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Analysis of preservice teachers' ability to develop TPACK integrated learning tools

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Abstract
This study aims to analyze the ability of preservice mathematics teachers at University of Mataram to develop learning tools such as powerpoint presentations and student worksheets integrated with TPACK to foster 21st-century skills. The study was conducted in Micro Teaching courses with 14 students as research subjects. Data collection techniques included assessment sheets and interviews. The results shows that the learning tools created by preservice teachers are quite capable of supporting 21st-century skills. The ability of preservice mathematics teachers to develop TPACK-integrated powerpoint presentations overall has an average score of 2.43, which is categorized as moderate. The ability of preservice mathematics teachers to develop worksheets integrated with TPACK overall has an average score of 3.59, which is categorized as high. Based on interview results, it was found that applying the TPACK approach in learning tools is very important, as it can create engaging, interactive learning and facilitate students' understanding of the material.

Keywords: powerpoint; student worksheet; TPACK; micro teaching

Abstrak
Penelitian ini bertujuan untuk menganalisis kemampuan calon guru Pendidikan Matematika Universitas Mataram dalam mengembangkan perangkat pembelajaran berupa powerpoint dan Lembar Kerja Peserta Didik (LKPD) yang terintegrasi dengan TPACK. Penelitian ini dilakukan pada mata kuliah Micro Teaching di semester 6 dengan jumlah mahasiswa calon guru Pendidikan Matematika sebanyak 14 orang sebagai subjek penelitian. Teknik pengumpulan data meliputi lembar penilaian dan wawancara. Hasil penelitian menunjukkan bahwa perangkat pembelajaran yang diciptakan oleh mahasiswa cukup mampu menunjang keterampilan abad 21. Kemampuan mahasiswa dalam mengembangkan presentasi powerpoint terintegrasi TPACK secara keseluruhan memiliki skor rata-rata sebesar 2,43 yang termasuk dalam kategori sedang. Kemampuan mahasiswa dalam mengembangkan LKPD terintegrasi TPACK secara keseluruhan mempunyai skor rata-rata 3,59 yang termasuk dalam kategori tinggi. Berdasarkan hasil wawancara diketahui bahwa penerapan pendekatan TPACK pada perangkat pembelajaran sangatlah penting, karena dapat menciptakan pembelajaran yang menarik, interaktif, dan memudahkan siswa dalam memahami materi.

Kata Kunci: powerpoint; LKPD; TPACK; Micro Teaching

1. INTRODUCTION

The world is currently undergoing profound transformations due to digitalization and globalization, often referred to as the era of Society 5.0. This era signifies a time when societies can address numerous social challenges by harnessing advancements in information and communication technologies introduced during the Fourth Industrial

Revolution. Key technologies in this context encompass the Internet of Things (IoT), Artificial Intelligence (AI), Big Data, and robotics, which have the potential to significantly impact human life, particularly in domains such as education (Imawan, Pettalongi, & Nurdin, 2023).

Investing in education is paramount for developing 21st-century skills. These skills are crucial for preparing future generations to thrive in today's competitive global landscape (Angga, Abidin, & Iskandar, 2022). Activities in 21st-century learning must aim to cultivate high-quality students capable of competing globally (Hadayani, Okta, Delinah, & Nurlina, 2020). These skills are categorized into three groups: learning and innovation skills, information, media, and technology skills, and life and career skills (Trilling & Fadel, 2009). Learning and innovation skills encompass critical thinking, problem-solving, communication, collaboration, creativity, and innovation. Information, media, and technology skills involve utilizing, evaluating, and enhancing the vast array of contemporary information, media, and technology. Life and career skills include adaptability, initiative, social skills, productivity, leadership, and responsibility (Winanto, Prasetyo, & Wangid, 2023).

In the realm of 21st-century skills, students are required to master learning and innovation skills which encompass critical thinking, problem-solving, communication, collaboration, creativity, and innovation (Stauffer, 2021). Critical thinking and problem-solving involve students' ability to critically analyze information to uncover truths. Creativity and innovation entail the capacity to approach issues from diverse perspectives and generate novel solutions within the learning process (Sari & Atmojo, 2021). Communication refers to students' proficiency in interpersonal interaction with peers and teachers, while collaboration is essential for establishing cooperative relationships with others, involving interaction, teamwork, and responsible behavior (Soleh & Arifin, 2021).

Furthermore, 21st-century skills necessitate the integration of technology in learning, compelling students, as future educators, to adapt to digital advancements, particularly in educational settings (Wistiawati, Putro, & Irianto, 2020). Therefore, there exists a critical role for educators, particularly in Mathematics Education, to equip and mentor preservice teachers in developing technological skills, such as those required in courses like Micro Teaching. Micro Teaching serves as a training method for preservice teachers, focusing on practicing various teaching skills in specific educational contexts (Arifmiboy, 2019: 87). The primary goal of Micro Teaching is to equip preservice teachers with essential teaching skills and to cultivate their understanding of when and how to effectively apply these skills in educational settings, including the integration of technology (Helmiati, 2013: 18-19).

Prior to incorporating technology into their teaching practices, preservice teachers must first master a learning framework known as Technological Pedagogical and Content

Knowledge (TPACK). Mishra & Koehler (2006) define TPACK as a type of knowledge that intertwines content knowledge, pedagogical knowledge, and technological knowledge. They argue that effective teaching requires a nuanced comprehension of these interconnected components: content, pedagogy, and technology.

In the context of Micro Teaching course at University of Mataram, preservice teachers are tasked with developing learning tools. These tools encompass various educational resources aimed at supporting teaching implementation and facilitating effective instructional activities (Abror, 2021). Specifically, the study focuses on integrating TPACK into PowerPoint presentations and student worksheets to innovate learning tools. This integration aims to enhance engagement, interactivity, and collaborative learning, aligning with the demands of 21st-century skills. So, this study's focus on examining "Analysis of Pre-Service Teachers' Ability to Develop TPACK-Integrated Learning Tools" addressing the aforementioned aspects comprehensively.

2. METHOD

This study is a descriptive qualitative that aims to systematically and accurately describe phenomena, facts, or events and explore relationships between variables (Wagiran, 2019). This approach prioritizes detailed, comprehensive, and thorough narrative descriptions to depict the actual situation and facilitate data presentation (Farida, 2014).

Table 1. TPACK Ability Level Categories

Category	Average value	Percentage
High	3,00-4,00	>79%
Medium	2,00-2,99	60%-79%
Low	1,00-1,99	<60%

Subjects for this study were selected through purposive sampling, resulting in two classes with a total of 14 students as research participants at mathematics education study program who were taking micro teaching courses. Data collection methods included assessment sheets designed to evaluate preservice teachers' proficiency in developing TPACK integrated PowerPoint presentations and student worksheets, supplemented by interviews. The assessment sheet in this study employs a Likert scale featuring statements offering four response options: 4 (Very Good), 3 (Good), 2 (Poor), and 1 (Very Poor). Its objective is to categorize students based on TPACK criteria into high, medium, and low proficiency levels, as illustrated in Table 1.

3. RESULTS AND DISCUSSION

3.1 Results of Analysis of TPACK-Integrated Learning Tools

The data obtained from the evaluation of TPACK integrated learning tools, such as powerpoint and student worksheet, created by preservice mathematics.

PowerPoint

PowerPoint is a Microsoft Office application program useful for creating presentations in the form of slides. This application is usually used for presentation purposes, teaching, and creating simple animations (Aryadillah & Fitriansyah, 2017). The analysis of powerpoint presentations integrated with TPACK is categorized into several aspects: Technological Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge (CK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical and Content Knowledge (TPACK).

1. *Technological Knowledge* (TK)

Technological knowledge refers to knowledge about various types of digital technologies such as the internet, computers, software applications, or knowledge to integrate technology into everyday life (Hanik et al., 2022). Data analysis of preservice mathematics teachers' powerpoint presentations integrated with TPACK assessment results can be seen in in Table 2.

Table 2. Preservice Mathematics Teachers ' PowerPoint Scores for TK

Statement Items	Mean	Percentage	Criteria
Powerpoint uses attractive templates, slide animations, and other Powerpoint features so that students do not get bored during learning activities.	3,21	80	High
PowerPoint is arranged according to the flow of learning activities.	2,93	73	Medium
Preservice mathematics teachers can display powerpoint properly and correctly without any obstacles. If there are technical problems when displaying powerpoint, students can solve them.	3.,14	78	Medium
Preservice mathematics teachers can determine and adjust the use of teaching aids, media, or software appropriately so that they can be used simultaneously with powerpoint teaching media.	3,07	77	Medium
Average	3,09	77	Medium

According to Table 2, the average score of preservice mathematics teachers meets the criteria for medium proficiency. This suggests that the technological competencies of these teachers are reasonably strong. Nevertheless, there is an expectation for these skills to be enhanced and advanced in the future.

2. *Pedagogical Knowledge* (PK)

Pedagogical Knowledge (PK) refers to knowledge about planning and managing learning, such as the use of appropriate strategies, methods, and learning models, so that learning objectives can be achieved effectively (Akhwani & Rahayu, 2021). According to the results of the data analysis, the assessment of TPACK-integrated powerpoint presentations by preservice mathematics teachers for PK is presented in Table 3.

Table 3. Preservice Mathematics Teachers' Powerpoint Scores for PK

Statement Items	Mean	Percentage	Criteria
PowerPoint designed by Competency Achievement Indicators (IPK) and learning objectives.	3,07	77	Medium
PowerPoint that uses a variety of learning strategies.	2,57	64	Medium
PowerPoint that includes an introduction or initial stimulus relevant to the material to be studied.	3,07	78	Medium
Interactive PowerPoint that facilitates interaction between teacher and students, making it easier for students to understand the material presented.	2,71	68	Medium
Average	2,85	72	Medium

Based on the average PK scores, preservice mathematics teachers fall within the medium category, with an average score of 2.85. This shows that the pedagogical knowledge of pre-service mathematics education teachers is quite good. However, it is hoped that this knowledge will be further improved and developed in the future.

3. *Content Knowledge (CK)*

Content Knowledge (CK) refers to the broad and deep understanding of the subject matter to be taught (Haniefa & Samsudin, 2023). Based on data analysis results, the assessment of TPACK-integrated PowerPoint presentations by preservice mathematics teachers for CK is presented in Table 4.

Table 4 Preservice Mathematics Teachers' PowerPoint Scores for CK

Statement Items	Mean	Percentage	Criteria
The powerpoint that is prepared contains questions that are displayed as material for evaluating students' understanding of the teaching material that has been presented.	2,57	64	Medium
Preservice mathematics teachers can provide feedback to students related to the evaluation questions displayed on the PowerPoint teaching media.	2,57	64	Medium
Preservice mathematics teachers use various assessments when presenting teaching materials using powerpoint media.	2,78	75	Medium
Average	2,64	68	Medium

From Table 4, it can be seen that the average score of the preservice mathematics teachers is in the medium category. This indicates that the content knowledge of the preservice mathematics teachers is quite good, but it is hoped that they will be further improved and developed in the future.

4. *Pedagogical Content Knowledge* (PCK)

Pedagogical Content Knowledge (PCK) is the knowledge teachers have in teaching content or material (Haniefa & Samsudin, 2023). When delivering material to students, teachers not only present the material but also use appropriate strategies. The PCK-integrated powerpoint assessment results of preservice mathematics teachers are presented in Table 5.

Table 5. Preservice Mathematics Teachers' PowerPoint Scores for PCK

Statement Items	Mean	Percentage	Criteria
The powerpoints include images/graphics, videos, and audio to clarify the material.	3,21	80	High
The powerpoints include questions used as assignments to test students' understanding of the material presented.	2,85	71	Medium
The powerpoints guide students to think critically about the material displayed.	3,00	75	Medium
The powerpoints include images/graphics, videos, and audio to clarify the material.	2,43	61	Medium
Average	2,87	72	Medium

From Table 5, it can be seen that the average score of preservice mathematics teachers is in the medium category, with an average score of 2.87. This indicates that the pedagogical content knowledge of the preservice mathematics teachers is quite good, but it is hoped that they will be further improved and developed in the future.

5. *Technological Content Knowledge* (TCK)

Technological Content Knowledge (TCK) is the knowledge of the content material and its adaptation with appropriate technology. Based on data analysis, the TCK-integrated powerpoint assessment results of preservice mathematics teachers are presented in Table 6.

Table 6. Preservice Mathematics Teachers' PowerPoint Scores for TCK

Statement Items	Mean	Percentage	Criteria
Preservice mathematics teachers can select teaching aids or supplementary media that can be used together with powerpoint to help students understand the concepts and theories presented.	3,14	78	Medium
Preservice mathematics teachers can design powerpoints by developing activities and assignments for students involving technology.	2,71	69	Medium
Average	2,92	73,5	Medium

Based on Table 6, the average TCK score of the preservice mathematics teachers is in the medium category with an average score of 2.92. This indicates that preservice mathematics teachers are using technology in learning activities, making it easier for students to understand basic mathematical concepts. However, it is hoped that this will be further improved and developed in the future.

6. *Technological Pedagogical Knowledge* (TPK)

Technological Pedagogical Knowledge (TPK) is the knowledge of applying technology to facilitate pedagogical approaches. Based on data analysis, the results of the TPK-integrated PowerPoint assessment of preservice mathematics teachers are presented in Table 7.

Table 7. Preservice Mathematics Teachers PowerPoint Scores for TPK

Statement Items	Mean	Percentage	Criteria
Preservice mathematics teachers can create PowerPoints that make students more active during learning activities, such as by displaying triggering questions and so on.	2,28	57	Low
The PowerPoints already utilize game-based learning applications such as Quizizz, Kahoot, Wordwall, and others.	3,07	77	Medium
Average	2,67	67	Medium

From Table 7, it can be seen that the average score of the preservice mathematics teachers is in the medium category with an average score of 2.67. This indicates that the ability of preservice mathematics teachers to combine technological and pedagogical knowledge is quite good, but it is hoped that this will be further improved and developed in the future.

7. *Technological Pedagogical and Content Knowledge* (TPACK)

Technological Pedagogical and Content Knowledge (TPACK) is a combination of knowledge and skills regarding lesson content and teaching methods, combined with technological advancements (Musdar et al., 2023). Based on data analysis, the results of the TPACK-integrated powerpoint assessment are presented in Table 8.

Table 8. Preservice Mathematics Teachers PowerPoint Scores for TPACK

Statement Items	Mean	Percentage	Criteria
The PowerPoints are designed according to the learning methods used so that learning objectives can be achieved.	2,36	59	Low
Preservice mathematics teachers can assess students' work with varied research after delivering teaching material with the help of PowerPoint media.	2,78	70	Medium
Preservice mathematics teachers can create PowerPoint teaching media that can be adapted to the use of other teaching media or teaching aids so that the learning process runs well and learning objectives can be achieved.	3,14	78	Medium
Average	2,76	69	Medium

Based on the average TPACK scores, the preservice mathematics teachers are in the medium category with an average score of 2.76. This indicates that the knowledge of preservice mathematics teachers regarding TPACK is still limited and needs to be

improved. An overview of the abilities of preservice mathematics teachers in creating TPACK-integrated PowerPoints is presented in Figure 1.

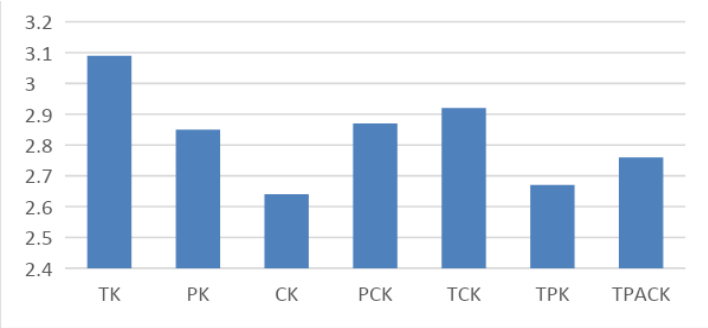

Figure 1. Average Scores of Students' Ability to Create TPACK-Integrated PowerPoints

In creating TPACK-integrated powerpoints, in addition to considering the use of technology, preservice mathematics teachers also need to ensure that the TPACK-integrated powerpoints they create can support 21st-century skills. Here is an overview of 21st-century skills that can be seen in the prepared PowerPoints:

1. Critical Thinking: In the powerpoints created by preservice mathematics teachers, the majority of them can create problems that train students to solve issues, especially in topics like Quadratic Equations and Algebra.
2. Creativity: Preservice mathematics teachers can develop powerpoints by adapting the use of auxiliary media to foster students' creativity and using applications like Quizizz to evaluate students' understanding.
3. Communication: Preservice mathematics teachers are quite good at guiding students to answer example questions displayed on the powerpoints.
4. Collaboration: In the powerpoints created by preservice mathematics teachers, some have been able to design interactive powerpoints, optimizing the interaction between teachers and students.

3.2 Student Worksheets Integrated with TPACK

Student worksheets is a set of sheets containing tasks that must be completed by students (Suweta, 2022). Student worksheets integrated with TPACK can be assessed from four aspects: content feasibility, language, presentation, and graphic design. Based on the analysis of these four aspects, the evaluation results of student worksheets integrated with TPACK created by preservice teachers are presented in Table 9 as follows.

Table 9. Analysis Student worksheets integrated with TPACK Aspects

Aspect	Mean	Percentage	Criteria
Content Suitability	3,41	85	High
Linguistic	3,88	97	High
Presentation	3,57	89	High
Graphics	3,50	88	High
Average	3,59	89,75	High

Based on Table 9, the ability of students to design student worksheets integrated with TPACK is in the high category, with an average score of 3.59. This is shown by the average scores in each aspect of student worksheets integrated with TPACK being in the high category: content feasibility at 3.41, language at 3.88, presentation at 3.57, and graphic design at 3.50. This indicates that the majority of preservice teachers have skills in designing student worksheet by considering these four aspects. Next, all the scores for each aspect of student workseet will be explained in more detail in the following discussion.

1. Content Feasibility

The content feasibility of student worksheets integrated with TPACK can be seen from the students' skills in presenting the content of the student worksheet combined with technology. Based on data analysis, the results of student worksheets integrated with TPACK content feasibility assessment are presented in Table 10 as follows.

Table 10. Analysis of the Content Feasibility Aspect of Student worksheets integrated with TPACK

Statement Items	Mean	Percentage	Criteria
Preservice teachers can present material in student worksheet according to Learning Outcomes, Learning Objectives, and Learning Objective Flows.	3,75	95	High
Preservice teachers can present accurate material in student worksheet from the latest sources, such as books, journals, and various other learning resources.	2,93	73	Medium
Preservice teachers can present material in student worksheet in a sequential and structured manner that can help students find a concept.	3,93	98	High
Preservice teachers can create contextual problems in student worksheet to find a concept according to the learning material.	3,43	86	High
Preservice teachers can compile student worksheet with various types of activities to develop students' understanding.	3,71	93	High
Facilitate students in drawing conclusions related to the material presented in student worksheet.	2,64	66	Medium
Preservice teachers can choose appropriate technology in student worksheet (tools/media/software) according to the material presented.	2,93	73	Medium
The technology used in student worksheet is easy to operate.	3,57	89	High
The technology used in student worksheet is attractive to students.	3,57	89	High
The technology used in student worksheet can encourage active student involvement.	3,57	89	High
Average	3,41	85	High

From Table 10, it can be seen that the average score for the content feasibility aspect of student worksheets integrated with TPACK made by preservice mathematics

teachers is in the high category, with an average score of 3.41. This indicates that the skills of preservice mathematics teachers in presenting the content of student worksheet integrated with technology are already good, but it is expected to be maintained and further developed in the future.

2. Linguistic

The language aspect is one of the important aspects of student worksheet. The use of appropriate language can ensure that the instructions and material presented in student worksheet are easily and clearly understood by students. Based on the analysis of the data, the results of student worksheets integrated with TPACK language aspect assessment are presented in Table 11 as follows.

Table 11. Analysis of the Language Aspect of Student worksheets integrated with TPACK

Statement Items	Mean	Percentage	Criteria
Preservice teachers can compose student worksheet with spelling that complies with Indonesian language rules.	3,71	93	High
Preservice teachers can compose student worksheet using standard terms.	3,93	98	High
The sentences used in student worksheet do not contain ambiguous meanings.	4,00	100	High
Preservice teachers can compose student worksheet using language that is easy to understand.	3,86	96	High
Average	3,88	97	High

From Table 11, it can be seen that the average score for the language aspect of student worksheets integrated with TPACK made by preservice mathematics teachers is in the high category, with an average score of 3.88. This indicates that the ability of preservice teachers to use appropriate and easily understood language in student worksheet is already good.

3. Presentation

The presentation aspect of student worksheets integrated with TPACK can be seen from the attractiveness of the student worksheet made by preservice mathematics teachers, the presentation of student worksheet elements, and the clarity of the instructions provided. Based on the analysis of the data, the results of student worksheets integrated with TPACK presentation aspect assessment are presented in Table 12 as follows.

Table 12. Analysis of the Presentation Aspect of Student Worksheets Integrated with TPACK

Statement Items	Mean	Percentage	Criteria
Preservice teachers can compile attractive LKPD.	3,29	82	High
Preservice teachers can compose clear instructions for using LKPD.	3,71	93	High
Preservice teachers can compile LKPD by presenting the time allocation for working on LKPD.	3,79	95	High
The instructions provided in LKPD are clear.	3,50	88	High
Average	3,58	89	High

From Table 12, it can be seen that the average score for the presentation aspect of student worksheets integrated with TPACK made by preservice mathematics teachers is in the high category, with an average score of 3.58. This indicates that the presentation skills of preservice mathematics teachers in presenting student worksheets are already good. However, in the future, it is hoped that they will be more creative in designing attractive student worksheets that can increase students' interest in learning.

4. Graphics

The graphics aspect of student worksheets integrated with TPACK can be seen from the cover design, color gradient suitability, font usage, use of illustrative images, text and image layout harmony, and colored print quality. Based on the data analysis, the results of the graphics aspect assessment of student worksheets integrated with TPACK are presented in Table 13 as follows.

Table 13. Analysis of the Graphics Aspect of Student Worksheets Integrated with TPACK

Statement Items	Mean	Percentage	Criteria
Preservice teachers can compile student worksheets with an attractive cover design that matches the content.	2,86	71	Medium
Appropriateness of the color gradient used in student worksheets.	3,71	93	High
Font usage (type and size) facilitates reader understanding of the student worksheets content.	3,29	82	High
Harmony in the layout of text and images in student worksheets.	3,64	91	High
Preservice teachers can choose attractive images in student worksheets to draw students' interest in learning activities.	3,57	89	High
Student worksheets print quality is good and colored.	3,93	98	High
Average	3,50	88	High

From Table 13, it can be seen that the average score for the graphics aspect of student worksheets integrated with TPACK made by preservice mathematics teachers is in the high category, with an average score of 3.50. This indicates that the skills of

preservice mathematics teachers in compiling student worksheets with attention to the graphics aspect are quite good. However, attention should also be paid to various graphic elements, such as color, font size and type, and selected illustrations.The depiction of the ability of preservice mathematics teachers to compile student worksheets integrated with TPACK is presented in Figure 2.

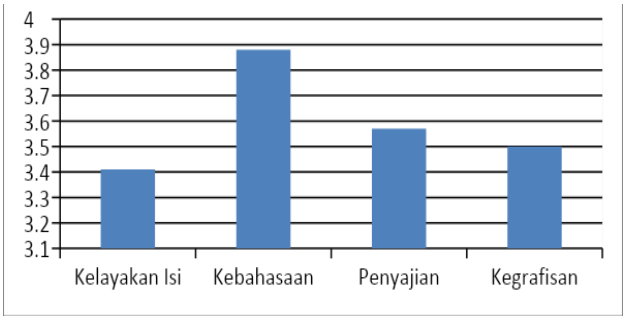

Figure 2. Average Scores of Preservice Teachers in Compiling TPACK-Integrated PowerPoint

In compiling student worksheets integrated with TPACK, besides considering the use of technology, preservice teachers also need to ensure that the student worksheets integrated with TPACK supports 21st-century skills for students. The following describes the 21st-century skills included in the student worksheets integrated with TPACK compiled by preservice teachers:

1. Critical thinking, in TPACK-integrated LKPD compiled by preservice mathematics teachers, the average preservice teacher can create contextual problems with various activities included in student worksheet that help students find concepts. In addition, students are asked to identify a collection of information related to the material presented through learning videos aimed at encouraging students' ability to identify and analyze a problem. Examples include flat-sided geometric shapes, mutually exclusive events and independent events, and algebra.
2. Creativity, preservice mathematics teachers are quite capable of innovating by using technology in student worksheet. The technology used includes teaching aids, Quizizz, hyperlinks, learning videos, and barcodes. The use of this technology aims to train students' technological skills, and create more engaging and less monotonous learning activities. Additionally, creativity in student worksheets can be seen in the variety of technologies used, the variety of activities included, the variety of learning resources, and the ability to apply the 5M learning process.
3. Communication, preservice teachers are quite capable of compiling student worksheets with attention to communication skills. This can be seen from the instructions for using student worksheets and the content of student worksheets. Examples include clear instructions in student worksheets, facilitating students in drawing conclusions related to the material taught and facilitating students in presenting the results of student worksheets tasks. Additionally, communication aspects in student worksheets can include the use of media and technology to deliver the taught material.

4. Collaboration, the collaboration aspect can be seen from the group formation in working on student worksheets. This is expected to show effective teamwork among students and demonstrate the ability to help each other in solving every problem presented in student worksheets. Moreover, the collaboration aspect can be observed when teachers and students conclude the results related to the taught material.

3.3 Analysis Results of Learning Device Feasibility

Based on the analysis of the TPACK-integrated PowerPoint, the results of the feasibility assessment of the TPACK-integrated PowerPoint created by the preservice mathematics teachers are presented in Table 14.

Table 14. Analysis of the Feasibility Aspect of TPACK-Integrated PowerPoint

Aspect	Mean	Percentage	Criteria
Validity	3,35	83,7	High
Significant	2,89	72	Medium
Function	3,00	75	Medium
Average	2,95	73,50	Medium

Based on Table 14, it is found that the feasibility of the TPACK-integrated PowerPoint prepared by preservice mathematics teachers is in the medium category, with an average score of 2.95. This is shown by the average score in each feasibility aspect of the TPACK-integrated PowerPoint being in the high and medium categories. The validity aspect is 3.35, the significance aspect is 2.89, and the usability aspect is 3.00. This indicates that the TPACK-integrated PowerPoint created by preservice mathematics teachers is suitable for use in learning activities, especially mathematics learning. The depiction of the feasibility of TPACK-Integrated PowerPoint prepared by preservice mathematics teachers is presented in Figure 3.

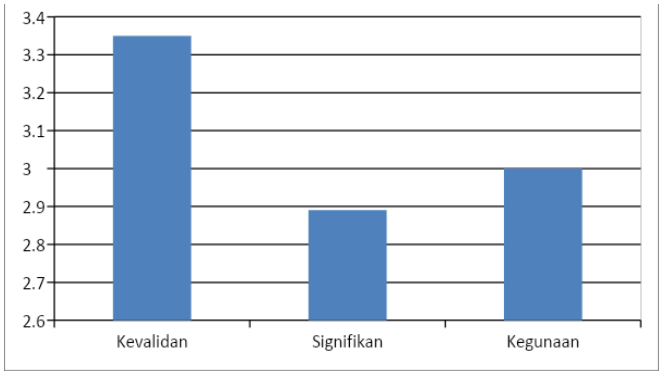

Figure 3. Average Feasibility Scores of TPACK-Integrated PowerPoint

Analysis of Student Worksheets Integrated with TPACK Feasibility

The feasibility of student worksheets integrated with TPACK can be seen from three aspects: validity, variety, and usability. Based on the analysis of these three aspects,

the results of the feasibility assessment of student worksheets integrated with TPACK created by preservice teachers are presented in Table 15.

Table 15. Analysis of the Feasibility of Student Worksheets Integrated with TPACK

Aspect	Mean	Percentage	Criteria
Validity	3,70	92	High
Diversity	3,32	83	High
Function	3,41	85	High
Average	3,48	86,70	High

Based on Table 15, it is found that the feasibility of the student worksheets integrated with TPACK prepared by preservice mathematics teachers is in the high category, with an average score of 3.48. This is shown by the average score in each feasibility aspect of the student worksheets integrated with TPACK being in the high category. The validity aspect is 3.70, the variety aspect is 3.32, and the usability aspect is 3.41. This indicates that the student worksheets integrated with TPACK created by preservice mathematics teachers is suitable for use in learning activities, especially mathematics learning.

The depiction of the feasibility of student worksheets integrated with TPACK prepared by preservice mathematics teachers is presented in Figure 4.

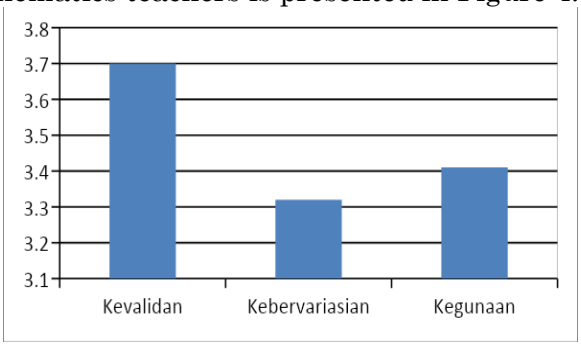

Figure 4. Average Feasibility Scores Of Student worksheets integrated with TPACK

Interview Results on TPACK-Integrated Learning Devices

The interviews were conducted with 4 students, 2 representatives from class 6B3 and 2 representatives from class 6E2. Based on the interviews with the four preservice teachers, it can be concluded that applying the TPACK approach in learning is very important because it can create interesting, interactive learning and make it easier for students to understand the material. Furthermore, in the aspect of integrating technology into PPT and student worksheets, the average preservice mathematics teacher can integrate technology into PPT and student worksheets. For example, by using learning videos from YouTube, Quizizz, Canva, Google Forms, barcodes, hyperlinks, and Microsoft Excel

4. CONCLUSION

Based on the results of the research and discussion above, it can be concluded that overall, the TPACK-integrated learning devices in the form of powerpoint and student worksheets created by preservice mathematics students are quite capable of supporting students' 21st-century skills

6. SUGGESTIONS

The use of information and communication technology in learning is an alternative to improving the quality of learning. Utilizing information and communication technology, can stimulate students' interest in learning, and create engaging, more interactive, and collaborative learning activities. To be able to integrate technology into learning, preservice teachers first need to master a learning approach, namely Technological Pedagogical and Content Knowledge (TPACK). Therefore, the lecturers at University of Mataram environment, especially the Mathematics Education Study Program, should further equip their students with TPACK skills to produce professional graduates who are proficient in integrating technology into learning

7. REFERENSI

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