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Analysis of Integration Technological Pedagogical Content Knowledge (TPCK) of Preservice Mathematics Teacher in Planning the Learning Process

Suripah1*, Endang Istikomah2, Nur Atiqah3

[1*] Mathematics Education, Universitas Islam Riau; rifah@edu.uir.ac.id
[2] Mathematics Education, Universitas Islam Riau; endangistikomah@edu.uir.ac.id
[3] Mathematics Education, Universitas Islam Riau; nuratiqahbks@gmail.com

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ABSTRACT

Background: Professional teachers are required to master pedagogical and technological content knowledge well. However, in reality there are still many teachers who have not been able to integrate technology into PCK as a form of learning innovation. Therefore, preparation is needed for preservice teachers so that they have more abilities in facing the world of work. Purpose**:** This study aims to analyze the ability of preservice mathematics teachers to integrate technology into pedagogical content knowledge in planning the process of learning mathematics. **Method:** This study used descriptive qualitative method. As for the subject of this research are 23 students of Mathematics teacher candidates for Semester V, Universitas Islam Riau. The TPCK analysis is carried out on learning device documents designed by preservice teachers in integrating technology. Analysis was carried out on three aspects, including: technological knowledge (TK), technological Content Knowledge (TCK) and Technological Tedagogical Knowledge (TPK). The procedures in data analysis include data collection, data reduction, data presentation, and data verification. **Findings:** The results showed that: the ability of preservice teachers in technology (TK) in designing learning process documents was in the very good category, the ability of preservice teachers in how preservice teachers' understanding of technology and content (TCK) influenced each other was in good criteria. Likewise in the TPK aspect, preservice teachers are in good criteria. **Conclusion:** Preservice teachers are already able to integrate technology into pedagogical content knowledge when making plans for implementing mathematics learning in the good category.

Corresponding Author:
First name Last name
Affiliation 1; e-mail@e-mail.com

1. INTRODUCTION

The role of technology in education is very important to improve the quality of learning and expand access to education, especially in this digital era. By using various digital devices and platforms, teachers can deliver material in a more interactive and engaging way. In addition, technology can help provide a more flexible learning experience through e-learning (Ulanday, Centeno, Bayla, & Callanta, 2021). However, the main challenges faced by teachers in integrating technology are lack of technical skills, limited access to devices or adequate internet connections, and resistance to change from some teachers who are not used to technology-based learning methods. In addition, the need to constantly update knowledge and skills in the face of very rapid technological developments is also a challenge in itself (Puspitasari, Utari, Rohim, & Sudadi, 2023).

Specific research problems in the context of education often focus on the gap between theory and practice, especially in developing the professional skills ofpreserviceteachers. Although many studies have explored various pedagogical approaches, there is still a lack of research that identifies the practical challenges that aspiring teachers face in applying these theories in the actual classroom. One of the main gaps is the lack of focus on the readiness of preservice teachers to deal with the diversity of student needs, such as differences in ability levels or diverse socio-economic backgrounds (Gheyssens, Coubergs, Griful-Freixenet, Engels, & Struyven, 2022). In addition, many aspiring teachers face difficulties in adapting more innovative teaching methods due to limited resources, inadequate training, or lack of support from the educational institutions where they study. More research is needed to address these barriers and ensure that preservice teachers are prepared to implement effective learning in the field. In addition, professional teachers are needed to know all the potentials that support learning so that it runs effectively (Chen & Jang, 2018). An active and effective learning process requires the professionalism of teachers to master the material, pedagogy, and technology (Xiang, 2014); (Rafi & Sabrina, 2019). The development of technology in the modern era can no longer be avoided for its influence on the world of education.

The four main competencies needed by teachers in Indonesia, especially related to pedagogical and professional competencies, include: (1) Pedagogic competence, which includes teachers' ability to design, implement, and evaluate effective learning by taking into account the characteristics and needs of students. (2) Professional Competencies, which requires teachers to master the subject matter in depth and continue to update their knowledge in accordance with the latest scientific and technological developments. (3) Social Competence, which includes teachers' ability to communicate and interact with students, parents, and peers, as well as build relationships that support students' social and emotional development. (4) Personal competence, which requires teachers to have integrity, emotional maturity, and a positive attitude that supports the formation of students' character, as well as providing an exemplary example in daily life (Suripah, Suyata, & Retnawati, 2021).

Pedagogic competence is one of the competencies that determines the success of a lesson. Pedagogic competence is the teacher's ability to manage learning, starting from designing learning activities, implementing learning, to evaluating learning (Gess-Newsome et al., 2019). Furthermore, the competence that must be possessed by teachers is professional competence. Professional competence is the ability to master subject matter (Suripah, Suyata, & Retnawati, 2018). Along with the rapid development of technology, teachers are required to be able to improve their professional competence. Teachers, in addition to having the ability to teach in the classroom, are also able to integrate the use of technology in learning. The use of technology in the learning process can help improve the quality of learning, and can increase student motivation and learning outcomes. The basic knowledge requirements that preservice mathematics teachers must have to integrate technology are by having technological knowledge, knowledge of pedagogy, and knowledge of content (Subali & Handoyo, 2021).

While teachers' pedagogical and professional competencies encompass a wide range of basic skills, in the modern educational era, the ability to integrate technology effectively is becoming an increasingly crucial skill. For this reason, from the beginning, Shulman has realized the importance of technology in learning, but according to (Xiang, 2014). Technology was not as sophisticated as it is now. Therefore, this integration is clearly captured through the TPCK (Technological Pedagogical Content Knowledge) framework. TPCK is a knowledge that emphasizes the importance of combining pedagogical knowledge, subject matter, and technology in the learning process of mathematics (Liang & Luo, 2016). In this context, teachers are not only required to master effective teaching methods, but also to be able to utilize technology to support learning that is more interactive and relevant to students' needs (Chuang & Ho, 2015). TPCK requires teachers not only to be familiar with various technological tools, but also to understand how these technologies can be applied appropriately in teaching according to the characteristics of the material and the needs of students. Thus, TPCK is the key to overcoming challenges in preparing teachers who are ready to face dynamic changes in the world of education.

TPCK is the knowledge needed to integrate technology in the learning process (Erduran & Ince, 2018). According to (Mishra & Koehler, 2006), TPCK is a form of knowledge that is interconnected between content, pedagogy, and technology. TPCK is divided into 8 components, namely: (1) Technology Knowledge (TK), knowledge about the use of technology, (2) Pedagogical Knowledge (PK), knowledge about pedagogy or learning strategies, (3) Content Knowledge (CK), knowledge about content or subject matter, (4) Pedagogical Content Knowledge (PCK), knowledge about strategies or how to teach subject matter, (5) Pedagogical Knowledge Technology (TPK), teachers' knowledge about how to teach using technology, (6) Knowledge of Technology Content (TCK), knowledge of delivering material through technology, (7) Pedagogical Knowledge and Technology Content (TPCK), knowledge of how to teach subject matter using technology.

Preservice mathematics teachers are required to be able to integrate technology into the learning process according to the character of students (Sintawati & Indriani, 2019). Integrating TPCK in mathematics learning can make it easier for students to understand mathematical concepts taught by teachers, especially mathematical concepts that are abstract, difficult and require visualization to understand these concepts (Rafi & Sabrina, 2019). The ability of TPCK preservice teachers can be seen from the learning tools they make themselves. The ability of preservice TPCK teachers can be seen from the design of learning implementation because it contains a pedagogic component, namely the method used, the content component, namely the material taught, and technology, namely the media used (Innaha, 2018). Therefore, learning tools must be able to contain TPCK components, because the learning tools prepared by preservice teachers are a reflection of the way they teach.

This research related to TPCK is important because it contributes significantly to overcoming the gap that exists in understanding how preservice mathematics teachers design learning tools that integrate TPCK. Although many studies have highlighted the importance of pedagogical and professional skills in education, there is still a lack of research specifically addressing how preservice math teachers combine pedagogical knowledge, content, and technology in designing effective teaching materials. By understanding this process, this research provides new insights that can help improve the quality of teacher training, especially in preparing them to use technology optimally in mathematics learning. This contribution is not only relevant for the development of TPCK theory, but also provides practical implications for the improvement of the teacher education curriculum, which in turn will improve the quality of mathematics education in Indonesia. The problem in this study is how to analyze the integration of TPCK mathematics teacher candidates in designing learning? Therefore, this study aims to describe how integration into the TPCK of preservice mathematics teachers in designing learning.

2. METHODS

This research is a qualitative descriptive research. The subjects of this study were 39 preservice mathematics teacher students at FKIP Universitas Islam Riau (UIR) who had attended Microteaching courses. The data collection technique was carried out by means of documentation studies from

Microteaching learning tools in the form of syllabi and lesson plans, while the research instrument was in the form of identification sheets. The components to be identified include TK, TCK, and TPK aspects. All components related to the aspects of kindergarten, TCK, and TPK have previously been validated in terms of validity, validity constructs, and expert validation to 3 lecturers for material, media, and language experts. After getting input and suggestions from experts, both materials, media and linguists, the researcher then makes revisions based on the input and suggestions given. After all components are declared valid, the researcher uses instruments that have been declared valid to take field data.

The data analysis techniques of this research are data collection, data reduction, data presentation, conclusion drawing, and data analysis results presentation. In this study, questionnaires will be distributed to all Semester V students at Universitas Islam Riau who are taking micro teaching courses. The TPCK questionnaire consists of components: (1) designing learning process documents, (2) development of reflection, (3) implementing the curriculum in the learning process, (4) integrating technology in the mathematics learning process, (5) as well as the constraints in integrating technology in mathematics learning in schools. Document studies are used to analyze the lesson plans forp reservice teachers that are made. While the qualitative method in this study used a descriptive approach.

Data analysis was carried out in a qualitative descriptive manner, namely describing preservice teachers in integrating TPCK in designing students and mathematics. Data analysis includes data collection, data reduction, data presentation, and data verification. The research procedure consists of (1) Preparation, including: observation, problem identification, determination of data sources, preparation of observation sheet instruments, presentation of teaching materials, learning strategies, and assessment documents, reflections, and lesson plans, questionnaires, interview guidelines. The last stage is the validation of the instruments given to the experts, (2) The implementation stage, the distribution of TPCK questionnaires, the study of learning documents, learning process documents, reflection document studies, (3) Descriptive data processing from observation sheets, documentation, questionnaire sheets, and interviews, the next stage in this study is to analyze observation sheets, documentation, questionnaire sheets, and interviews.

The assessment of each component of technology integration through the lesson plan is carried out by giving a score on a scale of four. The meaning of scoring is: 1: less, 2: enough, 3: good, and 4: very good. To calculate individual kills, it can be done with the following formula.

$$N = \frac{total\ score}{Number\ of\ items\ x4} X100$$

Meanwhile, to analyze the percentage of achievement in each aspect assessed in integrating technology in the lesson plan, it was carried out by calculating the number of scores of preservice teacher students who were the subject of the research, divided by the number of respondents multiplied by the maximum score) multiplied by 100%. In full the calculation is used the following formula:

$$P_j = \frac{\sum_i^n = JS_i}{N\ x\ maximum\ score} X100\%$$

Information:

P_j= percentage of mastery of the aspect to -j

JS_i= the number of scores of preservice teachers in the i aspect

i = number of items for item j

N = number of research subjects

The assessment criteria for the TPCK questionnaire list are presented in Table 1.

Table 1. The assessment criteria for the TPCK questionnaire

Value Range	Criteria
81%-100%	Very good
61%-80%	Good
41%-60%	Enough
21%-40%	Not good
0%-20%	Not good

3. FINDINGS AND DISCUSSION

The aspects that are expected to appear in this study refer to the instruments that have been developed including: 6 items of technological knowledge (TK), 6 items of technological content knowledge (TCK), and 8 items of technological pedagogical knowledge (TPK). From the Microteaching learning device for preservice mathematics education teachers in the form of lesson plans documents. The assessment list is used to obtain an overview of the ability to integrate technology in the TPCK of preservice mathematics education teachers in the lesson plan. From the results of the assessment analysis on preservice teacher Microteaching learning tools, a profile of preservice teacher assessments in integrating technology is obtained. The profile for evaluating the TPCK components in the leson plan is presented in Table 2.

Table 2. Profile of Technology Integration in Pedagogical Content Knowledge (TPCK)

Subject	Rated aspect (%)				Criteria
	TK	TCK	TPK	Average	
1	67	50	63	59.72	Enough
2	67	67	75	69.44	Good
3	83	83	75	80.56	Good
4	100	83	63	81.94	Very good
5	83	83	75	80.56	Good
6	100	83	75	86.11	Very good
7	83	100	63	81.94	Very good
8	100	83	75	86.11	Very good
9	100	83	75	86.11	Very good
10	67	100	75	80.56	Good
11	83	83	63	76.39	Good
12	100	83	100	94.44	Very good
13	50	33	75	52.78	Enough
14	100	100	100	100.00	Very good
15	100	83	75	86.11	Very good
16	83	67	63	70.83	Good
17	100	83	88	90.28	Very good
18	100	100	100	100.00	Very good
19	83	67	75	75.00	Good
20	67	67	75	69.44	Good
21	100	100	75	91.67	Very good
22	100	67	63	76.39	Good
23	67	67	75	69.44	Good
Total Average	86,23	78.99	75,54	80.25	
Criteria	Very good	Good	Good	Good	

Based on Table 2, it is obtained that the average for the TK aspects of preservice teachers is in the very good category, that is, out of 23 people, only one preservice teacher is in the enough criteria, the rest are in good criteria (5 people), and very good (17 people). The TCK aspect of preservice teachers in

learning tools is in good criteria, two preservice teachers are in enough criteria, 6 are in good criteria, and 15 are in very good criteria. The TPK aspect of preservice mathematics teachers in Microteaching learning tools is in good criteria, namely all preservice teachers are in good criteria (19 people) and very good (4 people) preservice teachers.

From Table 2, the average percentage of TK, TCK, and TPK abilities of preservice mathematics education teachers is obtained. TK teacher candidates (86.23%) are classified as very good. Based on a study of learning device documents in the form of syllabus and lesson plans, it was found that preservice teachers had already integrated ICT technology in learning. This can be seen from the microteaching learning plans made by preservice teachers, where out of 20 preservice teachers have been able to use ICT in selecting learning media. There is hardware such as laptops, computers, infocus, and cellphones to support the learning process taking place. While the software (software) there is the use of power point software to help convey the subject matter. Putria, Maula, & Uswatun, (2020) online learning is a learning process that is carried out without face-to-face but at home using the internet and other supporting tools. It is this situation that causes preservice mathematics teachers to use conference software technology, such as Zoom, Google Meet, Google Classroom, and WA Group as communication media. This is in accordance with the opinion Nayar & Akmar, (2020) that teachers use the Zoom, Google Meet, and Google Classroom applications in carrying out online teaching and learning processes as an example of one of the views of the planned class settings in the lesson plan by one of the 06 preservice teacher subjects through a zoom meeting. Based on the findings analyzed in this study, it confirms the results of other research on global trends, that the need for technology in learning is indeed very necessary. In addition, preservice teachers are required to be able to integrate technology in planning and learning processes (Janssen, Knoef, & Lazonder, 2019). The unique challenges in the local context are of its own value. One of them is how preservice teachers try to design a learning plan in an online condition using Zoom meetings as presented by the example of Preservice teacher 06 in Figure 1.

Figure 1. Design ofpreserviceTeachers in Using ICT Using Zoom

In addition,preservice teachers have also been able to guide students to practice searching for information with the Google search engine. This can be seen in one of the preservice teacher subject lesson plans 18 as shown in Figure 2 below.

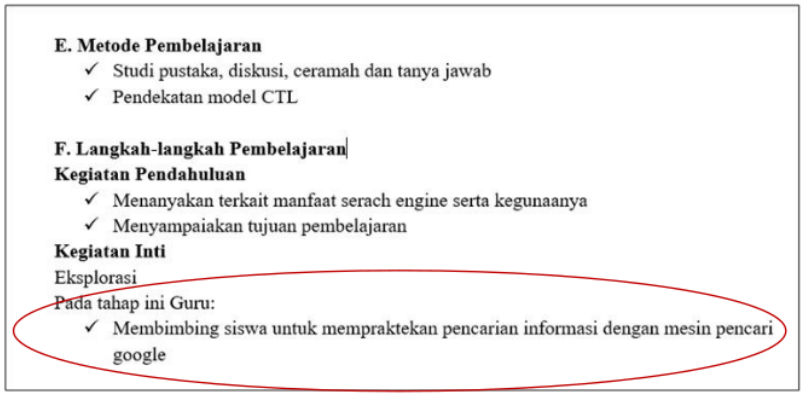

Figure 2. Example of Subject 18 lesson plan Components on Knowledge Technology Aspects The

TCK aspect of preservice teachers (78.99%) is in the good category. Judging from the learning tools developed,preservice teachers can already determine the mathematics material to be taught. As said (Maryanti, Hartati, Kurniawan, & Sukardi, 2022) before using learning media,preservice teachers first determine the material to be provided so that there is compatibility between the media and the material. The ICT media used by most preservice teachers is Power Point. The results of this study are supported by opinio (Sulaeman, 2021); (Stevani & Sucahyo, 2022) that Microsoft Power Point is the most widely used software as a learning medium. The material presented using Power Point can attract students' attention in the learning process. Presentation of material on Power Point can be packaged as needed such as inserting text, images, animations, and videos so that learning material will be more interesting (Misbahudin, Rochman, Nasrudin, & Solihati, 2018). Due to the Covid-19 outbreak, the use of learning media has become more sophisticated (Mansyur, 2020). The process of teaching and learning and giving assignments during online learning certainly requires media as a means for learning. Zoom, Google Classroom, Google Meet and Whattsap are ICT media that are used as media for communicating between teachers and students online. The following is an example of giving assignments to the subject of preservice teachers 21 in giving assignments via WA.

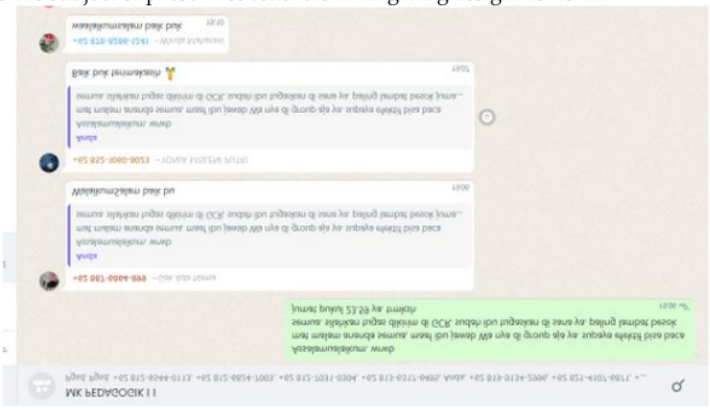

Figure 3. Example of 21preserviceTeacher Subjects on TCK When Giving Assignments

Teachers can discuss with students like meeting face to face via Zoom and Google Meet. As for the provision of materials and assignments, you can go through Google Classroom and WhatsApp (Wijayanto, 2020). However, based on the results of this study there are still preservice teachers who have not written down the activity steps on the media learning tools used for giving student

assignments. Therefore, it is necessary to plan carefully in the selection of learning media so that it can be put to good use.

Furthermore, the TPK aspect of preservice teachers (75.54%) is included in the good criteria. ICT media used by preservice mathematics education teachers in learning tools include Power Point, Zoom, Google Classroom, Google Meet and WhatsApp. The use of ICT media in the learning process can facilitate the process of communication between teachers and students (Cholik, 2017). ICT media used as a medium for communicating with students are Zoom, Google Classroom, Google Meet and WhatsApp. This is due to the spread of the corona virus which has an impact on the learning process activities. In accordance with theCircular Letter Number 4 of 2020 Concerning the Implementation of Education Policies in the Emergency Period of the Spread of Coronavirus Disease (COVID-19), that the spread of the corona virus is increasing, the learning process is carried out from home through online or distance learning. The online learning process can continue to run well through the use of ICT technology as a learning medium. In lesson plan Microteaching preservice teachers of mathematics education, ICT learning media are also adapted to the chosen model, approach and method. Then place the use of ICT technology in learning steps according to the chosen model, approach and learning method. However, there are still learning devices that use non-ICT media such as black boards. This is because the Microteaching learning device is designed by preservice mathematics education teachers when the teaching and learning process is carried out face-to-face. Besides that, also the content of the material being taught tends to be manual explanation procedures. Even the statement items related to preservice teachers on the use of ICT according to the characteristics of students have the lowest criteria. This is supported by previous research studies that, teacher experience in understanding the characteristics of students is very necessary (Rahmi & Samsudi, 2020). Meanwhile, preservice teachers do not have much experience in understanding the characteristics of students.

The obstacles faced by preservice teachers in designing learning include the lack of supporting infrastructure for learning media in practical schools, inadequate internet network support. These findings are supported by research studies that have also been conducted previously by (Susanti & Suripah, 2021; Suripah, Firdaus, & Novilanti, 2022) that one of the obstacles faced by preservice teachers and professional teachers in integrating technology in learning is the availability of internet networks. Apart from that, learning media and facilities that support technology in schools are still not optimal. In addition, the results of the reduction from the interviews obtained sub-themes as presented in the following table.

Table 3. Obstacles in Integrating Technology in Mathematics Learning

No	Sub-theme	Relationship between sub-themes
1	Infrastructure is not supportive	Limited supporting infrastructure
2	Internet/Wifi network constraints that are often not smooth	
3	Don't understand how to design media correctly	
4	In appropriate in the selection of teaching materials that are in accordance with the teaching media	Difficulties in adjusting the material and limitations in understanding existing multimedia
5	The ability to understand and use applications is still limited	

An example of the results of interviews withpreserviceteachers that support this statement is as follows.

"… Actually, there is a lack of supporting facilities and policies." (Preservice Teacher 7). The internet is often not smooth, so there is a lack of enthusiasm..." (Preservice Teacher 3, 4). If I don't really understand some applications and how to design good media, but I will continue to learn, ma'am..." (Preservice Teacher 2). I am still confused in sorting out which material is suitable for a particular learning medium, sometimes it is still confusing." (Preservice Teacher 10). Based on the answers of several preservice teachers, it is indicated that the support of teaching facilities and experience has an

effect on the integration of technology in learning. This is in accordance with the support of previous research that the facilities, infrastructure and experience of preservice teachers in preparing learning have a great influence on the integration of technology (Lawrence & Tar, 2018).

Teacher education programs can address identified barriers, such as infrastructure limitations, poor internet access, and lack of training, with some practical steps that are directed and integrated. Here are the steps that can be taken to overcome these problems: First, Overcome limited infrastructure, namely: Teacher education programs can provide adequate equipment, optimize the use of available infrastructure, and develop multimedia facilities. Second, overcoming the obstacles to poor internet access, namely: by developing a more stable internet network, using resources offline, providing digital learning materials. Third, training and competency development in designing learning, namely: training in designing effective learning media, the use of User-Friendly learning applications, and hands-on practice in designing media. Fourth, overcoming difficulties in adapting materials to teaching media, namely: assistance in selecting and adjusting media, and training on integrating technology in learning. Fifth, Improving the ability to use learning applications, namely: providing basic skills courses in educational technology, developing competencies in technology for learning, and independent learning and access to learning resources such as online tutorials, and learning videos. Sixth, the use of a collaboration-based learning model, namely: increasing collaboration between teachers and preservice teachers, and project-based learning.

The implications of the findings regarding the barriers faced by preservice teachers in designing technology-based learning are critical for education stakeholders, such as curriculum developers and policy makers. Given the many obstacles related to infrastructure, internet access, and limited technological skills, there are several changes that need to be considered in teacher preparation programs, especially in equipping preservice teachers with TPCK (Technological Pedagogical Content Knowledge) skills. Here are some changes that may be needed: First, changes in the curriculum of teacher education programs, namely: the integration of technology in all courses, project-based and surgical approaches, and a focus on the development of technological skills. Second, changes in education policies, namely: improving infrastructure in practicum schools, allocating budgets for educational technology, and teacher professional development policies. Third, increasing cooperation with the world of the educational technology industry, namely: collaboration with technology providers, and training by educational technology experts. Fourth, strengthening the pedagogical approach in technology, namely: the integration of pedagogy and technology in learning, and critical training in media selection. Fifth, Raising awareness of 21st century skills, namely: developing digital skills, and strengthening collaborative and creative learning.

4. CONCLUSION

Technology Knowledge(TK) preservice mathematics teachers are in very good criteria. Technological Content Knowledge (TCK) for preservice mathematics teachers in learning planning is quite good. Meanwhile Technological Pedagogical Knowledge (TPK) for mathematics teacher candidates in learning tools is in good criteria. In one of the statement items related to the use of ICT as a communication medium, all preservice teachers who were the subject of the study had used ICT and all used WA, as an effective communication tool. This research is only at the documentation study stage on the Microteaching learning device for preservice mathematics teachers in the form of a lesson plan. In addition to the obstacles that preservice teachers have in applying technology in TPCK, namely: infrastructure, internet access, and limited technology skills, there are several changes that need to be considered in the teacher preparation program. Therefore, it is hoped that at the next stage, a picture of the ability of preservice teachers to integrate technology in TPCK can be obtained through direct observation of learning.

Recommendation
For the next researcher, they can make direct observations on the implementation of the lesson plan that has been prepared by preservice teachers in real classes. This can provide a more concrete picture of the extent to which the planned TPCK capabilities can be applied in practice. Furthermore, researchers can also create training programs or workshops that can be held by educational institutions to streng then the ability of TPCK preservice mathematics teachers.

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Conflicts of Interest

We have no conflicts of interest to disclose with any parties.

REFERENCES

Chen, Y. H., & Jang, S. J. (2018). Exploring the Relationship Between Self-Regulation and TPACK of Taiwanese Secondary In-Service Teachers. *Journal of Educational Computing Research*, *57*(4), 978–1002. https://doi.org/10.1177/0735633118769442

Cholik, C. A. (2017). Pemanfaatan Teknologi Informasi Dan Komunikasi Untuk Meningkatkan Pendidikan Di Indonesia. *Syntax Literate; Jurnal Ilmiah Indonesia*, *2*(6), 21–30.

Chuang, H., & Ho, C. (2015). an Investigation of Early Childhood Teachers' Technological Pedagogical Content Knowledge(Tpack) in Taiwan Fulltext Pdf. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, *12*(2), 99–117.

Erduran, A., & Ince, B. (2018). Identifying Mathematics Teachers' Difficulties in Technology Integration in Terms of Technological Pedagogical Content Knowledge (TPCK). *International Journal of Research in Education and Science*, *4*(2), 555–576.

Gess-Newsome, J., Taylor, J. A., Carlson, J., Gardner, A. L., Wilson, C. D., & Stuhlsatz, M. A. M. (2019). Teacher pedagogical content knowledge, practice, and student achievement. *International Journal of Science Education*, *41*(7), 944–963.

Gheyssens, E., Coubergs, C., Griful-Freixenet, J., Engels, N., & Struyven, K. (2022). Differentiated instruction: the diversity of teachers' philosophy and praxis to adapt teaching to students' interests, readiness and learning profiles. *International Journal of Inclusive Education*, *26*(14), 1383–1400.

Innaha, R. (2018). *Kemampuan Technological Pedagogical and Content Knowledge (TPACK) Guru IPA di Sekolah Inklusi SMP Negeri 23 Surakarta Tahun Ajaran 2017-2018*. Universitas Muhammadiyah Surakarta.

Janssen, N., Knoef, M., & Lazonder, A. W. (2019). Technological and pedagogical support for pre-service teachers' lesson planning. *Technology, Pedagogy and Education*, *28*(1), 115–128.

Lawrence, J. E., & Tar, U. A. (2018). Factors that influence teachers' adoption and integration of ICT in teaching/learning process. *Educational Media International*, *55*(1), 79–105.

Liang, X., & Luo, J. (2016). Micro-lesson Design: A Typical Learning Activity to Develop Pre-service

Mathematics Teachers' TPACK Framework. *Proceedings - 2015 International Conference of Educational Innovation Through Technology, EITT 2015*, *2*, 259–263. https://doi.org/10.1109/EITT.2015.61

Mansyur, A. R. (2020). Dampak COVID-19 Terhadap Dinamika Pembelajaran di Indonesia. *Education and Learning Journal*, *1*(2), 113–123. https://doi.org/10.33096/eljour.v1i2.55

Maryanti, S., Hartati, S., Kurniawan, D. T., & Sukardi, R. R. (2022). Development of educational video teaching materials on Covid-19 issues by prospective teachers using the STREAM approach in science education. *European Online Journal of Natural and Social Sciences*, *11*(3), pp-679.

Misbahudin, D., Rochman, C., Nasrudin, D., & Solihati, I. (2018). Penggunaan Power Point Sebagai Media Pembelajaran: Efektifkah? *WaPFi (Wahana Pendidikan Fisika)*, *3*(1), 43. https://doi.org/10.17509/wapfi.v3i1.10939

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Integrating Technology in Teacher Knowledge. *Teachers College Record*, *108*(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Nayar, A., & Akmar, S. N. (2020). Technology Pedagogical Content Knowledge (TPCK) and Techno Pedagogy Integration Skill (TPIS) among pre-service science teachers-Case study of a University based ICT based teacher education curriculum. *Journal of Education and Practice*, *11*(6).

Puspitasari, A., Utari, D., Rohim, M., & Sudadi, S. (2023). Challenge and Transformation: The Innovative Role of Supervisors in 21st Century Educational Supervision. *Journal on Education*, *6*(1), 9477–9488.

Putria, H., Maula, L. H., & Uswatun, D. A. (2020). Analisis Proses Pembelajaran Dalam Jaringan (Daring) Masa Pandemi Covid-19 pada Guru Sekolah Dasar. *Jurnal Basicedu*, *4*(4), 861–872. https://doi.org/10.31004/basicedu.v4i4.460

Rafi, I., & Sabrina, N. (2019). Pengintegrasian TPACK dalam Pembelajaran Geometri SMA untuk Mengembangkan Profesionalitas Guru Matematika. *SJME (Supremum Journal of Mathematics Education)*, *3*(1), 47–56. https://doi.org/10.31235/osf.io/v2ygb

Rahmi, M. N., & Samsudi, M. A. (2020). Pemanfaatan media pembelajaran berbasis teknologi sesuai dengan karakteristik gaya belajar. *Edumaspul: Jurnal Pendidikan*, *4*(2), 355–363.

Sintawati, M., & Indriani, F. (2019). Pentingnya Literasi ICT Guru di Era Revolusi Industri 4.0. *Seminar Nasional Pagelaran Pendidikan Dasar Nasional (PPDN)*, *1*(2), 417–422.

Stevani, F., & Sucahyo, I. (2022). Development of Android-Based Learning Media Using Microsoft Powerpoint Integrated Ispring Suite on Class X's Work and Energy Materials. *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, *10*(3), 688–699.

Subali, B., & Handoyo, L. D. (2021). The Mastery of Technological, Pedagogical, and Content Knowledge among Indonesian Biology Teachers. *European Journal of Educational Research*, *10*(3), 1063–1073.

Suhery, S., Putra, T. J., & Jasmalinda, J. (2020). Sosialisasi Penggunaan Aplikasi Zoom Meeting Dan Google Classroom Pada Guru Di Sdn 17 Mata Air Padang Selatan. *Jurnal Inovasi Penelitian*, *1*(3),

129–132. https://doi.org/10.47492/jip.v1i3.90

Sulaeman, A. (2021). Microsoft PowerPoint Media Use and Student Learning Motivation in Islamic Religious Education. *AL-ISHLAH: Jurnal Pendidikan*, *13*(3), 2931–2938.

Suripah, S., Firdaus, F., & Novilanti, F. R. E. (2022). Mathematics Education Student Perceptions of Online Learning for IT-Based Data Analysis Courses That Are Itegrated With Character Values. *Prima: Jurnal Pendidikan Matematika*, *6*(2), 78–89.

Suripah, S., Suyata, S., & Retnawati, H. (2021). Pedagogical Content Knowledge (PCK) Mathematics Pre-service Teachers in Developing Content Representations (CoRes). *International Journal on Emerging Mathematics Education*, *5*(1), 41–50. https://doi.org/10.12928/ijeme.v5i1.19954

Suripah, Suyata, & Retnawati, H. (2018). Exploration of Pedagogical Content Knowledge Preservice Teacher For Analyzing Mathematics Understanding in Elementary School. *AIP Conference Proceedings*, *2014*(1), 20018. AIP Publishing LLC. https://doi.org/10.1063/1.5054422

Susanti, W. D., & Suripah, S. (2021). The Effectiveness of Website as a Mathematics Learning Media During the Online Learning Period. *Edumatica: Jurnal Pendidikan Matematika*, *11*(01), 73–83. https://doi.org/10.22437/edumatica.v11i01.12225

Ulanday, M. L., Centeno, Z. J., Bayla, M. C., & Callanta, J. (2021). Flexible learning adaptabilities in the new normal: E-learning resources, digital meeting platforms, online learning systems and learning engagement. *Asian Journal of Distance Education*, *16*(2).

Wijayanto, A. (2020). *BUNGA RAMPAI : Strategi Pembelajaran Pendidikan Jasmani Olahraga dan Kesehatan Selama Pandemi Covid-19*. Tulungagung: Akademi Pustaka.

Xiang, K. (2014). Evaluating Chinese pre-service mathematics teachers' knowledge of integrating technology in teaching. *Journal of Mathematics Education*, *7*(1), 48–58.

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