Didaktika: Jurnal Kependidikan, Vol. 12, No. 4, November 2023

Analysis of Pedagogic Content Knowledge Technology (TPCK) Capabilities of Teachers in Senior High School

Hasriadi[1], Nurul[2]
[1,2]IAIN Palopo, Indonesia

[1]hasriadi@iainpalopo.ac.id

Abstract

This study investigated the ability of Pedagogic Content Knowledge Technology (TPCK) of teachers in Senior High School. This study aims to assess and analyze (1) the ability of TPCK teachers and (2) its application in the context of learning in the school. The qualitative approach is descriptive, and data is obtained through observation, interviews, and documentation. The results showed that, although the teachers had demonstrated good TPCK skills, there were variations in the level of mastery between them. In terms of application, teachers have integrated technology well into the learning process, although they still face obstacles related to network infrastructure. This research illustrates the complexity of teachers' TPCK capabilities in today's technological era, highlights their success in overcoming challenges, and offers recommendations for improving the use of technology in learning. These findings provide important insights for future educational pedagogy and policy development.

Kata Kunci: *Pedagogic Technology Content Knowledge, High School*

Introduction

Education plays a crucial role in shaping the future of individuals and society. More than just teaching knowledge and skills, education opens the door to holistic understanding, awareness, and self-development (Mujiburrohman et al., 2023). With education, a person not only acquires skills to compete in the job market but also builds the character, moral values, and empathy needed to live side by side in a diverse society (Rusmulyani, 2021). Apart from that, education can potentially reduce poverty, eradicate ignorance, and increase the innovation and progress of a nation. By providing equal and quality access to education, we not only open the door to a brighter future for individuals but also build a solid foundation for a country's social, economic, and cultural development (Sabri, 2020, p. 50).

Teachers play an important role in education as educators who can shape students' personalities, thus enabling them to develop their potential (Szymkowiak et al., 2021). The teacher's task is not only to teach in the classroom but the teacher is a second educator after the parents of students at school (Hargreaves & Fullan, 2020). The teacher can educate and guide students to become individuals who have good morals and ethics, are disciplined in doing everything, and can be responsible for themselves and others (Erlinung, 2022).

The teacher must have pedagogic abilities. Pedagogic ability is the teacher's ability in the learning process (Susanto et al., 2020). Teachers who can teach at least have the following characteristics: understanding and insight into the basics of education, knowledge of students, curriculum or syllabus development, learning design, implementation of educational and dialogical learning, use of learning technology, evaluation of learning outcomes, and student development to realize their various potentials (Sadiman, 2018, pp. 23–24). The roles and responsibilities of teachers in the world of education are very influential in determining how

students succeed, where current information and communication technology is experiencing such rapid development (Rahmatullah et al., 2022; Sayaf et al., 2021). So, school teachers must master knowledge in their respective fields and also master information and communication technology.

The development of Information and Communication Technology (ICT) has had an impact, especially in Education (Hasriadi & Marwiyah, 2022). Rosenberg argues that with the development of the use of information and communication technology, there are five changes in the learning process, namely: 1) From training to appearance, 2) From classrooms anywhere and anytime, 3) From paper to "online" or channels, 4) Physical facilities to networking facilities, and 5) From cycle time to real-time.

Undeniably, students' insights today are highly developed, especially in using technology (Sanusi et al., 2022). They are proficient in operating various applications, browsing social media, and chatting to online games. Judging from students' daily lives close to the Internet, it allows their knowledge and knowledge to develop faster; even students who are very curious about lessons can learn directly through the Internet (Haleem et al., 2022). However, many teachers still need to work on technology, which is a big problem because it hinders the use of technology (Alvarez, 2020; Dong et al., 2020).

The rapid development of Information and Communication Technology (ICT) in this era can be utilized by teachers in the world of education because it is very influential in the learning process, where technological abilities must be mastered to adapt to the times (Hasriadi, 2022). The emergence of technology originated from the function of humans as learning beings who can sprinkle the universe. Allah Almighty has created humans by bestowing the mind to see the signs of His greatness and power on this earth.

In this context, Allah Almighty teaches in the Qur'an (Sura Ali-Imran/3:190-191) that humans are given reason to understand the signs of His greatness seen in the creation of heaven, earth, the alternation of night and day (Ministry of Religious Affairs of the Republic of Indonesia, 2009, p. 75). Therefore, teachers in the modern era must develop their understanding of 21st-century science and technology. Teachers must be able to search, analyze, evaluate, and solve problems using technology (Spiteri & Chang Rundgren, 2020).

Teachers must master technology skills to create an effective and efficient learning environment(Asad et al., 2020). Learning success involves factors such as family environment, school environment, and community environment(J. et al., 2023). However, the role of the teacher is very significant in motivating students and creating learning conditions that affect student success in school.

In the Industrial Revolution 4.0 era, teachers' technology skills have become very important. Teachers must integrate technology into learning and master Pedagogic Content Knowledge Technology (TPCK)(S. Li et al., 2022). TPCK is an integration between technological knowledge (TK), content knowledge (CK), and pedagogic knowledge (PK) to create effective and fun learning ((Absari et al., 2020). Teachers need to master TPCK to develop innovative, creative, and effective knowledge in the classroom, considering that students today are very familiar with technology(Hiyaroh et al., 2022)

Teachers in Senior High Schools use the WhatsApp application to teach, test students, give assignments, and send materials(Nashir & Laili, 2021; Okebukola et al., 2020; Pratiwi, 2020). Therefore, researchers are interested in assessing teachers' TPCK capabilities and their application in manual learning. Thus, this study aims to explore and analyze the extent to which teachers understand and apply TPCK in manual teaching, particularly in an era where technology has a central role in education.

Method

This research adopts a qualitative approach with qualitative descriptive methods. This approach describes factual situations and events surrounding the phenomenon under study, namely the application of Pedagogic Content Knowledge Technology (TPCK) by Teachers in Senior High School. The study subjects involved teachers and students at North Luwu State High School 1. The research focuses on the learning process related to the teacher's TPCK ability. In this case, teacher ability is measured as a skill teachers must possess to carry out their duties effectively and by expectations. TPCK, short for Pedagogic Technology Content Knowledge, is the knowledge that connects subject matter, technology, and pedagogics, enabling teachers to present innovative and efficient learning.

This study used data collection techniques through direct observation, structured interviews with teachers and students, and documentation from school archives and reference materials. The data obtained will be reduced, presented in narrative form, and analyzed using Atlas—Ti 23 software to facilitate data categorization and coding. The validity of the data is checked through triangulation of sources and methods. The conclusions of the results of this study will be drawn after ensuring the correctness, robustness, and suitability of the data obtained from various data collection techniques.

Results

Pedagogic Technology Capabilities Content Knowledge (TPCK) Education Teachers in Senior High School

The ability of Pedagogic Content Knowledge Technology (TPCK) in Senior High School can be seen using the Atlas. Ti 23 tools, making it easier for researchers to get the gist of the interviewee's answers. Here is a look at Atlas. Ti 23:

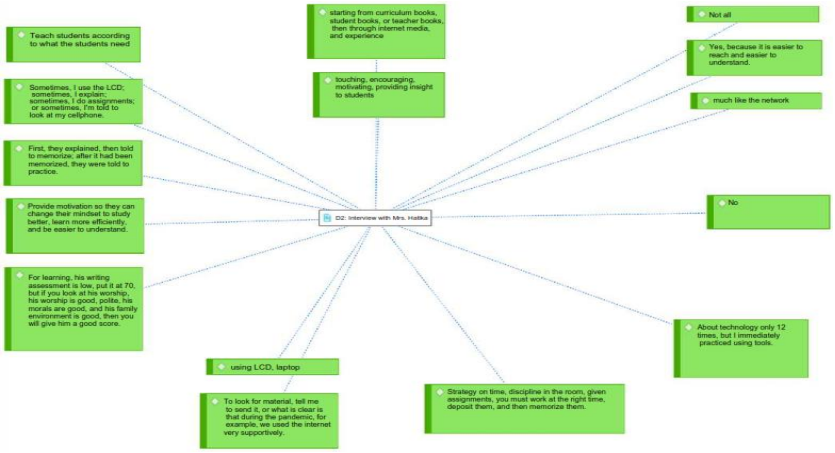

Figure 1. Atlas. Ti 23 Display for Teacher Interview 1

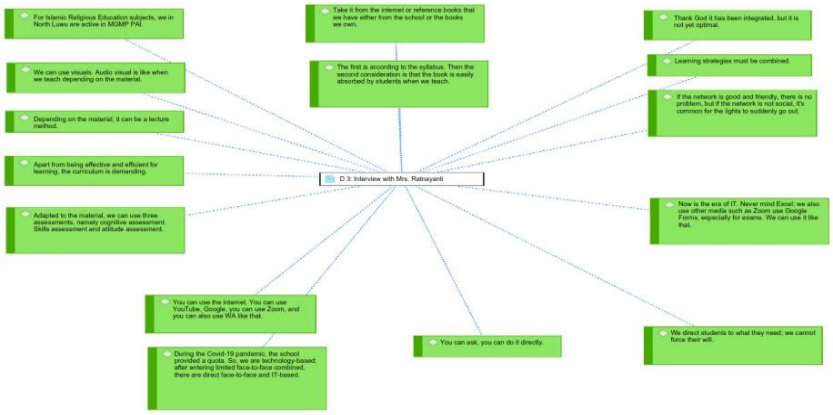

Figure 2. Atlas. Ti 23 View for Teacher Interview 2

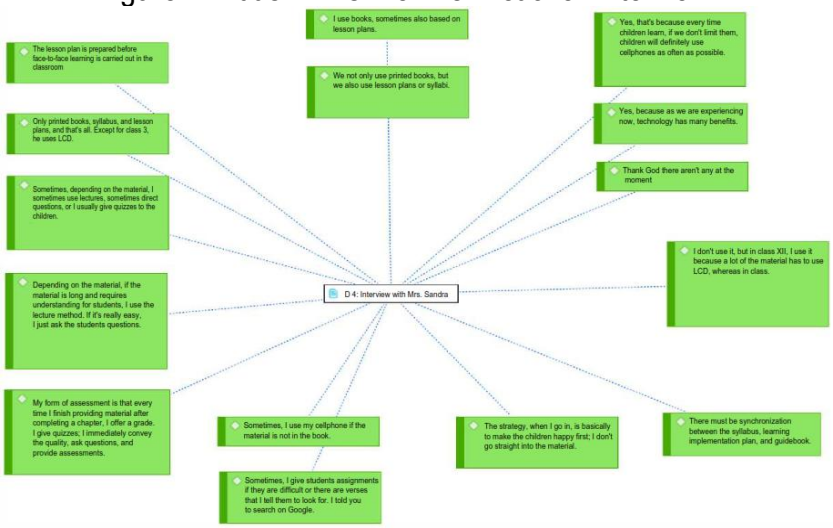

Figure 3. Atlas. Ti 23 View for Teacher Interview 3

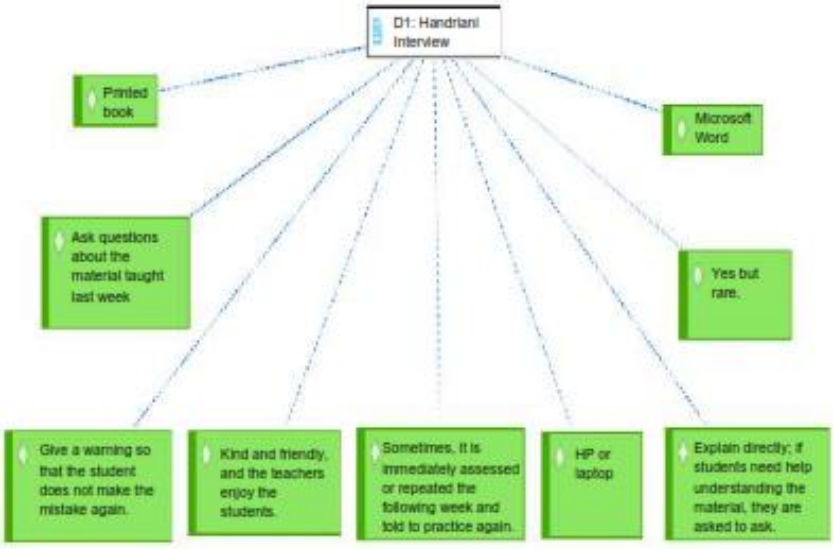

Figure 4. Atlas. Ti 23 Display for Student Interview 1

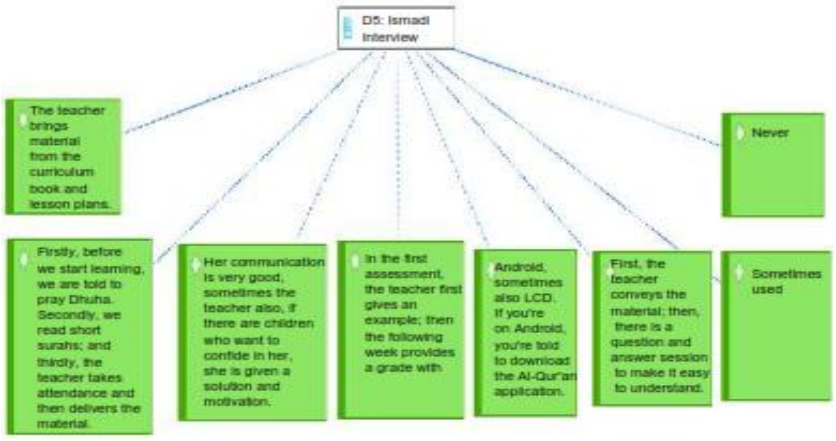

Figure 5. Atlas. Ti 23 View for Student Interviews 2

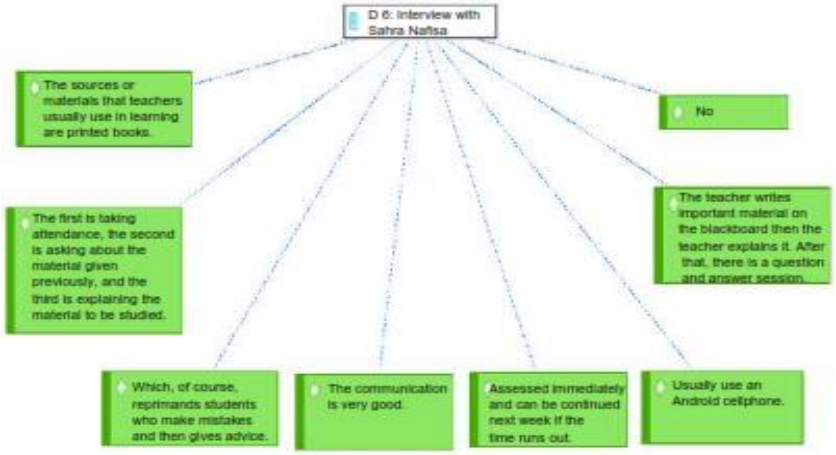

Figure 6. Atlas. Ti 23 Display for Student Interviews 3

Application of Pedagogic Content Knowledge (TPCK) Technology Skills of Teachers in Senior High School

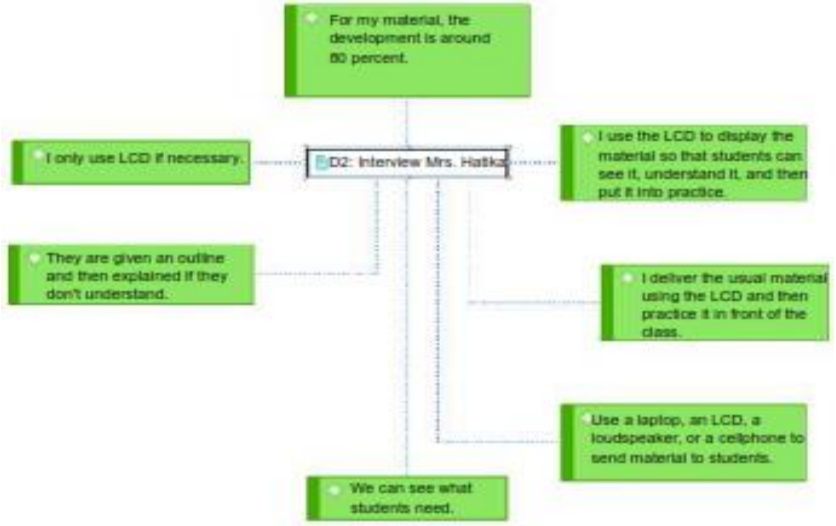

Figure 7. Atlas. Ti 23 Display for Teacher Interview 1

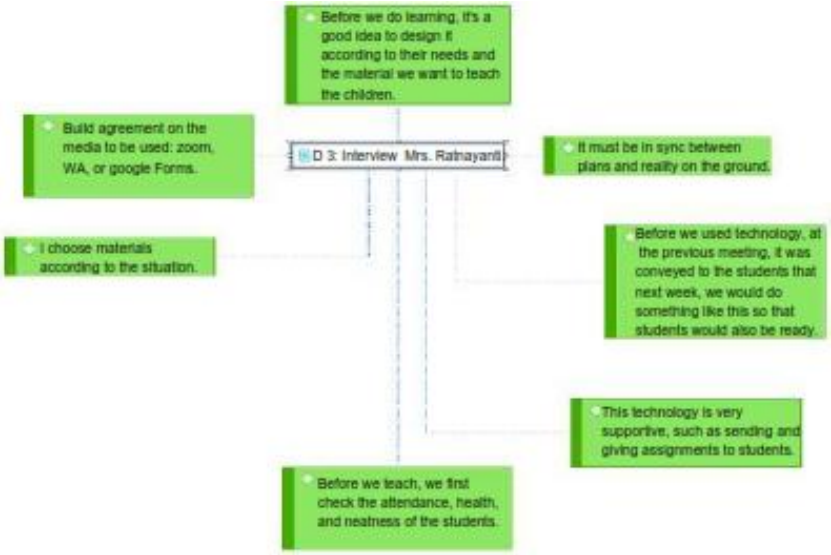

Figure 8. Atlas. Ti 23 View for Teacher Interview 2

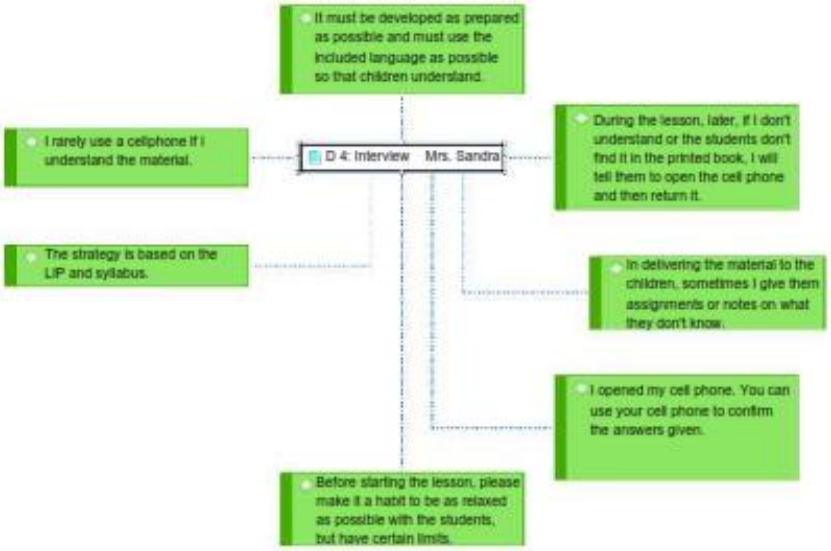

Figure 9. Atlas. Ti 23 View for Teacher Interview 3

Discussion

Pedagogic Content Knowledge (TPCK) Technology Skills of Teachers in Senior High School

The results of the research found by researchers on the ability of Pedagogic Content Knowledge Technology (TPCK) Teachers in Senior High Schools include the following:

a.Content Knowledge (CK)

Based on the results of data analysis using Atlas. Ti 23, regarding Content or material knowledge, has been done very well. This shows that teachers use these sources/materials not only from one source but from various sources, ranging from lesson plans or syllabi, package books, the internet, and from experiences that teachers see both from the family, school, and community environments, to achieve an effective and efficient learning process so that what the teacher wants is achieved. This is in line with Robert Gagne's opinion in(Iqbal et al., 2021), which explains that a person's learning changes because of his experience.

From the various sources/materials used, teachers do not necessarily give science material to students, but teachers must consider it first. In choosing sources/materials, teachers think

several things: the first is based on the Learning Implementation Plan (LIP) or syllabus; teachers use books because students more easily absorb them during learning activities, and teachers also use the internet if there is material that is not understood, and the last is that teachers see experiences in the surrounding environment as well as using cellphones. At this time, all technology has been all-round makes people use it in everyday life. Even children are familiar with HP, so teachers have to be able to provide encouragement, motivation, and views and change the mindset of students that HP has a negative value. Still, HP also has a lot of positive sides if used properly.

b.Pedagogik Knowledge (PK)

To facilitate teachers in carrying out their duties in the learning process in the classroom, it is very important to master pedagogic knowledge so that students easily receive and understand the material taught in line with Misrah and Koehler's opinion in (Hill & Uribe-Florez, 2020), which states that teachers should master the teaching process or method in learning.

Based on the results of interview data analysis using Atlas. Ti 23 related to activities carried out by teachers before starting learning in class; the teacher first directs students to the prayer room to perform dhuha prayers in the congregation and read the Qur'an together. This is done so that students are familiar with things that make them aware of the importance of carrying out obligations as Muslims because this is not only a matter of the world but of the Hereafter. In addition, in implementing classroom learning, there are things that teachers would rather avoid, especially for students who make mistakes. Namely, the teacher does not immediately give punishment but is first given a reprimand to avoid repeating the error and given encouragement and motivation to establish a good communication relationship between teachers and students.

Meanwhile, based on the results of interview data analysis using Atlas. Ti 23 obtained about teachers in preparing LIP, first conducting Subject Teacher Deliberation (MGMP) activities to foster cooperative relationships between teachers in developing teacher professional competencies. LIP is designed in such a way through the method used and equated with the subject matter, as the teacher applies the lecture method during the implementation of learning in class. If the material is long, then students memorize it and practice. The way to explain the material presented by the teacher also uses learning media, namely visual and audio-visual media. As for the form of assessment in subjects, it uses three, namely Cognitive, Affective, and Psychomotor assessments.

c.Teknologi Knowledge (TK)

Technology makes it easier for teachers to channel information to students to create more effective, efficient, and innovative learning. Technology knowledge is very important for teachers to support understanding of the material taught to students. In line with the opinion(Taghizadeh & Hasani Yourdshahi, 2020), which emphasizes that basic knowledge, technological knowledge, and skills are used to support understanding of the material to be studied.

Based on the results of data analysis using Atlas. Ti 23 that in learning, teachers use technology such as HP to download Qur'an applications, and laptops and LCDs display material to attract students' attention to understand the subject matter better. In learning, teachers also use the internet to support the teaching and learning process carried out during the COVID-19 pandemic because education is very limited, so teachers give assignments to students and then send them via the WhatsApp application, or teachers can also use the Zoom application to do online learning if there are students who do not understand the subject matter.

d.Pedagogik Content Knowledge (PCK)

In the implementation of learning, Pedagogic Content Knowledge (PCK) is very important for a teacher as it is known that when the teacher teaches in the classroom, the strategies must be adjusted to the subject matter to be prepared so that students easily understand the material.

As stated ((Prasetia et al., 2021), pedagogical content knowledge must be integrated into the learning process to create new knowledge, namely Pedagogic Content Knowledge (PCK).

Based on the results of data analysis of teacher and student interviews in Senior High School using Atlas. It shows that teachers' learning strategies have been done very well. Even though each teacher has their strategy for teaching, the goal remains the same. As done by Mrs. Hatika before starting the lesson, first, the teacher and students perform dhuha prayers in the mushollah and then, after that, proceed to read the holy verses of the Qur'an together. Teachers use this strategy to touch students' hearts and get closer to Allah SWT. Another approach carried out by Mrs. Sandra is that before starting learning on the subject matter, first give a lecture or funny story so that students feel confident to follow the learning. In Mrs. Ratnayanti, the strategy used is inquiry or direct.

e.Teknologi Content Knowledge (TCK)

In learning activities, several things need to be considered by teachers, especially to create a pleasant atmosphere for every student at school. Therefore, teachers must understand how to connect technology and subject matter to start new knowledge. This is the opinion (Eliyanto et al., 2021) suggesting that Content Knowledge Technology (TCK) is knowledge about how technology can create a new picture of certain materials.

Based on the data analysis of teacher and student interviews in high schools using Atlas. Ti 23, in choosing technology and learning media that are by the subject matter, the teacher looks more at what is needed by students and adjusts to the material to be taught because if it is not appropriate, learning is not effective and efficient. As researchers have seen when observing learning, teachers only use technology a few times because it must be adjusted to the subject matter, as in the practice material of bathing the corpse does not use technology but directly uses tools, namely dolls, shrouds, and other tools.

f.Teknologi Pedagogik Knowledge (TPK)

Technology is very useful for teachers in implementing learning, which can be used as a support in teaching practice. This is the opinion (Santos & Castro, 2021), which suggests that Pedagogic Knowledge Technology (TPK) is knowledge about how various technologies can be used in teaching and how these technologies can change how teachers teach.

Based on the data analysis of teacher and student interviews in Senior High Schools using Atlas. Ti 23 that the use of computer-based applications in learning and teaching practices is used and not used because teachers only adapt technology to the subject matter. The teacher who teaches in class X has more basic knowledge, but among the three teachers interviewed, some use it because it is known that now it is the era of IT, so that teachers can use various applications such as Zoom, WhatsApp, and so on.

g.Teknologi Pedagogik Content Knowledge (TPCK)

The creation of effective and efficient learning can have a good influence on students, inseparable from the teacher's task of integrating technology into education. The opinion (Tunjera Chigona, 2020) explains that the TPCK principle combines technology, pedagogic, and content/material in one context.

Based on the data analysis of teacher interviews in Senior High Schools using Atlas. Ti 23, related to Pedagogic Content Knowledge Technology (TPCK) learning, is currently integrated with technology and learning media, but everything is not as optimal as what teachers want. There are problems faced by teachers in integrating technology into learning.

There are obstacles regarding the use of technology and learning media experienced by teachers in the learning process, namely constrained by the network, which makes teachers have to be patient in such situations because it is undeniable that ordinary networks are not

friendly, such as lights out or on internet networks that are slowly connected to hinder the learning process, this is a problem for teachers, especially in the use of internet quota.

The solution given to the above problem is that the government should provide policies on the educational aspect to provide free application services in the learning process, especially for schools; it is better to provide Wi-Fi to help smooth the network in accessing the internet around the school so that teachers no longer have difficulties with the problems faced.

Application of Pedagogic Content Knowledge Technology (TPCK) skills of teachers in Senior High School

From data and information obtained through informants using Atlas. Ti 23 regarding applying Pedagogic Content Knowledge Technology (TPCK) skills of teachers in Senior High Schools. Based on the results of the study, data can be obtained, namely:

a.Content Knowledge (CK)

From the results of analyzing teacher interview data in Senior High Schools using Atlas. Ti 23, it can be seen that the development of material carried out by teachers in learning practices is good. In contrast, before learning in class, teachers have prepared lesson materials according to student needs. The teacher does this so students can practice the material developed easily. Researchers saw when making observations in the learning process in class that the teacher has well developed the subject matter on the practice of bathing the corpse to provide opportunities for students to advance in front of the class to practice how to clean the corpse equipped with tools such as dolls, shrouds, dippers, buckets, and others so that students easily understand it.

b.Pedagogik Knowledge (PK)

Based on the results of teacher interview data analysis using Atlas. Ti 23 related to managing classes in the learning process in Senior High School has been done well because, basically, good classroom management greatly determines the quality of teaching and learning activities; if the quality of learning and teaching that occurs in the classroom is good, certainly, students will also get a good level of understanding but it does not rule out the possibility that in every In class, there must be students who are difficult to understand the lesson so the teacher must find ways as much as possible to overcome it. As the teacher said, when entering the classroom, the first thing to do is see students' presence, health, and tidiness and build an atmosphere that makes students feel comfortable without pressure. Then, what will be taught to students must be adjusted to the material and their needs.

c.Teknologi Knowledge (TK)

Technological changes that continue to grow day by day make teachers must be able to have an understanding of how to use computer devices or technology in the context of education. Technology is a tool for acquiring knowledge and support in learning. Based on the results of interview data analysis using Atlas. Ti 23 shows that high school teachers use technology to support learning, such as laptops, to make assignments, create lesson plans, and so on. In contrast, LCDs display material to make it easier to understand and attract students' attention; cellphones are used to find material if something is not understood and send assignments to students, especially during the COVID-19 pandemic.

d.Pedagogik Content Knowledge (PCK)

Based on the results of interview data analysis using Atlas. Ti 23, it was found that teachers in implementing learning strategies that are by the subject matter first the strategies used must be based on the lesson plan or syllabus, then in choosing the subject matter, must be adjusted to the situation or conditions because not everything desired and expected by the teacher is achieved perfectly without any problems faced.

e.Teknologi Content Knowledge (TCK)

From the results of interview data analysis using Atlas. Ti 23 about how teachers can deliver lesson material using technology, namely by using laptops and LCDs or loudspeakers so that they can display lesson material, then students can see and listen to the material in class in other ways, namely in delivering lesson material, teachers usually give tasks to memorize verses, Of the many students in the class, there must be those who do not bring the Qur'an, so by taking the initiative, the teacher allows students to open cellphones to download the Qur'an application.

f.Teknologi Pedagogik Knowledge (TPK)

From the results of data analysis of teacher interviews in Senior High Schools using Atlas. Ti 23 related to choosing technology by learning approaches and strategies; teachers usually use LCD if there is material that must be displayed so that students more easily understand the lesson, but not all material delivered in learning practices uses LCD. As for the use of cell phones, teachers and students have made a mutual agreement from the beginning to download applications such as WhatsApp, Zoom, and others.

g.Teknologi Pedagogik Content Knowledge (TPCK)

Based on the data analysis of teacher interviews in Senior High Schools using Atlas. Ti 23 regarding the way teachers integrate technology into learning, namely based on lesson plans that have been prepared so that they must be in sync with what is practiced in the classroom.

Conclusion

Based on the results of research that have been described in the previous chapters, several important conclusions can be drawn as follows:

1. The ability of Pedagogic Technology Content Knowledge (TPCK) teachers in Senior High School shows positive results. This research involves seven indicators, namely Content Knowledge (CK), Pedagogic Knowledge (PK), Technology Knowledge (TK), Pedagogic Content Knowledge (PCK), Content Knowledge Technology (TCK), Pedagogic Knowledge Technology (TPK), and Pedagogic Content Knowledge Technology (TPCK). In general, the TPCK ability of teachers can already be considered good. However, it should be noted that this ability level varies between teachers, indicating a difference in mastery of TPCK aspects.
2. In applying TPCK skills, teachers in high schools have used their knowledge effectively. They successfully integrate technology into the learning process, creating a more interactive and enjoyable learning experience for students. However, network-related constraints are still obstacles. This problem indicates the need to improve school technology infrastructure so that teachers can optimize the implementation of their TPCK without being constrained by technical issues.

Despite certain challenges faced in applying TPCK, the study concludes that teachers in high schools have made good efforts in utilizing their TPCK knowledge. However, further support is needed, especially in terms of technology infrastructure, to ensure a more optimal and comprehensive implementation of TPCK in the learning process in the future.

References

Absari, N., Priyanto, P., & Muslikhin, M. (2020). The Effectiveness of Technology, Pedagogy and Content Knowledge (TPACK) in Learning. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *26*(1), Article 1. https://doi.org/10.21831/jptk.v26i1.24012

Alvarez, A. V. (2020). Learning from the Problems and Challenges in Blended Learning: Basis for Faculty Development and Program Enhancement. *Asian Journal of Distance Education*, *15*(2), 112–132.

Asad, M. M., Hussain, N., Wadho, M., Khand, Z. H., & Churi, P. P. (2020). Integration of e-learning technologies for interactive teaching and learning process: An empirical study on higher education institutes of Pakistan. *Journal of Applied Research in Higher Education*, *13*(3), 649–663. https://doi.org/10.1108/JARHE-04-2020-0103

Dong, Y., Xu, C., Chai, C. S., & Zhai, X. (2020). Exploring the Structural Relationship Among Teachers' Technostress, Technological Pedagogical Content Knowledge (TPACK), Computer Self-efficacy and School Support. *The Asia-Pacific Education Researcher*, *29*(2), 147–157. https://doi.org/10.1007/s40299-019-00461-5

Eliyanto, Adesta, E. Y. T., & Fatimah, S. (2021). Islamic Education Teachers' Technological Pedagogical Content Knowledge (TPACK): A Study in Indonesia. *Edukasia Islamika : Jurnal Pendidikan Islam*, *6*(2), 144–163. https://doi.org/10.28918/jei.v6i2.625

Erlinung, N. (2022). Peranan Guru Pendidikan Agama Islam (PAI) Dalam Membentuk Akhlak Peserta Didik. *GUAU: Jurnal Pendidikan Profesi Guru Agama Islam*, *2*(1), Article 1.

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, *3*, 275–285. https://doi.org/10.1016/j.susoc.2022.05.004

Hargreaves, A., & Fullan, M. (2020). Professional capital after the pandemic: Revisiting and revising classic understandings of teachers' work. *Journal of Professional Capital and Community*, *5*(3/4), 327–336. https://doi.org/10.1108/JPCC-06-2020-0039

Hasriadi, H. (2022). Metode Pembelajaran Inovatif di Era Digitalisasi. *Jurnal Sinestesia*, *12*(1), Article 1.

Hasriadi, H., & Marwiyah, St. (2022). *Model Pembelajaran Jarak Jauh Pendidikan Agama Islam Berbasis Teknologi Informasi dan Komunikasi | Jurnal Konsepsi*. https://www.p3i.my.id/index.php/konsepsi/article/view/174

Hill, J. E., & Uribe-Florez, L. (2020). Understanding Secondary School Teachers' TPACK and Technology Implementation in Mathematics Classrooms. *International Journal of Technology in Education*, *3*(1), 1–13.

Hiyaroh, D. E., Salimah, I. D., & Thohir, M. (2022). Perception of Islamic Religious Education Teachers Based on TPACK. *EDUKASI : Jurnal Pendidikan Islam (e-Journal)*, *10*(1), Article 1. https://doi.org/10.54956/edukasi.v10i1.308

Iqbal, Md. H., Siddiqie, S. A., & Mazid, Md. A. (2021). Rethinking theories of lesson plan for effective teaching and learning. *Social Sciences & Humanities Open*, *4*(1), 100172. https://doi.org/10.1016/j.ssaho.2021.100172

Kementerian Agama RI. (2009). *Al-Qur'an Terjemah dan Asbabun Nuzul*. Al-Hanan.

Li, J., & Xue, E. (2023). Dynamic Interaction between Student Learning Behaviour and Learning Environment: Meta-Analysis of Student Engagement and Its Influencing Factors. *Behavioral Sciences*, *13*(1), Article 1. https://doi.org/10.3390/bs13010059

Li, S., Liu, Y., & Su, Y.-S. (2022). Differential Analysis of Teachers' Technological Pedagogical Content Knowledge (TPACK) Abilities According to Teaching Stages and Educational Levels. *Sustainability*, *14*(12), Article 12. https://doi.org/10.3390/su14127176

Mujiburrohman, Daliman, Amru, H., & M, S. A. (2023). Pengembangan SDM Tenaga Pendidik di Madrasah Aliyah Nurul Islam Ngemplak Boyolali Menghadapi Abad ke-21. *Indonesian Journal of Humanities and Social Sciences*, *4*(1), Article 1. https://doi.org/10.33367/ijhass.v4i1.4191

Nashir, M., & Laili, R. N. (2021). English Teachers' Perception toward the Switch from Offline to Online Teaching during lockdown in the Midst of Covid-19 Outbreak. *EDUKATIF : JURNAL ILMU PENDIDIKAN*, *3*(2), Article 2. https://doi.org/10.31004/edukatif.v3i2.287

Okebukola, P. A., Suwadu, B., Oladejo, A., Nyandwi, R., Ademola, I., Okorie, H., & Awaah, F. (2020). Delivering High School Chemistry During COVID-19 Lockdown: Voices from Africa. *Journal of Chemical Education*, *97*(9), 3285–3289. https://doi.org/10.1021/acs.jchemed.0c00725

Prasetia, S. A., Khalidiyah, T., & Arif, S. (2021). TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE: A New Pedagogical Approach in Islamic Education in the Pandemic Era. *Al-Tadzkiyyah: Jurnal Pendidikan Islam*, *12*(2), Article 2. https://doi.org/10.24042/atjpi.v12i2.9390

Pratiwi, W. R. (2020). The Practice of Digital Learning (D-Learning) in the Study from Home (SFH) Policy: Teachers' Perceptions. *Journal of Southwest Jiaotong University*, *55*(4), Article 4. http://jsju.org/index.php/journal/article/view/662

Rahmatullah, A. S., Mulyasa, E., Syahrani, S., Pongpalilu, F., & Putri, R. E. (2022). Digital era 4.0: The contribution to education and student psychology. *Linguistics and Culture Review*, *6*(S3), Article S3. https://doi.org/10.21744/lingcure.v6nS3.2064

Rusmulyani, R. (2021). Technical Vocational Education And Training (TVET) Innovation Dengan Model Pelatihan Berbasis Kompetensi Dalam Pengembangan Soft-Skill Sumber Daya Manusia. *Jurnal Inovasi Penelitian*, *1*(8), Article 8. https://doi.org/10.47492/jip.v1i8.318

Sabri, A. (2020). *Pendidikan Islam Menyongsong Era Industri 4.0*. Deepublish.

Sadiman, S. (2018). *Menjadi Guru Super*. Bumi Aksara.

Santos, J. M., & Castro, R. D. R. (2021). Technological Pedagogical content knowledge (TPACK) in action: Application of learning in the classroom by pre-service teachers (PST). *Social Sciences & Humanities Open*, *3*(1), 100110. https://doi.org/10.1016/j.ssaho.2021.100110

Sanusi, I. T., Oyelere, S. S., & Omidiora, J. O. (2022). Exploring teachers' preconceptions of teaching machine learning in high school: A preliminary insight from Africa. *Computers and Education Open*, *3*, 100072. https://doi.org/10.1016/j.caeo.2021.100072

Sayaf, A. M., Alamri, M. M., Alqahtani, M. A., & Al-Rahmi, W. M. (2021). Information and Communications Technology Used in Higher Education: An Empirical Study on Digital Learning as Sustainability. *Sustainability*, *13*(13), Article 13. https://doi.org/10.3390/su13137074

Spiteri, M., & Chang Rundgren, S.-N. (2020). Literature Review on the Factors Affecting Primary Teachers' Use of Digital Technology. *Technology, Knowledge and Learning*, *25*(1), 115–128. https://doi.org/10.1007/s10758-018-9376-x

Susanto, R., Rachmadtullah, R., & Rachbini, W. (2020). Technological and Pedagogical Models: Analysis of Factors and Measurement of Learning Outcomes in Education. *Journal of Ethnic and Cultural Studies*, *7*(2), 1–14.

Szymkowiak, A., Melović, B., Dabić, M., Jeganathan, K., & Kundi, G. S. (2021). Information technology and Gen Z: The role of teachers, the internet, and technology in the education of young people. *Technology in Society*, *65*, 101565. https://doi.org/10.1016/j.techsoc.2021.101565

Taghizadeh, M., & Hasani Yourdshahi, Z. (2020). Integrating technology into young learners' classes: Language teachers' perceptions. *Computer Assisted Language Learning*, *33*(8), 982–1006. https://doi.org/10.1080/09588221.2019.1618876