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Development of Project-Based Learning e-Lkpd in Increasing Students' Interest in Learning in Mathematics Subject for Grade III SDN 1 Maria

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A B S T R A C T

This study aims to design and implement instructional materials in the form of a Problem Based Learning (PBL) based electronic Student Worksheet (e LKPD) to enhance learning interest among third grade students at SDN 1 Maria. The focus of the research is mathematics, specifically whole numbers up to 1.000. The research employed a Research and Development (R&D) approach using the ADDIE model, comprising five phases: Analysis, Design, Development, Implementation, and Evaluation. Validation results revealed that the media received an average score of 78.6 % in the first phase and 94.6 % in the second phase. Material experts yielded an average validation score of 83.6 % in the first phase and 92.7 % in the second phase-indicating that the e LKPD is highly suitable for instructional use. During the implementation phase, teacher responses averaged 94.4 % and student responses averaged 94.7 %, demonstrating that the e LKPD is very practical to apply. The effectiveness of the e LKPD was assessed through an N Gain test, comparing pre test and post test scores. The average N Gain score was 0.84, categorized as High. In conclusion, the PBL based e LKPD is considered highly feasible, practical, and effective as a teaching medium to enhance students' learning interest.

1. Introduction

In the teaching and learning process at the elementary school level, especially in mathematics, student progress is often hindered by low learning motivation, which results in poor academic achievement (Kusuma & Nurmawanti, 2023). Learning mathematics means that learning is a process of behavior or performance change through a series of activities such as reading, observing, listening, and imitating (Sulistiani & Masrukan, 2016). Mathematics has been introduced to students from the elementary level through higher levels; however, its usefulness extends beyond quantitative calculation skills to structuring thinking particularly in developing analytical abilities, evaluative skills, and problem-solving capabilities (Rahmaini & Ogylva Chandra, 2024). Numeracy literacy skills represent the ability to apply

mathematical knowledge to address daily life problems (Hanum & Amini, 2023). Student ability should be evaluated not only based on literacy but also on numeracy skills, which are equally essential (Rahim et al., 2025). Students with strong mathematical and reading abilities tend to achieve good academic performance (Nisa, 2023). Based on the opinions mentioned earlier, it is evident that mathematics instruction, particularly at the elementary school level, can help students understand concepts accurately and deeply, thereby enabling them to learn whole numbers effectively (Latifah et al., 2024). The application of mathematical learning begins with students learning to read and write whole numbers (Nurhasni Nurhasni et al., 2025). Students must establish a foundational base to grasp more complex mathematical concepts (Makkawaru, 2019), as cited in Therefore, this foundational aspect is an important consideration for teachers when teaching in the classroom; however, in practice, many teachers still overlook this (Shabrina et al., 2025).

Based on observations during the mathematics learning process at SDN 1 Maria, several issues were identified, including: 1) students do not enjoy participating in mathematics lessons; 2) students pay insufficient attention to the material being taught; and 3) students tend to come in and out of the classroom during lessons. These problems indicate a lack of student learning interest, which clearly impedes the teaching and learning process in mathematics. Another contributing factor is the delivery of the material: teachers rarely use varied instructional models and instead rely overwhelmingly on lecturing, which limits students' opportunities to develop themselves, reduces interaction among the students, and results in overly teacher-centered instruction. Although supportive media such as projectors are available, they are used only sparingly and mostly for presentations (Basyori, 2025). This reflects a lack of utilization of technology-based student worksheets (LKPD), making lessons less engaging. To address these issues, a student-centered learning approach is needed one that encourages active participation, with the teacher acting more as a facilitator (Andi Sadriani et al., 2023).

The use of learning models that promote social interaction, collaboration, and communication among students can enhance their interest in learning (Novitasari et al., 2025). In this regard, innovative learning models are essential. For elementary schools, Problem-Based Learning (PBL) is very suitable (Rizkyani et al., 2023). Achieving this goal requires the existence of well-designed student worksheets (LKPD) (Pratiwi & Luh Indrayani, 2023). The appropriate use of LKPD supports students in completing tasks both independently and in groups (Umbaryati, 2016). The learning process will proceed smoothly when supported by well-prepared instructional materials and e-LKPD for mathematics (Arisma et al., 2025). High-quality learning is achieved when students demonstrate a high level of mastery over their school tasks that aligns with real-life needs (Sari et al., 2025). To ensure that the education system produces high-quality graduates, electronic student worksheets (e-LKPD) can serve as structured guidelines for accomplishing programmed tasks (Relia, 2018). Student worksheets are tools used by students to carry out learning activities. E-LKPD can serve as guides for exercises that develop all aspects of learning through experiments or demonstrations (Hanum & Amini, 2023). E-LKPDs are instrumental in directing students to learn and discover

concepts through individual or group activities (Simamora et al., 2024). Based on the background described above, this study aims to develop a PBL-based e-LKPD using the Lumio application for Grade III mathematics focused on whole number operations to enhance learning interest at SDN 1 Maria.

2. Methodology

This study employs a Research and Development (R&D) design that emphasizes the development aspect. It aims to assess the feasibility, practicality, and effectiveness of a PBL-based electronic student worksheet (e-LKPD) in enhancing learning interest in third-grade mathematics at SDN 1 Maria. The research population consists of 22 students for the large-group test and 11 students for the small-group test in Grade III at SDN 1 Maria. Data were collected through both qualitative and quantitative descriptive methods, using instruments including expert validation questionnaires (material and media experts), teacher and student response questionnaires, observation sheets, and pre- and post-test questionnaires. The study utilizes the ADDIE model, comprising five phases: Analysis, Design, Development, Implementation, and Evaluation, as illustrated below.

Data are analyzed using the descriptive percentage technique, based on the following formula:

$$p = \frac{\mathrm{F}}{\mathrm{N}} \times 100\%$$

Here's a refined English version of your caption along with an illustrative table depicting the validation criteria:

Figure 1. Criteria for Expert Validation (Material and Media Experts)

Percentage Range	Practicality Category
81% - 100%	Very Practical
61% - 80%	Practical
41% - 60%	Quite Practical
21% - 40%	Not Practical
0% - 20%	Very Not Practical

The analysis employs the N-Gain metric, with calculation based on the percentage of answer choices, using the following formula:

$$P = \frac{\sum x}{\sum xi} \times 100\%$$

To measure the effectiveness of the PBL-based e-LKPD in increasing students' learning interest, the N-Gain score is calculated, with response categories for teachers and students as outlined in Table 2.

Table 2. Response Rating Categories for Teachers and Students

Percentage Range	Practicality Category
0% - 20%	Very Impractical
21% - 40%	Impractical
41% - 60%	Quite Practical
61% - 80%	Practical
81% - 100%	Very Practical

To assess the effectiveness of the PBL-based e-LKPD in enhancing students' learning interest, the researcher employs the N-Gain calculation. This analytical method is applied to determine the level of learning interest improvement achieved by students after using the developed e-LKPD.The formula used to calculate N-Gain is as follows:

$$g = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score}}$$

To determine how effective the PBL-based e-LKPD is at developing students' learning interest, the researcher calculates N-Gain scores. These scores are then categorized according to the effectiveness criteria shown in Table 3.

Table 3. N-Gain Score Categories for Effectiveness

N-Gain Score Range	Effectiveness Category
≥ 0.70	High
0.30 – 0.69	Medium
< 0.30	Low

3. Results and Discussion

This development of the e-LKPD is structured around the five stages of the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation, which together form a systematic framework for creating effective instructional materials. In the Analysis phase, the researcher identified needs and challenges within the school's learning environment based on interviews and observations. The data revealed that, during mathematics lessons in Grade III at SDN 1 Maria, there was no use of digital student worksheets (LKPD). Instruction relied instead on real-world contexts particularly in lessons on whole numbers up to 1,000 where teachers directly instructed students in writing and identifying place values. The researcher then assessed the availability of facilities and resources to support the new product. The Design phase involved developing the instructional media plan, beginning with conceptualizing the content and structure of the product. At this stage, applications such as Canva and Lumio were selected for use in the development process.

In the Development phase, the product begins to be crafted through a series of detailed steps. This starts with designing the digital e-LKPD using applications such

as Canva and Lumio, preparing validation questionnaires for both media and content experts, and conducting validations of the interactive digital video learning media with those two experts. The process of developing the PBL-based e-LKPD is depicted in Figure 3.

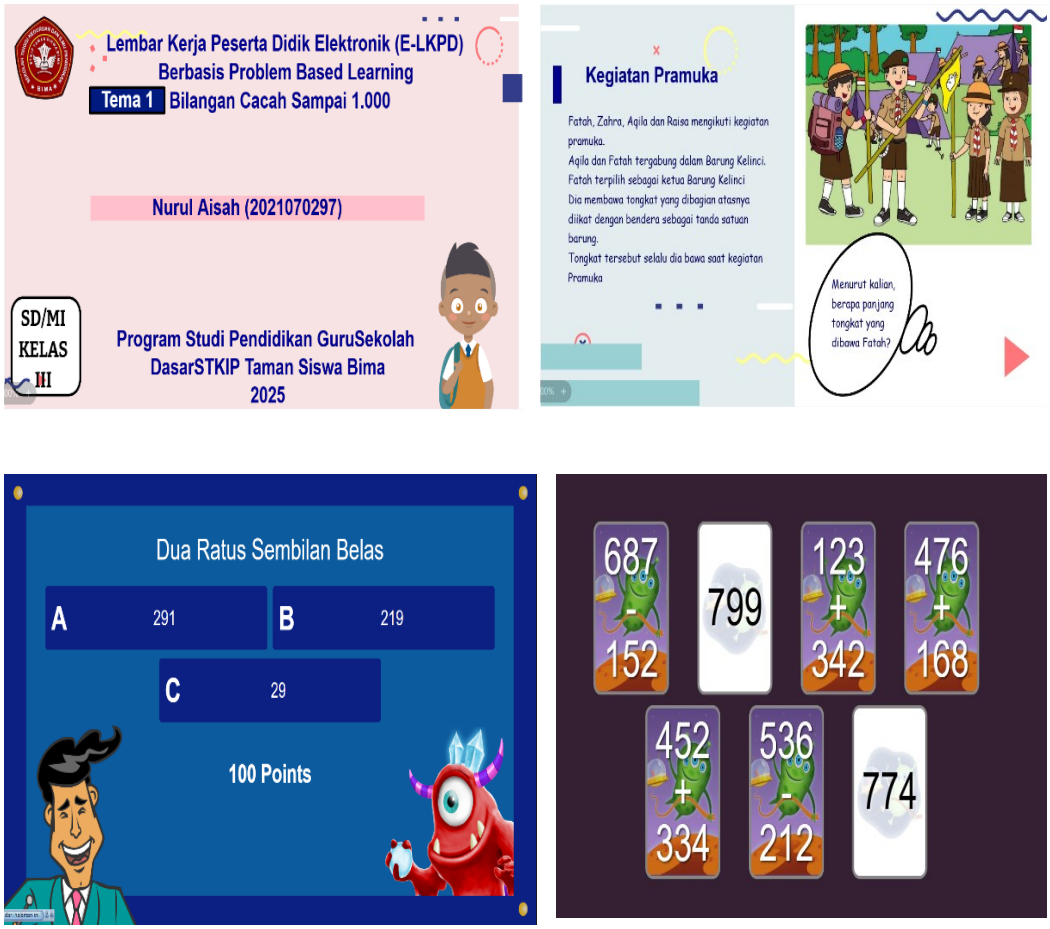


Figure 3. stages of preparing the e-LKPD

The validation results from media experts through two revision phases. In the first revision conducted on July 22, 2025, the average score was 78.6%, categorized as "Feasible". In the second revision on July 24, 2025, the average score increased to 94.6% and was categorized as "Very Feasible" as shown in Table 4.

Table 4. Media Expert Validation Results

Phase of Revision	Maximum Score	Obtained Score	Percentage	Category
Revision 1				
Appearance	55	45	81,8%	Feasible
Presentation	20	14	70%	Feasible
Average	**75**	**82**	**78,6%**	**Feasible**
Revisi 2				
Appearance	55	53	96,3%	Highly Feasible
Presentation	20	18	90%	Highly Feasible
Average	**75**	**71**	**94,6%**	Highly Feasible

The results of expert validation for both revision phases are as follows: during the first revision on July 7, 2025, the average score was 83.6%, categorized as "Very Feasible". After the second revision on July 11, 2025, the average increased to 92.7%, still maintaining the designation of "Very Feasible". The results of the material expert validation are very feasible as shown in table 5.

Table 5. Material Expert Validation Results

Phase of Revision	Maximum score	Obtained score	Percentage	Category
Revision 1				
Competency Achievement	10	8	80%	Highly Feasible
Completeness of Material	30	27	90%	Highly Feasible
Language	15	11	73,3%	Highly Feasible
Average	**55**	**46**	**83,6%**	Highly Feasible
Revision 2				
Competency Achievement	10	9	90%	Highly Feasible
Completeness of Material	30	28	93,3%	Highly Feasible
Language	15	14	93,3%	Highly Feasible
Average	**55**	**51**	**92,7%**	Highly Feasible

In the fourth phase, which is Implementation, the e-LKPD product was tested in both small and large group trials. The small group trial was conducted with different third-grade classes consisting of 11 students. The practicality of the media, as reflected in the responses from teachers and students, is detailed in Tables 6 and 7 below. The average response from teachers collected on July 28, 2025, was 94.4%, categorized as "Very Practical", indicating that the PBL-based e-LKPD is very practical for teaching Mathematics, particularly integers up to 1,000. It is important to note that the assessment of practicality is not solely based on feedback from teachers. The average teacher responses are shown in Table 6.

Table 6. Teacher Response Results

Aspect	Maximum score	Obtained score	Percentage	Category
Appearance and Usage Effects	25	24	96%	Very Pratical
Praticality	25	24	96%	Very Pratical
Media Content	20	19	95%	Very Pratical
Subject Matter	20	18	90%	Very Pratical
Overall Result			**94,4%**	**Very Pratical**

The average student response collected on July 28, 2025, is 94.7%, which falls into the category of 'Very Practical.' This indicates that the PBL-based e-LKPD is very practical for use in teaching mathematics on the topic of integers up to 1,000. The average student responses are shown in Table 7.

Table 7. Student Response Results

Aspect	Maximum score	Obtained score	Percentage	Category
Appearance and Usage Effects	250	242	96,8%	Very Pratical
Praticality	250	239	95,6%	Very Pratical
Media Content	200	183	91,5%	Very Pratical
Subject Matter	200	189	94,5%	Very Pratical
Overall Result			**94,7%**	**Very Pratical**

Based on Table 8, there was a notable improvement in students' post-test results following the implementation of the e-LKPD compared to their pre-test scores. The pre-test, administered on July 11, 2025, yielded an average score of 57.45, categorized as Moderately Effective, whereas the post-test, conducted on July 28, 2025, produced an average of 86,41, categorized as Highly Effective, The results of the pre-test and post-test as shown in the table 8.

Table 8. Recapitulation of Pre-test and Post-test Results

Pre-test		Post-test	
Obtained Score	**Maximum score**	**Obtained Score**	**Maximum score**
1264	2.200	1901	**2.200**
Mean		**Mean**	
57,45		**86,41**	

In the fifth stage, which is the evaluation, the purpose is to assess the overall quality of the developed product and determine whether the product effectively enhances the learning interest of third-grade students at SDN 1 Maria. The evaluation used the N Gain test, calculated from the results of pre-tests and post-tests given to the third-grade students at SDN 1 Maria. The effectiveness of the PBL-based e-LKPD is calculated using the N Gain formula, which resulted in a value of 0.84, categorized as 'High' ($0.70 \leq$ N Gain). Thus, the PBL-based e-LKPD demonstrates a high level of effectiveness in increasing the learning interest of students in the third grade at SDN 1 Maria. This finding aligns with achieving 98% eligibility, reinforcing the high effectiveness of the implementation of e-LKPD.

4. Conclusion

The development of the PBL-based e-Student Worksheet (e LKPD) follows the Research & Development methodology using the ADDIE model as a guide that ensures systematic analysis, design, development, implementation, and evaluation stages. Validation by media and content experts confirmed the feasibility of the e LKPD for classroom use. In addition, feedback collected during the implementation phase from teachers and students indicated a high level of practicality. Effectiveness was demonstrated through an increase in students' learning interest, as measured by N Gain analysis of the pre-test and post-test comparison. These results support the conclusion that PBL-based e LKPDs are not only feasible and practical but also highly effective as a teaching resource for teaching primary level

mathematics. This is in line with similar studies on the application of PBL-orientated e-LKPDs that have reported high levels of feasibility, usability and effectiveness in improving student learning outcomes.

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