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The Ability of Prospective Mathematics Teachers in Preparing TPACK Integrated Student Worksheet

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Abstract: Student worksheet made by prospective mathematics teachers many have not integrated TPACK. By mastering the understanding of TPACK, teachers can create interesting, innovative and quality learning. This study aims to describe the ability of prospective mathematics teachers in compiling the TPACK integrated student worksheet in terms of the feasibility of content, language, presentation, and graphics. This type of research is a quantitative descriptive research with the research sample being Mathematics Education students who are taking Micro Teaching courses, namely classes 6B3 and 6E2 totaling 14 people. The sampling technique was carried out by purposive sampling technique. The data of this study was obtained from the results of the observation of the TPACK integrated student worksheet compiled by prospective mathematics teachers. The data obtained was analyzed by descriptive analysis techniques. Based on the results of the research, the ability of prospective mathematics teachers in compiling the TPACK integrated student worksheet aspect in the aspect of content eligibility was obtained a percentage of 86% with a high category, the language aspect was obtained a percentage of 92% with a high category, the presentation aspect was obtained a percentage of 85% with a high category and the graphic aspect was obtained a percentage of 84% with a medium category. Overall, it can be concluded that the ability of prospective mathematics teachers in compiling the TPACK integrated student worksheet has a high category with a percentage of 86.75%.

Keywords: micro teaching; prospective teachers; student worksheet; tpack.

INTRODUCTION

The 21st century is very synonymous with the era of digitalization which affects the field of education, both in learning activities, the use of teaching modules, learning methods, evaluation media, learning approaches and learning media can be facilitated with the help of technology. This requires students as prospective teachers to be able to adapt to technological developments, especially the use of technology in the learning process (Wistiawati et al., 2020). Therefore, it is necessary for the role of lecturers to train and guide prospective teachers in developing the ability to use technology in learning.

One example of the implementation of digital technology in learning is by using a learning tool in the form of a Student Worksheet (LKPD). According to (Lestari et al., 2023), the student worksheet is a sheet that contains tasks that must be done by students in the learning process, containing instructions or steps in completing tasks in accordance with basic competencies, learning objectives and indicators of achievement of learning outcomes that must be achieved. The use of student worksheet in learning is very important because it can optimize the active role of students in the learning process, can help teachers in delivering teaching materials, can help teachers in managing classes so that learning becomes more meaningful and can optimize student learning outcomes (Kristianingsih et al., 2022).

Based on the results of the latest research on the role of learning technology, it is known that 21st century learning can occur successfully if it is supported by skills in utilizing technology, the ability to master the material and use the right learning strategies. Based on (Said's, 2023) research, the use of appropriate and well-integrated learning technology can help improve the quality of learning, increase learning effectiveness, and encourage active student involvement. Therefore, in the implementation of learning activities, it is necessary to

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have a synergy between technology, material, and pedagogic knowledge that is integrated with each other to support the teaching and learning process or better known as technological, pedagogical, and content knowledge (TPACK).

TPACK is a form of knowledge that is interconnected, namely between content, pedagogic and technological (Mishra & Koehler, 2006). TPACK directs teachers not only to master pedagogic knowledge and content, but also to be able to integrate technology into learning (Aminah et al., 2020). With the ability of TPACK, teachers can create interesting, innovative and quality learning so that students become more enthusiastic about learning (Murtiyasa & Atikah, 2021). Based on the results of initial observations made in the Micro Teaching course, it was found that the student worksheet made by prospective students of Mathematics Education FKIP University of Mataram still did not apply the TPACK concept in it. This was strengthened by interview activities about the basic knowledge of TPACK students who are prospective teachers, the majority of whom have still never heard of the term TPACK. Of the 7 speakers, only 2 had heard of the term TPACK. Then in the knowledge of TPACK components, only 1 student knows the components of TPACK. Then in terms of compiling the TPACK integrated student worksheet, all students as resource persons have still never compiled the TPACK integrated student worksheet. According to (Turmuzi & Kurniawan, 2021), to be able to integrate technology into learning, a teacher or prospective teacher must have technological pedagogical and content knowledge (TPACK) skills.

The results of this observation are strengthened by the research of (Turmuzi & Kurniawan, 2021) showing that the overall TPACK ability of students has an average score of 3.89 (Scale 1-5) which is categorized as moderate. In addition, based on research by Zulhazlinda et al., (2023) shows that there is a positive and significant influence between the understanding of TPACK on the readiness to become a professional teacher in students of the PTN Economics Study Program in Central Java. This shows that the higher the understanding of TPACK by prospective teacher students, the higher their readiness to become professional economics teachers.

In contrast to previous studies that emphasized more on the relationship between TPACK understanding and teaching readiness, this study prioritizes the application of TPACK in the context of practical learning design. This research focuses on the ability of prospective mathematics teachers to prepare student worksheet that utilizes technology appropriately to support the teaching and learning process. Therefore, it is necessary to conduct an analysis of the ability of prospective teachers of Mathematics Education FKIP University of Mataram in compiling the TPACK integrated student worksheet. This study aims to determine the ability of prospective mathematics teachers in compiling the TPACK integrated student worksheet.

METHODS

This study uses a quantitative descriptive research method. This research was conducted in the Micro Teaching course of the Mathematics Education Study Program with a research sample, namely classes 6B3 and 6E2 totaling 14 people. The sampling technique was carried out by purposive sampling technique. The data of this study was obtained from the results of the observation of the TPACK integrated student worksheet compiled by prospective mathematics teachers. The data obtained was analyzed by descriptive analysis techniques.

Based on the observation results, the data analysis procedure can be carried out using the Likert scale according to Table 1, namely:

Table 1. Guidelines for Scoring Research Instruments

Score	Category
4	Excellent
3	Good
2	Less
1	Very Less

The formula used to convert the score obtained into a percentage form is:

$$P = \frac{f}{N} \times 100\% \quad \text{.....(1)}$$

The data obtained are then changed in the score interpretation category as follows.

Table 2. TPACK Integrated Student Worksheet Preparation Ability Level Category

Category	Percentage
High	$85\% \leq x \leq 100\%$
Medium	$70\% \leq x < 85\%$
Low	$0\% \leq x < 70\%$

RESULTS AND DISCUSSION

The assessment of the ability of prospective teachers in compiling the TPACK integrated student worksheet was carried out to 14 students of the Mathematics Education Study Program of FKIP University of Mataram who are taking the Micro Teaching course. Based on the results of the assessment that has been carried out using the observation sheet, the distribution of data on the level of ability of prospective teachers in compiling the TPACK integrated student worksheet is obtained in the following Table 3.

Table 3. Distribution Data on the Ability Level of Prospective Teachers in Compiling the TPACK Integrated Student Worksheet

Category	Number of Teacher Candidates				
	Content Eligibility	Linguistics	Presentation	Graphics	Overall
High	12	11	9	7	12
Medium	-	3	5	7	2
Low	2	-	-	-	-

Based on Table 3, the ability of prospective teachers to prepare the TPACK integrated student worksheet was obtained by 12 people with a high category and 2 people with a medium category. The eligibility aspect of content was obtained by 12 people with a high category and 2 people with a low category. The linguistic aspect was obtained by 11 people with a high category and 3 people with a medium category. The aspect of presentation was obtained by 9 people with a high category and 5 people with a medium category. The graphic aspect was obtained by 7 people with a high category and 7 people with a medium category.

In more detail, the assessment of the ability of prospective mathematics teachers in compiling the TPACK integrated student worksheet can be seen from the ability in each aspect, namely the eligibility of the content, the linguistic aspect, the presentation aspect and the graphic aspect. First, the eligibility aspect of content. Based on the results of the data analysis that has been carried out, the level of ability of prospective teachers in compiling the TPACK integrated student worksheet in terms of content eligibility is as follows.

Table 4. Data on the Results of Observation of the Ability of Teacher Candidates in Compiling the TPACK Integrated Student Worksheet Aspects of Content Eligibility

No	Statement	Average	Percentage	Category
1	The presentation of material can support the achievement of Learning Outcomes	3,71	93%	High
2	Presentation of accurate material sourced from books, journals, and various other learning resources.	2,93	73%	Medium
3	Presentation of material in a structured and sequential manner that can help students in finding a concept	3,93	98%	High
4	Loading the syntax of the learning model used	2,86	71%	Medium
5	Contains contextual problems that can help students find a concept according to the learning material	3,43	86%	High
6	Contains the types of activities in it to develop students' understanding	3,64	91%	High
7	Using technology (props/media/software) in delivering material or solving a problem	3,00	75%	Medium
8	The technology used is easy to operate	3,57	89%	High
9	The technology used has an appeal for students	3,57	89%	High
10	The technology used can encourage active student engagement	3,57	89%	High
	Average	3,42	86%	High

Based on Table 4, the ability of prospective teachers to prepare the TPACK integrated student worksheet in terms of content eligibility has a high category with a percentage of 86%. This is in line with the research of (Sridana et al., 2024) that the ability of prospective teachers to prepare the TPACK integrated student worksheet in terms of content eligibility is in the high category with a percentage of 85%. The highest percentage is found in the statement of presenting the material in a structured and sequential manner which can help students in finding a concept of 93% with a high category. According to (Afina et al., 2024), the presentation of material in a structured and sequential manner can help students understand the learning flow better. While the lowest percentage is found in the statement containing the syntax of the learning model used, which is 71% with the medium category. Based on the data analysis carried out, it shows that the average prospective teacher is quite capable in presenting material in the student worksheet in accordance with the syntax of the learning model used.

Second, the linguistic aspect. Based on the results of the data analysis that has been carried out, the level of ability of prospective teachers in compiling the TPACK integrated student worksheet language aspects is obtained as follows.

Table 5. Data on the Observation Results of the Ability of Teacher Candidates in Compiling the TPACK Integrated Student Worksheet Language Aspects

No	Statement	Average	Percentage	Category
1	Spelling in accordance with Indonesian rules	3,71	93%	High
2	Using standard terms	2,93	73%	Medium
3	The sentences used do not contain double meanings	3,93	98%	High
4	Use easy-to-understand language	2,86	71%	Medium
	Average	3,42	86%	High

Based on Table 5, the ability of prospective teachers to prepare the TPACK integrated student worksheet in the language aspect has a high category with a percentage of 92%. According to (Laili & Kuntjoro, 2021), student worksheet is said to be good and correct if it meets the requirements related to sentence structure, use of language, vocabulary, level of difficulty, and clarity of the sentences used so that it makes it easier for students to understand the content of. student worksheet The highest percentage is found in the statement that the sentence used does not contain a double meaning of 96% with a high category. The use of sentences that do not contain double meanings in the student worksheet aims to prevent students from experiencing confusion with each sentence used and for students to understand sentences properly and correctly (Solikhah & Novita, 2020). While the lowest percentage is found in spelling statements in accordance with Indonesian rules, which is 86% with a high category. Based on the data analysis carried out, it shows that the average prospective teacher is able to pay attention to typing word by word to be in accordance with the rules of the Indonesian language. Writing sentences in student worksheet must use the correct vocabulary and in accordance with good and correct Indonesian rules (Harfian & Fadillah, 2022).

Third, the aspect of presentation. Based on the results of the data analysis that has been carried out, the level of ability of prospective teachers in compiling the TPACK integrated student worksheet is obtained in the following aspects of presentation.

Table 6. Data on the Results of Observation of the Ability of Prospective Teachers in Compiling the TPACK Integrated Student Worksheet Presentation Aspects

No	Statement	Average	Percentage	Category
1	Student worksheet interesting	3,29	82%	Medium
2	Loading instructions for using student worksheet	3.71	93%	High
3	Presenting time allocation in working on student worksheet	3,79	95%	Medium
4	Presenting the conclusion drawing section	2,64	66%	Low
5	The instructions provided are clear	3,50	88%	High
	Average	3.39	85%	High

Based on Table 6, the ability of prospective teachers in compiling the TPACK integrated student worksheet in the aspect of presentation has a high category with a percentage of 85%. This is in line with the research of (Sridana et al., 2024), that the ability of prospective teachers to prepare the TPACK integrated student worksheet in the aspect of presentation is in the high category. The highest percentage is found in the statement presenting the time allocation in working on the student worksheet of 95% with a high category. Based on the data analysis carried out, it shows that the average prospective teacher

is able to present the time allocation for student worksheet work. When explored through interviews, the average of the respondents mentioned the time allocation on the elements of student worksheet. While the lowest percentage is found in the statement presenting the conclusion drawing part, which is 66% with a low category. Based on the data analysis carried out, it shows that the average prospective teacher is quite capable in presenting the conclusion drawing part in the student worksheet. Although there are still some prospective teachers who do not present the conclusion drawing part.

Fourth, the aspect of grind. Based on the results of the data analysis that has been carried out, the level of ability of prospective teachers in compiling the TPACK integrated student worksheet graphic aspects is obtained as follows.

Table 7. Data on the Results of Observation of the Ability of Prospective Teachers in Compiling the TPACK Integrated Student Worksheet Graphics Aspects

No	Statement	Average	Percentage	Category
1	The cover design is attractive and in accordance with the contents of the student worksheet	2,86	71%	Medium
2	Suitability of the color degradation used	3,57	89%	High
3	The use of fonts (types and sizes) makes it easier for readers to understand the content of the student worksheet	3,07	77%	Medium
4	Text and image layout compatibility	3,36	84%	Medium
5	The pictures used are interesting	3,50	88%	High
	Average	3.37	84%	Medium

Based on Table 7, the ability of prospective teachers to compile the integrated student worksheet of TPACK graphics has a medium category with a percentage of 84%. According to the National Education Standards Agency (BSNP, 2012), student worksheet is said to be good from the graphic aspect if the student worksheet contains display design, colors, covers, center of view, composition, harmonious layout, illustrations used to make it easier to understand, and the typography used can attract students' interest. The highest percentage is found in the student worksheet print quality statement of good and color at 96% with the high category. This means that prospective teachers are able to pay attention to the print quality of the student worksheet made, whether it is colored and clearly visible or not. Meanwhile, the lowest percentage is found in the statement of attractive cover design and in accordance with the content of the student worksheet, which is 71% with the medium category. Based on the data analysis carried out, it shows that the average prospective teacher is quite capable in making a cover design that is in accordance with the material presented.

Overall, based on the results of the data analysis that has been carried out regarding the ability of prospective mathematics teachers in compiling the TPACK integrated student worksheet seen from the aspects of content eligibility, linguistic aspects, presentation aspects, and graphic aspects, a recapitulation of the data presented in Figure 1 is obtained.

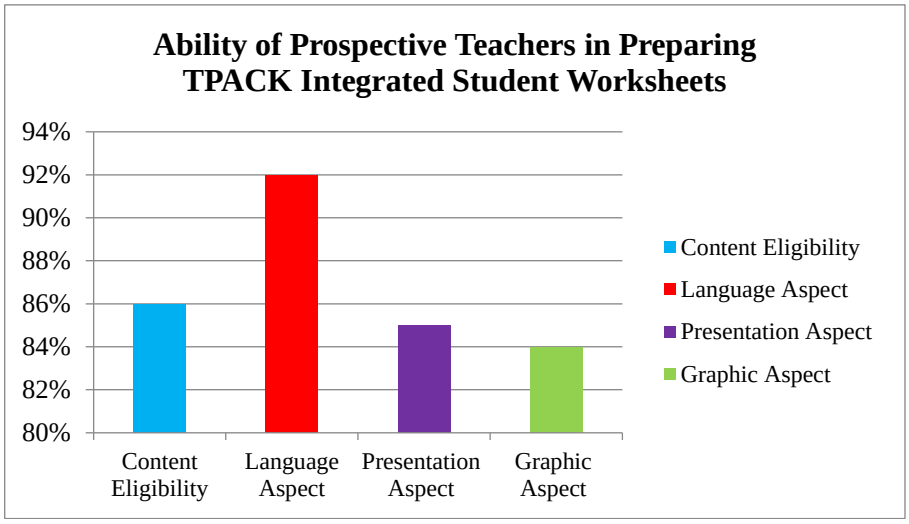

Figure 1. Ability of Prospective Teachers in Compiling TPACK Integrated Student Worksheet

Based on Figure 1, obtained the ability of prospective teachers of Mathematics Education FKIP University of Mataram in compiling the TPACK integrated student worksheet percentage is 86.75% with a high category. This is in line with the research of (Nisa & Faroh, 2021) showing that students' ability to compile learning tools is very good. According to Aini et al., (2022) the use of student worksheet based on the TPACK framework in learning has an effect on students' problem-solving skills. Meanwhile, according to (Nurjanah et al., 2022) the use of TPACK-based student worksheet can increase students' learning activities and help students understand the learning material. The ability of prospective teachers of Mathematics Education FKIP University of Mataram in compiling the TPACK integrated student worksheet aspect of content feasibility obtained a percentage of 86% with the high category, the linguistic aspect obtained a percentage of 92% with the high category, the presentation aspect with a percentage of 85% with the high category, and the graphic aspect with a percentage of 84% with the medium category.

CONCLUSION

The ability of prospective teachers of Mathematics Education FKIP Mataram University in compiling the TPACK integrated student worksheet has a high category with a percentage of 86.75%. The ability of prospective teachers of Mathematics Education FKIP University of Mataram in compiling the TPACK integrated student worksheet aspect of content eligibility obtained a percentage of 86% with a high category, the language aspect obtained a percentage of 92% with a high category, the presentation aspect obtained a percentage of 85% with a high category and the graphic aspect obtained a percentage of 84% with a medium category. It is hoped that future researchers will increase the research sample, because with a large sample it allows researchers to get more accurate results. For example, by comparing the abilities of prospective teachers from various educational study programs (for example, Chemistry Education, Biology Education, and Physics Education).

REFERENCES

Afina, A., Saputra, D. F., & Angraeni, L. (2024). Pengembangan E-LKPD Berbantuan Liveworksheets pada Materi Pengukuran Kelas X SMA Wisuda Pontianak. *Social,*

Humanities, and Educational Studies (SHES): Conference Series, 7(3). https://doi.org/10.20961/shes.v7i3.91494

Aini, F. Q., Sepriyanti, N., & Susanto, A. (2022). Penggunaan LKPD Berdasarkan Kerangka Kerja TPACK Terhadap Kemampuan Pemecahan Masalah Matematis Peserta Didik Kelas X MAN 4 AGAM. *Jurnal Prinsip Pendidikan Matematika, 5*(1), 74-80. https://doi.org/10.33578/prinsip.v5i1.157

Aminah, N., Waluya, S. B., & Rochmad. (2020). Integrasi Teknologi Dalam Pengajaran Matematika. *Mathline*: *Jurnal Matematika dan Pendidikan Matematika, 5*(1), 87-100. https://doi.org/10.31943/mathline.v5i1.122

BSNP. (2012). *Panduan Penyusunan Kurikulum Tingkat Satuan Pendidikan Jenjang Pendidikan Dasar dan Menengah*. Jakarta: Depdiknas.

Harfian, B. A. A., & Fadillah, E. N. (2022, September). Pengembangan LKPD Biologi Materi Keanekaragaman Hayati Berbasis *Problem Based Learning* Untuk Peserta Didik SMA Kelas X. *Prosiding Seminar Nasional Biologi*, *2*(1), 213-222.

Kristianingsih., Suardana, I. N., & Juniartina, P. P. (2022). Pengembangan Lembar Kerja Peserta Didik IPA SMP Berbasis *Problem Based Learning* Pada Materi Usaha dan Pesawat Sederhana. *Jurnal Pendidikan dan Pembelajaran IPA Indonesia*, *12*(1), 38-48. https://doi.org/10.23887/jppii.v12i1.56549

Laili, I., & Kuntjoro, S. (2021). Validitas LKPD Pencemaran Lingkungan Berbasis Contextual Teaching and Learning (CTL) untuk Melatihkan Keterampilan Berpikir Kritis. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, *10*(1), 20-30.

Lestari, N. A., Kurniawan, P. W., & Hendratama, O. (2023). Pengembangan Lembar Kerja Peserta Didik (LKPD) Bebasis *Discovery Learning* Pada Materi Kehidupan Masyarakat Praaksara Indonesia Kelas X IPS di SMA Gajah Mada. *Prodiksema, 2*(2), 72-82.

Mishra, P. dan M. J. Koehler. (2006). *Technological Pedagogical Content Knowledge*: A Framework for Teacher Knowledge. *Teachers Colege Record*, *6*(108), 1017-1058. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Murtiyasa, B., & Atikah, M. D. (2021). Kemampuan TPACK Mahasiswa Calon Guru Matematika pada Mata Kuliah Praktikum Pembuatan Alat Peraga Matematika. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(4), 2577-2590. http://dx.doi.org/10.24127/ajpm.v10i4.4351

Nisa, R., & Faroh, N. (2021). Analisis Kemampuan Menyusun Perangkat Pembelajaran Mahasiswa Universitas Qomaruddin Ditinjau dari TPACK. *Buana Matematika: Jurnal Ilmiah Matematika dan Pendidikan Matematika*, *11*(1), 1-13. https://doi.org/10.36456/buanamatematika.v11i1.2692

Nurjanah, Sutrisno, & Marzal, J. (2021). Pengembangan RPP dan LKPD Berbasis TPACK Pada Materi Garis dan Sudut Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis*: Jurnal Cendekia: Jurnal Pendidikan Matematika*, *6*(1), 259-269. https://doi.org/10.31004/cendekia.v6i1.104

Said, S. (2023). Peran Teknologi Sebagai Media Pembelajaran di Era Abad 21. *Jurnal PenKoMi: Kajian Pendidikan & Ekonomi*, *6*(2), 194-202. https://doi.org/10.33627/pk.62.1300

Solikhah, S., & Novita, D. (2020). Kelayakan lembar kerja peserta didik (LKPD) berorientasi guided discovery untuk melatihkan keterampilan berpikir kritis materi ikatan kimia kelas X SMA. *UNESA Journal of Chemical Education, 9*(2), https://doi.org/10.26740/ujced.v9n2.p253-261

Sridana, N., Novitasari, D., & Magfirah, N. (2024). Analysis of Preservice Teachers' Ability to Develop TPACK Integrated Learning Tools. *Griya Journal of Mathematics Education and Application, 4*(3), 197-212. https://doi.org/10.29303/griya.v4i3.473

Turmuzi, M., & Kurniawan, E. (2021). Kemampuan Mengajar Mahasiswa Calon Guru Matematika Ditinjau Dari *Technological Pedagogical and Content Knowledge* (TPACK) Pada Mata Kuliah *Micro Teaching*. *Jurnal Cendekia: Jurnal Pendidikan Matematika, 5*(3), 2484-2498. https://doi.org/10.31004/cendekia.v5i3.881

Wistiawati, A. T., Putro, S. C., & Irianto, W. S. G. (2020). Hubungan Sosial Kognitif dan *Life Skills Education* Terhadap Kemampuan Adaptasi Calon Guru Pada Era Revolusi Industri 4.0 Mahasiswa S1 PTE Jurusan Teknik Elektro Universitas Negeri Malang. *Pembelajar: Jurnal Ilmu Pendidikan, Keguruan, dan Pembelajaran, 4*(2), 88-97. http://dx.doi.org/10.26858/pembelajar.v4i2.14291

Zulhazlinda, W., Noviani, L., & Sangka, K. B. (2023). Pengaruh TPACK Terhadap Kesiapan Menjadi Guru Profesional Pada Mahasiswa Pendidikan Ekonomi di Jawa Tengah. *Jurnal Pendidikan Ekonomi, 11*(3), 26-38. https://doi.org/10.26740/jupe.v11n1.p26-38