JAMES

Journal of Advanced Multidisciplinary Education Studies

PISSN XXX-XXX (Print)
ISSN XXX-XXXX (Electronic)
https doi xxxxx

Development of PBL-Based Liveworksheet E-LKPD on Circle Topics for Eighth Grade to Improve Mathematical Literacy Skills

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ABSTRACT

This research aims to develop an E-LKPD Liveworksheet based on Problem Based Learning (PBL) for circle material in 8th grade, to enhance students' mathematical literacy abilities. This is motivated by the low mathematical literacy of Indonesian students based on PISA results and the limited utilization of technology in learning. This Research and Development (R&D) study adopts the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), focusing solely on the development stage through a small-scale trial involving 2 teachers and 6 students. The research results indicate that the developed E-LKPD Liveworksheet is highly valid and practical. The product's validity obtained a percentage of 93.12% from material experts (very valid) and 92.04% from media experts (very valid). Meanwhile, the practicality of the product achieved a percentage of 95.65% from teacher trials (very practical) and 83.77% from student trials (very practical), with an overall recapitulation of 87.81% (very practical). Thus, this PBL-based E-LKPD Liveworksheet is highly practical for use in mathematics learning

Keywords:

Mathematical Literacy;
Liveworksheet;
Problem Based Learning

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Introduction

Mathematical literacy is one of the essential skills in the 21st century. This skill is crucial for students to apply mathematical concepts in solving everyday problems (Afifah et al., 2020). It is vital for facing many challenges in modern life. However, the results of mathematical literacy among students in Indonesia remain a significant issue. According to PISA (Programme for International Student Assessment) data, Indonesia continues to rank at the bottom in mathematics, even placing 70th out of 81 countries in the 2022 PISA results. This indicates that Indonesia still struggles with solving problems related to mathematical literacy (Rosdiyanti, 2023).

Previous literature supports the PISA findings regarding the low mathematical literacy among students. Studies conducted by Aldi et al. (2020) and Rodliyah (2023) specifically show that junior high school students still face difficulties in understanding material and problems, often relying on rote memorization of formulas without a deep understanding of the concepts, especially in the topic of

circles. Furthermore, mathematics learning in classrooms is often dominated by conventional approaches that provide limited opportunities for students to develop independent problem-solving strategies (Afifah et al., 2020). On the other hand, despite the rapid development of technology and its role in the implementation of the Merdeka Curriculum to improve the quality of education, the use of technology-based learning media in classrooms is still limited. This condition can lead to student boredom and hinder the optimization of the learning process (Dinata, 2022).

To bridge this gap, innovation in the development of teaching materials that align with the demands of the 21st century and can effectively enhance students' mathematical literacy is needed. Problem-Based Learning (PBL) has proven to be an effective learning model in encouraging active student involvement in solving mathematical problems, which can improve students' mathematical literacy (Dinata, 2022). Along with this, Liveworksheet offers an interactive platform that allows the creation of electronic Student Worksheets (E-LKPD) with multimedia features and automatic correction, making it an engaging and efficient learning tool. Although there are studies that examine the development of PBL-based LKPD or the use of Liveworksheet separately, there is still a lack of research specifically integrating E-LKPD Liveworksheet with the PBL approach on circle topics to comprehensively enhance students' mathematical literacy.

Based on the gap analysis, this study focuses on the development of PBL-based E-LKPD Liveworksheet on the topic of circles for eighth-grade students. The novelty of this research lies in the synthesis of the PBL model and the interactive features of Liveworksheet within the context of circle material, specifically designed to stimulate and measure students' mathematical literacy. The main issue to be addressed is how to design, develop, and test the validity and practicality of the E-LKPD Liveworksheet. Therefore, this study aims to describe the design and development of the PBL-based E-LKPD Liveworksheet product and analyze its validity and practicality in facilitating the improvement of mathematical literacy on the topic of circles

Methods

The method used in this study is Research and Development (R&D) with a development procedure based on the ADDIE model (Analyze, Design, Development, Implement, and Evaluate) proposed by Dick & Carey, as cited in Syarifuddin (2025). The aim of this study is to develop a Problem-Based Learning (PBL) based E-LKPD Liveworksheet. The subjects used for product validation are 2 validators: the first is a lecturer from the Mathematics Education program at Alma Ata University in Yogyakarta, and the second is a teacher from MA Mu'allimat Muhammadiyah Yogyakarta (material validator). Additionally, there are 2 lecturers from the Information Systems program at Alma Ata University in Yogyakarta (media validators), 2 mathematics teachers from SMP N 2 Kasihan and SMP Ali Maksum (teacher practicality test subjects), and 6 eighth-grade students from SMP N 2 Kasihan (student practicality test subjects). The instruments used are interviews and a Likert scale to validate the validity and practicality of the developed E-LKPD.

The scoring guidelines for the material and media expert validators in the evaluation instrument are as follows:

$$p = \frac{\sum x}{N} X\ 100\%$$

Explanation:
p: Percentage score
∑ x: Total validation score from each validator
N: Maximum score

After obtaining the final percentage score, the validity criteria percentage is then calculated. The criteria used are as follows:

Table 1. Validity Test Criteria

Percentage (%)	Validity Level
81 - 100	Very valid, can be used without revision
61 - 80	Valid, can be used but needs minor revisions
41 - 60	Less valid, needs major improvements, recommended not to use
21 - 40	Invalid, cannot be used
0 - 20	Totally invalid, should not be used

To determine the level of practicality of the E-LKPD being developed, the following formula is used:

$$p = \frac{\sum x}{N} X\ 100\%$$

Information:

p : Score percentage

$\sum x$: Total practicality score

N : Maximum score

After obtaining the final percentage score, the next step is to find the percentage of practicality criteria. The criteria used are as follows:

Table 2. Practicality test criteria

Presentase (%)	Level of Practicality
86 - 100	Very practical
76 - 85	Practical
60 - 75	Quite practical
55 - 59	Less practical
54 - 0	Not practical

In this study, the development procedure used was the Analyze, Design, Development, Implementation, and Evaluation (ADDIE) model. However, this study was limited to the Development stage.

Figure 1. Steps in the research procedure

Based on the diagram above, the steps in the development research procedure are as follows:

Analyze

The analysis phase aims to identify problems in learning and analyze the reasons for the need for teaching materials, one of which is the E-LKPD. There are three analysis activities that will be carried out, as follows:

a. Analysis of Material Needs. The purpose of the analysis of material needs is to obtain information related to learning achievements, learning objectives, and the material to be used. In this study, the researcher took the step of using a literature review, analyzing the achievements in the Merdeka Curriculum, and formulating the learning objectives that must be achieved by students. Additionally, the researcher also used interviews as a data collection technique to determine the material needs based on the learning resources used by teachers and students.

b. Analysis of User Needs. The purpose of the user needs analysis is to obtain information about the criteria of users who will operate the developed product so that an appropriate design can be determined. Data for this analysis was obtained through interviews.

c. Product Specification Analysis. The purpose of the product specification analysis is to determine various types of systems or software that can be used in the development of the product in this study. The researcher's approach to this was using a literature review.

Design

The design phase aims to facilitate the development of the product that will be developed by the researcher in accordance with the learning objectives from the Analyze phase.

a. Creating a storyboard as an initial sketch of the E-LKPD design to be made.
b. Collecting references for material, example problems, and content to be included in the E-LKPD.

Development

The Development phase is the process of creating a learning medium aimed at determining the validity of the product. In the Development phase, four key tasks must be carried out:

a. Product Creation. In this phase, the researcher gathers supporting components necessary for product development, including materials, videos, images, animations, and other multimedia elements. The researcher then designs the Student Activity Sheets (LKPD) based on the storyboard using the Canva application to create an attractive design. After the LKPD design is completed using Canva, it is saved in PNG format and uploaded to the Liveworksheet platform, which will produce an interactive E-LKPD to support the digital learning process
b. Product Validation. Product validation is used to assess the quality and suitability of the developed product. There are two types of validation: media expert validation and material expert validation. Material expert validation is assessed based on the learning aspects and content of the material in the E-LKPD, which is designed to improve Mathematical Literacy on circle topics for grade VIII. Media expert validation is assessed based on the design and programming aspects of the media product.
c. Product Revision. After the validation phase by material and media experts, the next step is to revise the product for improvement and refinement. This revision process is carried out twice, incorporating constructive feedback, criticism, and suggestions from both material and media experts. The main goal of this revision is to ensure that the developed mathematics learning media is not only attractive and interactive but also aligned with the curriculum requirements in use. Through this process, it is hoped that the final product will meet educational standards and provide an optimal learning experience for students.
d. Practicality Testing of the Product. Practicality testing is conducted after the product has been revised and is ready for testing. The goal of this practicality test is to collect data through questionnaires that can be used as a reference to determine the practicality level of the developed product. Additionally, this test involves both teachers and students to gather comprehensive feedback on the practicality and ease of use of the product in the learning context.

The results of this performance analysis are presented in Table 3. Results and Discussion

Analyze

In this study, an initial analysis was conducted through a literature review and an examination of the learning conditions at SMP N 2 Kasihan Yogyakarta. After the researcher conducted the literature review, the next step was to conduct an interview with a teacher. The results of the literature review and the interview were used as an assessment of the causes of the performance gap in learning. The results of this preliminary analysis include the learning process in the field, comparing the process that should be carried out and the causes of the performance gap. The results of this performance analysis are presented in Table 3.

Table 3. Results of preliminary analysis

The actual situation	Desired state	The main cause
Limited use of technology-based mathematics learning media	Effective and efficient use of media in mathematics learning	Lack of training in the use of technology-based learning media
Mathematics learning is still dominated by teachers	Student-focused learning	Teachers only focus on achievement and become facilitators.
Low mathematical literacy skills based on the results of the 2022 PISA	Orientation towards mathematical literacy skills	Students are not given enough practice in the form of contextual problems to stimulate students' mathematical literacy skills.

Table 3. shows that the use of E-LKPD is still monotonous and relies solely on government-issued textbooks. The learning process is still dominated by the teacher using lecture and discussion methods, making the learning activities teacher-centered. This results in students becoming passive listeners, rarely expressing their opinions, and only memorizing materials or formulas, which leads to insufficient stimulation in students' mathematical literacy skills. In response to this gap, the researcher took the initiative to develop a learning tool in the form of a Problem-Based Learning (PBL) based E-LKPD Liveworksheet.

The creation of the E-LKPD begins by making a storyboard in the Canva application as an initial sketch and interpretation of the features that will be used in the development of the E-LKPD. The storyboard will then be uploaded to the web-based Liveworksheet platform. At this stage, the researcher prepares the design for the product to be developed, starting from designing the PBL-based E-LKPD and adjusting it to the specified needs. The designed E-LKPD includes the cover, names of the authors and validators, foreword, learning objectives, learning outcomes, usage instructions, materials,

instructional videos, student identification, LKPD, practice exercises, and the biographies of the E-LKPD creators.

Development

At this step, the validation results from material experts, media experts, and the practicality of the E-LKPD are obtained. Below are the results of the material validation obtained Table 4 shows that the use of E-LKPD is still monotonous and relies solely on government-issued textbooks. The learning process is still dominated by the teacher using lecture and discussion methods, making the learning activities teacher-centered. This results in students becoming passive listeners, rarely expressing their opinions, and only memorizing materials or formulas, which leads to insufficient stimulation in students' mathematical literacy skills. In response to this gap, the researcher took the initiative to develop a Problem-Based Learning (PBL) based E-LKPD Liveworksheet.

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At this step, the validation results from material experts, media experts, and the practicality of the E-LKPD are obtained. Below are the results of the material validation obtained.

Table 4. Material validation results

No.	Aspect	Question Items	Total Score	Maximum Score	Presentation
1	Media display quality	6	40	48	83,33%
2	Quality of learning design	12	95	96	98,95%
3	Quality of use technique	2	14	16	87,5%
	Total	20	149	160	93,12%
	Final criteria		Very Valid		

Source: Processed data, 2025

Based on the table above, it can be concluded that the validation results carried out by two mathematics material experts obtained a percentage of 93.12%, categorized as very valid. The following is a visualization of the E-LKPD after the material validation was carried out.

Figure 2 E-LKPD display after material validation

The media validation results are listed in the following table:

Table 5. Media validation results

No	Aspect	Question Items	Total Score	Maximum Score	Presentation
1	Media display quality	14	100	112	89,28%
2	Quality of learning design	6	40	48	83,33%
3	Quality of use technique	1	7	8	87,5%
	Total	21	147	168	87,5%
	Final criteria		Very Valid		

Source: Processed data, 2025

Based on the table above, it can be concluded that the validation results conducted by two media experts obtained a percentage of 87.5%, categorized as very valid. Product revisions based on media validation only included suggestions regarding the use of the Liveworksheet platform, which contains advertisements, which can interfere with viewing and the process of completing the E-LKPD. The results of the teacher practicality test are summarized in the following table

Table 6. Results of teacher practicality questionnaire

No	Aspect	Question Items	Total Score	Maximum Score	Presentation
1	Media display quality	14	109	112	97,32%
2	Quality of learning design	7	55	56	98,21%
3	Quality of use technique	2	16	16	100%
	Total	23	180	184	97,82%
	Final criteria		Very Valid		

Source: Processed data, 2025

Based on the table above, the results of the teacher practicality questionnaire regarding the developed E-LKPD showed that 96.82% met the criteria for being very practical. This indicates that the E-LKPD using PBL-based Liveworksheets is "very practical" for use in learning activities. The results of the student practicality test are summarized in the following table:

Table 7. Results of teacher practicality questionnaire

No	Aspect	Question Items	Total Score	Maximum Score	Presentation
1	Media display quality	9	177	216	81,94%
2	Quality of learning design	5	101	120	84,16%
3	Quality of use technique	5	104	120	86,66%
	Total	19	382	456	83,77%
	Final criteria		Very Practical		

Source: Processed data, 2025

Based on the table above, the results of the student practicality questionnaire for the developed E-LKPD show a percentage of 83.77%, which meets the "very practical" criteria. This indicates that the PBL-based Liveworksheet E-LKPD is “very practical” to use in the learning process. Referring to the results from both teacher and student practicality tests, it can be concluded that the PBL-based Liveworksheet E-LKPD for enhancing mathematical literacy is considered very practical and highly suitable for use in teaching. This aligns with the research conducted by Pebrian (2025), which found that the practicality test for the developed E-LKPD material received an average percentage of 80.56%, classified as "practical." Overall, the results of this study indicate that the PBL-based E-LKPD is an

effective learning tool for developing students' mathematical literacy (Sholihah, 2025). The E-LKPD developed through the Liveworksheet.com website makes it more engaging and easily accessible for students (Umaroh et al., 2022). In addition to being aligned with the needs of 21st-century education, this medium also has the potential to be used as a model for the development of teaching materials.

Conclusion

From the conclusions above, it can be summarized that the developed E-LKPD is classified as very valid and highly practical. Therefore, the PBL-based E-LKPD using the Liveworksheet web platform is suitable for use in mathematics teaching. Based on the results of this development study, the researcher provides the following suggestions:

1. The students' mathematical literacy skills can develop maximally.
2. For educators, this E-LKPD is expected to serve as a reference or motivation for teachers to develop web-based Liveworksheet learning media.
3. For schools, this E-LKPD is expected to serve as a reference to improve the quality of learning to achieve the learning objectives in line with the current curriculum.
4. For other researchers, the results of this study can be continued into the implementation phase to evaluate the effectiveness of the E-LKPD product in improving mathematical literacy within the Problem-Based Learning (PBL) model.

References

Afifah, B. A., Imswatama, A., & Setiani, A. (2020). Penerapan Model Problem Based Learning Untuk Meningkatkan Kemampuan Penalaran Matematis Siswa. *De Fermat : Jurnal Pendidikan Matematika*, *3*(1), 9–16. https://doi.org/10.36277/defermat.v3i1.46

Aldi, M., Siregar, B. H., Alam, P., Medan, U. N., Digital, B. A., Learning, P. B., Matematis, K. L., & Pendahuluan, A. (2020). *PENGEMBANGAN BAHAN AJAR DIGITAL BERBASIS PROBLEM BASED LEARNING (PBL) UNTUK MENINGKATKAN KEMAMPUAN LITERASI MATEMATIS*. *9*, 207–223.

Dinata, O. I. (2022). Meta Analisis Penggunaan Model PBL Guna Meningkatkan Kemampuan Literasi Matematika Siswa. *Mathema Journal*, *4*(2), 67–76.

Pebrian, M. A. (2025). *ELEKTRONIK PADA MATERI SISTEM PERSAMAAN LINEAR DUA VARIABEL (SPLDV) KELAS X SMA NEGERI 1 PALOPO ELEKTRONIK PADA MATERI SISTEM PERSAMAAN LINEAR DUA VARIABEL (SPLDV) KELAS X SMA NEGERI 1 PALOPO*.

Rodliyah, S. Ik. F. (2023). *Pengembangan Modul Berbasis Model Missouri Mathematics Project Untuk Meningkatkan Literasi Matematika Pada Materi …*.

Rosdiyanti, I. (2023). *Pengembangan E-Modul Berbasis Problem Based Learning Menggunakan Flip PDF Profesional Pada Materi Usaha dan Energi*. *8*, 218–228. https://digilib.uns.ac.id/dokumen/detail/104684/

Syarifuddin, A. (2025). *MODUL PENGENALAN KODING BAGI MAHASISWA CALON GURU MATEMATIKA Azhar Syarifuddin*. *11*(1), 80–84.

Tika Awwalus Sholihah, U. F. (2025). PENGEMBANGAN E-LKPD BERBASIS PROBLEM BASED LEARNING UNTUK MELATIH KETERAMPILAN BERPIKIR KRITIS MATERI PERTUMBUHAN DAN PERKEMBANGAN TUMBUHAN Developoment of E-LKPD Based on Problem Based Learning to Train Critical Thinking Skills on Plant Growth and Develo. *BioEdu*, *14*(2), 502–511.

Umaroh, U., Novaliyosi, N., & Setiani, Y. (2022). Pengembangan Lembar Kerja Peserta Didik Elektronik (E-LKPD) Berbasis Problem Based

Afifah, B. A., Imswatama, A., & Setiani, A. (2020). Penerapan Model Problem Based Learning Untuk Meningkatkan Kemampuan Penalaran Matematis Siswa. *De Fermat : Jurnal Pendidikan Matematika*, *3*(1), 9–16. https://doi.org/10.36277/defermat.v3i1.46

Aldi, M., Siregar, B. H., Alam, P., Medan, U. N., Digital, B. A., Learning, P. B., Matematis, K. L., & Pendahuluan, A. (2020). *PENGEMBANGAN BAHAN AJAR DIGITAL BERBASIS PROBLEM BASED LEARNING (PBL) UNTUK MENINGKATKAN KEMAMPUAN LITERASI MATEMATIS*. *9*, 207–223.

Dinata, O. I. (2022). Meta Analisis Penggunaan Model PBL Guna Meningkatkan Kemampuan Literasi Matematika Siswa. *Mathema Journal*, *4*(2), 67–76.

Pebrian, M. A. (2025). *ELEKTRONIK PADA MATERI SISTEM PERSAMAAN LINEAR DUA VARIABEL (SPLDV) KELAS X SMA NEGERI 1 PALOPO ELEKTRONIK PADA MATERI SISTEM PERSAMAAN LINEAR DUA VARIABEL (SPLDV) KELAS X SMA NEGERI 1 PALOPO*.

Rodliyah, S. Ik. F. (2023). *Pengembangan Modul Berbasis Model Missouri Mathematics Project Untuk Meningkatkan Literasi Matematika Pada Materi …*.

Rosdiyanti, I. (2023). *Pengembangan E-Modul Berbasis Problem Based Learning Menggunakan Flip PDF Profesional Pada Materi Usaha dan Energi*. *8*, 218–228. https://digilib.uns.ac.id/dokumen/detail/104684/

Syarifuddin, A. (2025). *MODUL PENGENALAN KODING BAGI MAHASISWA CALON GURU MATEMATIKA Azhar Syarifuddin*. *11*(1), 80–84.

Tika Awwalus Sholihah, U. F. (2025). PENGEMBANGAN E-LKPD BERBASIS PROBLEM BASED LEARNING UNTUK MELATIH KETERAMPILAN BERPIKIR KRITIS MATERI PERTUMBUHAN DAN PERKEMBANGAN TUMBUHAN Developoment of E-LKPD Based on Problem Based Learning to Train Critical Thinking Skills on Plant Growth and Develo. *BioEdu*, *14*(2), 502–511.

Umaroh, U., Novaliyosi, N., & Setiani, Y. (2022). Pengembangan Lembar Kerja Peserta Didik Elektronik (E-LKPD) Berbasis Problem Based Learning (PBL) untuk Memfasilitasi Kemampuan Penalaran Peserta Didik pada Materi Lingkaran. *Wilangan: Jurnal Inovasi Dan Riset Pendidikan Matematika*, *3*(1), 61. https://doi.org/10.56704/jirpm.v3i1.13368