processors, spreadsheets, browsers, email, and other applications.

Teachers' ability to keep up with the latest technological developments needs to be continuously developed through learning. From another perspective, technological knowledge not only refers to the instrumental skills required to operate technology but also implies understanding the capabilities of technology to achieve personal and professional goals (Jamieson-Proctor et al., 2010). In line with this, interviews with teachers revealed that technological capabilities are not only important for the learning process but also for enhancing teacher professionalism. One of the interviewees stated about the importance of technological knowledge as follow.

> *Penggunaan teknologi dalam pembelajaran sangat penting bagi para guru di era digital saat ini. Tidak bisa dipungkiri bahwa semua aspek kehidupan kita bergerak seiring dengan teknologi. Saya sendiri menggunakan teknologi sebagai media pembelajaran, menggabungkannya dengan metode pengajaran konvensional. Tujuannya adalah untuk mencegah siswa menjadi bosan, tetapi kita harus cerdas dalam memilih media yang tepat untuk mata pelajaran tertentu. Misalnya, kapan menggunakan video, kapan menggunakan presentasi PowerPoint, kapan praktik langsung diperlukan, dan kapan menggunakan sumber daya internet atau penelitian dari percobaan sekolah lain. Jika kami menemukan sesuatu yang efektif, kami mencoba menggunakannya. Jadi, kami masih memiliki berbagai media yang tersedia, tetapi tetap selektif. (Informan 1)*
>
> [The use of technology in education is highly important for teachers in the current digital era. It cannot be denied that all aspects of our lives are moving in sync with technology. Personally, I utilize technology as a learning tool, combining it with conventional teaching methods. The goal is to prevent students from getting bored, but we must be smart in choosing the appropriate media for specific subjects. For instance, knowing when to use videos, when to use PowerPoint presentations, when handson practice is needed, and when to utilize internet resources or research from experiments conducted in other schools. If we find something effective, we try to incorporate it. So, we still have various media options available, but we remain selective. (Informant 1)]

Based on triangulation conducted by the researchers, it was found that the teachers at Semarang Excellence School possess the technological knowledge to independently use technology in the classroom. They demonstrated proficiency in using laptops or computers, LCD projectors, and displaying presentation slides using MS Office (Word) and PowerPoint. In practice, teachers of the Olympiad class at Semarang Excellence School collaborate using non digital technology to write material concepts and practice questions. They also utilize laboratory tools for chemistry learning during laboratory practicums.

Technological knowledge capabilities also include basic knowledge of how teachers address technical problems that arise with the technological devices used. Teachers have various ways of dealing with technical issues. Some teachers handle these problems independently, while others choose alternative methods such as using other tools or platforms, for example, sending materials via Google Classroom.

However, during the initial research in the field, the researchers discovered a new phenomenon. On several occasions, it was found that teachers in practice handled technical constraints that arose with the technological devices they used. For example, there were instances of errors on the projector screen, and the teacher sought assistance from students. Additionally, students also voluntarily helped teachers who experienced difficulties in using the technology. One student said as follow.

> *Kalau Bu Emi biasanya dicoba sendiri dulu, terus misalnya kalau bener bener ngga bisa terus, kayak waktu yang lama, minta tolong ke muridnya. Ya biasanya langsung minta tolong gitu. Nanti siswa yang sekiranya tahu langsung maju. [kalau] Pak Fauzan biasanya langsung file dikirm ke group WhatsApp. (Informan 2)*
>
> [Ms. Emi usually tries it herself first, and if she really can't figure it out for a long time, she asks her students for help. She usually asks for their assistance directly. Later, the students who know about it will step forward. (On the contrary) Mr. Fauzan usually sends the files directly to the WhatsApp group. (Informant 2)]

Other obstacles include technical problems such as sudden electricity outages and unstable internet networks. These issues interfere with the teacher's planned activities, especially in utilizing information and communication technology for learning. Despite having wireless hotspot facilities covering all school areas, the internet connection cannot be established.

According to Yaumi (Suryawati et al., 2014), the use of communication media like the internet has introduced a new model of interaction in current learning practices. Teachers in Olympiad classes utilize platforms such as Google Classroom, Moodle, and Edmodo, which are easily accessible on the internet. Furthermore, teachers employ online applications like Kahoot, Quizizz, Webex, and YouTube to enhance students' critical thinking skills. This finding supported by Sukardi and Rozi's research (2019) that Moodle and Google Classroom Online Tutorials are deemed valid, practical, and effective for enhancing student learning processes and outcomes.

Hence, it can be deduced that the Technological Knowledge (TK) possessed by teachers in the Olympiad class is regarded as advantageous by these educators. Technology is employed by teachers in diverse manners, and each instructor creatively adapts its usage to suit their individual requirements. The learning experience within the Olympiad class is enriched through the cultivation of skills and the integration of technology, information, and communication. The incorporation of technology into the learning process introduces various novel teaching methodologies that facilitate effective engagement between educators and students. The availability of easy internet access has led to the emergence of captivating learning opportunities with the aid of several applications, such as Kahoot, Quipper, virtual laboratories, and others. The proficiency in technological knowledge among teachers in the Olympiad class acknowledges the inherent benefits of technology. Educators utilize technology in distinctive ways, demonstrating ingenuity in its application to cater to their specific needs..

B. Pedagogical Knowledge in Learning Practices

From the data obtained by the researcher, the teacher's Pedagogical Knowledge (PK) ability in learning practices involves the teacher's in-depth knowledge of the processes, practices, and methods of teaching and learning in the Olympiad class. This knowledge encompasses the goals, values, and objectives of education as a whole. It includes understanding how students learn, classroom management skills, lesson planning, and student assessment (Harris et al., 2009)

According to Minister of National Education's regulation (2007) on pedagogical competence, teachers' pedagogical competence is their ability to manage learning. Specific competencies that differentiate teachers from other professions include their understanding of students, designing and implementing learning activities, evaluating learning outcomes, and developing students to actualize their various potentials. Mastery of learning strategies, especially those that emphasize active student engagement and consider students' uniqueness and prior knowledge, is an important aspect for teachers (Arnyana, 2007).

Teachers in the Olympiad class employ

various learning models (such as inquiry, discovery learning, and problem-based learning) in learning practices to help students acquire knowledge, skills, and critical thinking abilities. In certain lessons, the teacher adapts the learning model based on students' responses in order to continue facilitating exploration and nurturing students' curiosity. This may involve displaying videos or materials related to student questions and processing them into new knowledge, even if the material is outside the main topic being taught. The choice of learning model is aligned with the learning approach used by the teacher. Below is the reason why teacher uses certain learning model.

> *Pendekatan saya sesuai dengan Kurikulum 2013, ya itu pendekatan ilmiah, ada 5M itu. Contoh ya membicarakan redoks, tapi peserta didik ada yang tanya, loh Bu tapi kok bahan ini kok kalau dikasih Coca-cola bisa rontok ya? Saya punya video tentang Coca-cola, maka saya tunjukan. [...] Kadang saya membuka media itu karena berdasarkan pertanyaan peserta didik. Jadi media apapun selalu saya pingin punya. (Informan 3)*
>
> [My approach is in accordance with the 2013 curriculum, which includes the scientific approach with the 5Ms. For instance, during discussions on redox reactions, a student might inquire about why a specific substance dissolve when exposed to Coca-Cola. In such a scenario, I utilize a video related to Coca-Cola and present it to the students. [...] Consequently, I always strive to have diverse media resources readily available to address various teaching situations (Informant 3)]

Bhattacherjee (2012, p.5) explains that the scientific method refers to standard techniques for building scientific knowledge. It involves making valid observations, interpreting results, and generalizing these findings. Research conducted by Hapsari et al. (2019) indicates that the application of this scientific approach also enhances students' social relations through group activities. Students learn to collaborate and assist each other within their groups, leading to an increase in their acquired knowledge.

Furthermore, in the Olympiad class, teachers activate students in the learning process using various techniques such as discussions, question and answer sessions, practice questions, assignments, problem solving, and projects. This approach is a valuable tip for teachers to maintain the quality of learning in the Olympiad class, especially for students who may not have fully grasped the material. If students encounter difficulties, the teacher encourages them to step forward and work on the questions, providing guidance and assistance until they are able to solve the problems gradually and systematically. One of the informants tell how and why she choose peer learning as follow.

> *Strategi saya ya itu pemunculan masalah jadi soal-soal, dikerjakan bareng, yang belum bisa saya suruh maju ke depan untuk dikerjakan, nanti saya tetap bantu. Terus ada tutor sebaya, saya kasih Worksheet, saya beri ini. Terus nanti, ee yang ini di kelas berapa itu, barangkali itu anaknya sendiri yang ngajarin temennya sendiri. Saya kadang dikirimi videonya, [komentar saya] oo ya [sudah] bener, terus pertemuan besoknya saya cek salah satu siswa, saya beri soal yang setipe ini, kemudian dia bisa menjawab, berarti kemaren yang dijelaskan temannya sendiri [dia] bisa [menangkap materinya]. Dan adanya tutor sebaya, siswa dapat saling belajar dengan teman temannya. Malah dengan dia belajar dengan temannya sendiri dia cepat nangkep [paham materi]. Itu kemaren tu ada yang di pemahamannya itu kurang, akhirnya belajar dengan temannya bisa [lebih paham].*
>
> [My strategy is to turn issues into questions, work on them collaboratively, and if there's something a student can't do, I encourage them to step forward and work on it. I'll still provide assistance when needed. Then, there's a peer tutor. I give them a worksheet, I provide this. Later, in a classroom setting, perhaps it's the student themselves who teach their own friend. Sometimes, they send me videos. [My comment] Oh yes, [it's] correct. Then, in the next meeting, I assess one of the students. I give them a similar problem, and if they can answer, it means that what their friend explained yesterday, they've grasped [the material]. And with the presence of peer tutors, students can learn from their peers. In fact, by studying with their friends, they quickly understand the material. If someone didn't quite comprehend it yesterday, eventually, through studying with their friend, they can understand it better.]

The pedagogical knowledge of the teachers in the Olympiad class at Semarang Excellence School is already of a very high standard. The selection and utilization of diverse learning models in the Olympiad class are carried out to cultivate students' knowledge, skills, and attitudes. Teachers facilitate learning through processes such as observation, questioning, experimentation, association, and communication, thereby fostering the development of critical thinking skills among students. By employing various learning approaches that encourage active student participation, teachers aim to enhance

students' systematic problem solving abilities. Through affording students' opportunities for direct involvement in the learning process and providing appropriate guidance, teachers can effectively assist students in surmounting challenges and deepening their comprehension. This proactive approach ensures the maintenance of a superior quality of education within the Olympiad class and maximizes students' potential for achieving outstanding results.

C. Technological Pedagogical Knowledge in Learning Practices

Technological Pedagogical Content Knowledge (TPCK) refers to the knowledge of how different technologies can be effectively utilized in teaching and how these technologies can impact instructional practices (Schmidt et al., 2009). Teachers integrate technology, both hardware and software, into their teaching approaches based on interviews, observations, and document analysis. They make use of presentation software like PowerPoint and Microsoft Office (Word) to deliver instructional materials. However, research conducted Husain (2014) suggests that teachers primarily limit their use of information and communication technology to presentations, particularly PowerPoint.

In the Olympiad class, teachers go beyond using videos related to the learning materials and also incorporate Virtual Labs in chemistry to demonstrate digital-based chemical reactions. This approach aligns with Na'im & Kholik (2017) perspective on the potential of integrating Information and Communication Technology into the learning process, fostering student creativity during learning activities. It is essential for teachers to actively involve themselves in the effective integration of technology into teaching practices, ensuring that technology facilitates engaging, efficient, and enjoyable learning experiences, ultimately leading to improved performance (Warsita, 2013).

Furthermore, in the Olympiad class, the integration of technology into teaching practices is tailored to specific strategies and learning approaches. For instance, in computer science learning, teachers utilize computer laboratories for student practice. The ability of teachers to discern when to use certain programs individually versus in group settings reflects their competency in applying technological pedagogical knowledge (Setyawan, 2016).

Integrating technology in learning includes the use of the internet by teachers in learning practices. Teachers utilize the internet as a source of learning to facilitate the learning process, access additional information, expand knowledge, explore diverse information, and aid in completing teacher assignments alongside their duties as educators (Munawaroh, 2009). Munadi (2013) emphasizes that the internet has a significant impact on both the process and outcomes of learning, both within and outside the classroom. The use of the internet enables independence, acceleration, enrichment, expansion, effectiveness, and productivity in the implementation of the learning process.

Integrating technology into learning practices is a deliberate effort by teachers to enhance the effectiveness and efficiency of learning. In the Olympiad class, classroom management effectively incorporates technology by utilizing Android devices. Teachers use online applications (such as Quizizz, Kahoot, and Google Forms) to administer pre-tests and post-tests at the beginning and end of each learning session. While students use technology, teachers still provide guidance and direction to ensure its appropriate use according to the learning objectives. One of the informants stated why she prefer Google form as follow.

> *Laptop, Android, juga untuk ya saya pakai [untuk] pembelajaran, kayak buka Google form, jadi tugas linknya saya share kemudian anak-anak mengerjakan biasanya saya kasih tiga minggu untuk waktu pengiriman tugasnya. Kalo email itu agak anu si mbak, agak ribet kayaknya. Kalo Google form itu khan langsung respon, langsung saya lihat ditanggapan nilai sudah muncul, akan saya rekap juga mudah. Quiziz juga sama. Kahoot juga bisa. Intinya enaknya Kahoot sama Quiziz khan untuk bisa bermain ya tadi ya, ada saat kita, apa namanya, mainkan langsung live di kelas, khan ada point-pointnya, terus kalo Quiziz ada power up dan seterusnya, pastinya anak anak lebih senang gitu. Jadi, nanti di saya, yang sebagai pembuatnya akan muncul, yang sudah mengerjakan siapa. Ada skor perolehannya. Misal Khafid itu 100 persen bisa mengerjakan, kemudian ada informasi, [sambil menunjukan hasil aplikasi yang digunakan di kelas]...*
>
> [I use a laptop and an Android device for teaching purposes as well. For instance, I open Google Forms to share assignment links with my students. Typically, I give them a three week deadline to submit their assignments. Email can be a bit complicated; it seems a bit

> cumbersome. With Google Forms, the response is immediate; I can see the submitted answers, and the grades appear right away. It's also easy for me to compile the results. The same goes for Quizizz. Kahoot works too. The good thing about Kahoot and Quizizz is that students can play them live in class. There are points involved, and with Quizizz, there are power-ups and so on. This definitely makes the students more engaged. So, on my end as the creator, the information about who has completed the assignments and their scores will be visible. For example, Khafid has completed it 100%, and there's information (while showing the application results used in class) ...]

Students' involvement in learning with technology is encouraged through the utilization of Learning Management Systems (such as Google Classroom) and various online applications (like Kahoot and Quizizz), which can be accessed through Android devices. Moreover, the use of Android devices activates students' engagement in learning, making them more active participants in learning practices. in this regard, research conducted by Setyawan (2016) emphasizes the importance of software readiness and, most importantly, the readiness of students to engage in technology-integrated learning. Therefore, teachers must always uphold the principle that technology serves as a means, not the end goal of learning. What has been done by teachers in the Olympiad class reflect this very basic principle of use of technology in learning practices.

Furthermore, teachers also integrate technology into learning practices, which includes the assessment of the learning process using technology. This is one aspect of implementing Technological Pedagogical Knowledge, which refers to teachers' pedagogical and technological knowledge. In the Olympiad class, teachers assess the learning process based on the 2013 Curriculum, which comprises three domains: attitudes, knowledge, and task assessment. While attitudes are evaluated through tasks, assessments such as daily formative assessment, mid semester assessment, and final semester assessment (summative assessment) still utilize paper-based test (PBT). Additionally, teachers employ Learning Management Systems (LMS) and online applications that are easily accessible and free for students' participation in the learning process.

Assessing attitudes using technology can be observed through timely assignment submissions. LMS platforms like Google Classroom have features that allow teachers to set assignment deadlines. Cognitive assessment can be measured through student assignment results, while skills assessment using technology can be conducted during online learning. In a study conducted by Hikmatiar et al. (2020), the analysis of Google Classroom as a learning medium demonstrated significant effectiveness. The learning planning component scored 74.50%, designing and creating materials achieved 75.27%, learning delivery reached 75%, learning interaction stood at 66.10%, and the evaluation component implementation scored 69.01%.

According to the findings, it can be concluded that teachers in the Olympiad class are adept at integrating both digital and non-digital technologies into lesson planning and execution, tailored to the learners' needs. For instance, they incorporate multimedia presentations, videos, audios, and simulations to enhance students' comprehension. The use of technology in teaching aims to stimulate critical and creative thinking abilities. Teachers are able to create challenging tasks and activities that foster independent thinking and deeper comprehension. In some class sessions, teachers also harness the internet as an additional learning resource. They search for educational materials, learning resources, instructional videos, and other pertinent educational content to augment their teaching. By implementing Technological Pedagogical Knowledge (TPK), teachers can harness the full potential of technology to support the learning process and facilitate improved learning outcomes for students.

CONCLUSION

According to the main findings of this study, teachers possess both Technological Knowledge (TK) and Pedagogical Knowledge (PK) to effectively integrate technology into their teaching practices. They are adept at independently utilizing a wide range of digital and non-digital technology devices, addressing technical issues with alternative solutions, and leveraging Learning Management Systems (LMS) and e-learning platforms for online learning. Alongside their technological expertise, teachers excel in managing classrooms, selecting appropriate learning models, and assessing the learning process based on the 2013 curriculum. They tailor their instructional approaches, methods, and techniques to meet the diverse needs of students, fostering engagement and promoting

holistic development. By integrating technology thoughtfully, teachers create dynamic and conducive learning environments that enhance student learning outcomes. They employ Learning Management Systems and online applications to track progress, provide timely feedback, and facilitate interactive discussions. Through the seamless integration of technology and effective classroom management, teachers nurture student growth, collaboration, and success. Their expertise in combining technological and pedagogical knowledge enables them to create engaging and meaningful learning experiences, equipping students with the necessary skills for the digital age. Ultimately, teachers play a vital role in maximizing the potential of technology in education, ensuring that it serves as a valuable tool to enhance learning and empower students.

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