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DEVELOPMENT OF PROBLEM-BASED LEARNING E-LKPD WITH EDUCATIONAL GAMES ON INTEGERS

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ABSTRACT
At SMP Negeri 5 Terbanggi Besar, seventh-grade students still show low engagement and understanding of integer material. The student worksheets (LKPD) and textbooks used in learning are visually unattractive and lack interactivity, causing students to become bored easily and less motivated. In addition, the internet facilities available at the school have not been maximized to support more engaging and interactive technology-based learning. This research was conducted at SMP Negeri 5 Terbanggi Besar with seventh-grade students as the subjects. The objectives of this study are: (1) to describe the process of developing an electronic student worksheet (E-LKPD) based on Problem-Based Learning (PBL) supported by educational games using the ADDIE development model, and (2) to determine the validity and practicality of the developed E-LKPD. The development model used is ADDIE, consisting of five stages: Analyze, Design, Development, Implementation, and Evaluation. Data collection instruments include interview sheets, expert validation sheets, and student response questionnaires. Validation was carried out by three material experts and three media experts, while the practicality test was conducted with ten seventh-grade students. The result of this research is a PBL-based E-LKPD integrated with educational games to facilitate learning on integer material. The analysis stage identified the needs of teachers and students for learning media, while the design and development stages produced a visually appealing and interactive prototype. Evaluation was conducted through revisions based on feedback from experts and users. The average validation score was 86% (very valid), and the practicality test result was 90% (very practical), indicating that the E-LKPD is feasible and effective for use in the learning process.
Keywords: educational game; E-LKPD; integer; problem based learning

ABSTRAK
Di SMP Negeri 5 Terbanggi Besar, siswa kelas VII masih menunjukkan keterlibatan dan pemahaman yang rendah terhadap materi bilangan bulat. LKPD dan buku cetak yang digunakan dalam pembelajaran kurang menarik secara tampilan dan minim interaktivitas, sehingga siswa cepat merasa bosan dan kurang termotivasi. Selain itu, fasilitas internet yang tersedia di sekolah belum dimaksimalkan untuk mendukung pembelajaran berbasis teknologi yang lebih menarik dan interaktif. Penelitian ini dilakukan di SMP Negeri 5 Terbanggi Besar dengan subjek siswa kelas VII. Tujuan dari penelitian ini adalah: (1) untuk mendeskripsikan proses pengembangan Lembar Kerja Peserta Didik Elektronik (E-LKPD) berbasis PBL yang didukung oleh game edukasi dengan menggunakan model pengembangan ADDIE, dan (2) untuk mengetahui validitas dan kepraktisan dari E-LKPD yang dikembangkan. Model pengembangan yang digunakan adalah ADDIE, yang terdiri dari lima tahap: Analyze, Design, Development, Implementation, dan Evaluation. Instrumen pengumpulan data meliputi lembar wawancara, lembar validasi ahli, dan angket respon siswa. Validasi dilakukan oleh tiga ahli materi dan tiga ahli media, sedangkan uji kepraktisan dilakukan kepada sepuluh siswa kelas VII. Hasil penelitian berupa E-LKPD berbasis PBL yang terintegrasi dengan game edukasi untuk memfasilitasi pembelajaran materi bilangan bulat. Tahap analisis

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mengidentifikasi kebutuhan guru dan siswa terhadap media pembelajaran, sementara tahap desain dan pengembangan menghasilkan prototipe yang menarik secara visual dan interaktif. Evaluasi dilakukan melalui revisi berdasarkan masukan dari ahli dan pengguna. Nilai rata-rata hasil validasi adalah 86% (sangat valid), dan hasil uji kepraktisan sebesar 90% (sangat praktis), sehingga E-LKPD ini dinyatakan layak dan efektif digunakan dalam proses pembelajaran.
***Kata kunci**: bilangan bulat; E-LKPD; game edukasi; pembelajaran berbasis masalah*

Introduction

Learning mathematics, especially integer material, is often considered difficult and less interesting for students. This is exacerbated by learning media that are less interactive and less visually appealing, such as student worksheets (LKPD) and conventional printed books that are still predominantly used (Fauzy & Nurfauziah, 2021). In addition, the implementation of *the Problem Based Learning* (PBL) learning model that has been used in several schools is still not optimal, so that student involvement and understanding have not been maximized. Technological developments provide opportunities to develop more interesting and interactive learning media, such as the use of Electronic Learner Worksheets (E-LKPD) that can integrate multimedia and educational games (Suryaningsih & Nurlita, 2021; Mahardani, 2021).

Previous studies have shown that PBL-based E-LKPD is effectively used as an online learning medium and can increase the effectiveness and practicality of mathematics learning. For example, Supriatna et al. (2022) developed PBL-based E-LKPD on flat building materials that are valid and practical but limited in content and do not use learning videos. Widiyarsih et al. (2023) reported the validity and practicality of Liveworksheet-based E-LKPD for Trigonometry materials with several technical limitations in the assessment system. Research by Phatona et al. (2024) shows that PBL-based LKPD supported by Cabri 3D can improve mathematical problem-solving skills, but the printed LKPD has not utilized interactive multimedia elements.

Based on the study, there is a gap in the use of PBL-based E-LKPD which integrates educational games and interactive multimedia on integer materials, especially at the junior high school level in grade VII. Most previous research has not optimized multimedia elements such as educational videos and games that have the potential to significantly increase students' interest, focus, and understanding. The lack of this interactive element makes students tend to be passive and quickly lose motivation in learning, so that learning results are not optimal. In addition, the implementation of the PBL model in the field still does not fully follow the correct syntax, which has an impact on students' low ability to solve problems independently. Therefore, learning media is needed that not only supports the implementation of PBL effectively and contextually, but is also able to foster motivation and improve student learning outcomes through a more interesting and interactive learning experience.

The main problem at SMP Negeri 5 Terbanggi Besar is the low involvement and understanding of students in integer materials due to the use of LKPD and printed materials that are less aesthetic and innovative. The existing LKPD only contains

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practice questions without interactive elements, so students tend to be passive and less interested in learning. Based on the results of initial observations, most of the students seemed to be less active in participating in learning, only about 30–40% of students were involved in class discussions, while the rest were more silent and waiting for explanations from the teacher. This condition has an impact on low learning outcomes, where some students have not reached the Minimum Completeness Criteria (KKM) set by the school. Although *the Problem Based Learning* (PBL) model has been implemented, the implementation is not optimal because teachers are still dominant in teaching one-way and students are not given the opportunity to discuss or work together. Important stages of PBL such as problem orientation, investigation, and presentation of results have also not gone well, so the learning process has not fully encouraged students to think critically and actively participate.

This study developed E-LKPD based on Problem Based Learning assisted by an educational game for integer material for grade VII SMP Negeri 5 Terbanggi Besar using the ADDIE model. In the analysis stage, data is collected on student characteristics, engagement, understanding, and learning facilities to determine appropriate multimedia content and elements. The design stage produces an E-LKPD design with learning objectives, PBL syntax, and integration of videos, images, audio, and educational games to increase student engagement and motivation. In the development stage, prototypes are created and validated by experts, then tested on a small scale to ensure suitability and comfort of use. Implementation was limited to assess ease of use and interactivity, while evaluation emphasized the validity, practicality, and effectiveness of multimedia in supporting students' cognitive and affective aspects (Puspita & Dewi, 2021; Wangid, 2023). This approach ensures that the developed E-LKPD is attractive, interactive, and supports the implementation of PBL optimally.

The purpose of this study is to describe the process of developing PBL-based E-LKPD supported by educational games and to find out the validity and practicality of the learning media developed by involving teachers and students in trials and evaluations to get direct input. E-LKPD is expected to be valid, practical, and effective in increasing students' engagement and understanding of integer materials, with indicators of validity from expert assessments and practicality of student responses to media use. This research was conducted at SMP Negeri 5 Terbanggi Besar, where grade VII students have a diverse level of technological literacy and limited experience with the PBL model, so they face challenges in understanding the concept of integers independently. Through the integration of educational games, E-LKPD is designed to support PBL syntax, facilitate discussion, problem-solving, and group collaboration, so that students can develop 21st century skills, including critical thinking, creativity, and cooperation, as well as become an innovative learning model that can be applied in other schools with similar problems.

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Research Methods

Development Model

This research focuses on the development of E-LKPD by utilizing *Problem Based Learning* (PBL) which is equipped with an *educational game* for integer concepts in Class VII of SMP Negeri 5 Terbanggi Besar, using the ADDIE model because this model is simple, the approach is methodical, and easy for researchers to understand. Figure 1. illustrates ADDIE's learning design approach (Branch, 2009).

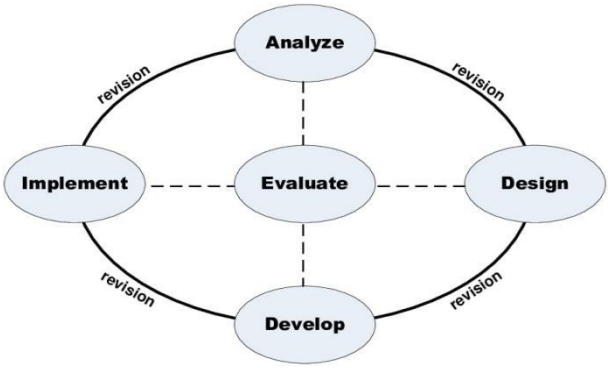

Figure 1. ADDIE Development Model (Source: Branch, 2009)

The stages in the ADDIE model are as follows:

1. Analysis

The researcher identified the needs and gaps of mathematics learning at SMP Negeri 5 Terbanggi Besar, including classroom observations, interviews with teachers and students, as well as a review of the LKPD and printed books used. Analysis of student characteristics, availability of facilities, and appropriate learning methods was also carried out. The results of this analysis are used to formulate the objectives of the development of the E-LKPD and prepare a systematic project plan.

2. Design

The researcher prepared the initial design of the learning media which included the determination of learning objectives, content structure, E-LKPD format, types of tasks, and multimedia elements such as videos, audio, images, and educational games. The educational game is designed to be tailored to each step in the Problem Based Learning (PBL) model, from problem orientation, investigation, to presentation of results, so that the interactivity encourages students to think critically, solve problems independently, and collaborate in groups. The storyboard and initial prototype of E-LKPD were created with the integration of these elements in mind, so that the media design is ready to be tested at the development stage and has advantages over conventional learning media which tend to be passive and have minimal interactivity.

3. Development

E-LKPD products are developed according to the design design using flipbook and interactive multimedia applications. Concrete steps include the creation of digital content, the preparation of contextual exercise questions, the addition of educational videos and games, and the integration of audio features to support learning. The resulting product is then validated by material and media experts to assess the suitability of content, clarity of presentation, and quality of interactivity.

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Small-scale trials were conducted on students to evaluate the ease of use, appeal, and effectiveness of the media.

4. Implementation

The full implementation stage was not carried out by the researcher because the focus of this research was to develop and evaluate E-LKPD to meet the criteria of validity and practicality, not on long-term application in the classroom. This approach allows researchers to ensure learning media has been optimally designed before it is widely used. The results of the high validation and practicality tests provide a solid foundation for teachers to implement E-LKPD effectively, as well as guide for further development, including content adaptation, technology integration, and classroom management strategies to support interactive learning and comprehensive PBL implementation in the future.

5. Evaluation

The evaluation was carried out to assess the quality of the media based on aspects of content and media validity, using validation and practicality questionnaires. Assessments are carried out at each stage of development to ensure the suitability of the product with learning needs.

Data Collection Instruments

This research uses several data collection instruments that are tailored to the needs at each stage of development. The first instrument is the interview guideline, which is used in the initial stage to identify problems, explore the needs of students, and obtain information about the condition of the learning media used at SMP Negeri 5 Terbanggi Besar. Interviews were conducted with educators and students with indicators including the learning process in the classroom, obstacles during learning, media commonly used in mathematics subjects, teachers' understanding of media, and responses to the use of LKPD. The second instrument is the validation questionnaire, which consists of two parts, namely the validation of material experts and the validation of media experts. The material validation was carried out by two mathematics education lecturers and one mathematics teacher, with aspects assessed including core competencies, language use, presentation systematics, and graphic display (Nirwana & Andriani, 2024).

Meanwhile, media validation was carried out by three experts, namely mathematics education lecturers, computer science lecturers, and junior high school teachers. The aspects assessed included the suitability of the design with the material, layout, color and font combinations, clarity of text and images, interactive elements, and the attractiveness of the educational games used (Wardani & Suniasih, 2022). The third instrument is a practicality questionnaire aimed at students to find out the extent to which the developed media is considered easy to use, attractive, and in accordance with their learning needs. The assessment aspects include the feasibility of the material content, the readability of the text and illustrations, the physical appearance of the E-LKPD, and the ease of navigation in its use (Nirwana & Andriani, 2024). These three instruments help researchers obtain comprehensive data on the validity and practicality of the developed products, so that the results of the evaluation can be used as a basis for improving learning media.

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Data Analysis Techniques

Data analysis was carried out to determine the validity and practicality of the product through a questionnaire filled out by experts and students. The data collected is in the form of qualitative inputs and quantitative calculations to assess the feasibility of the product.

1. Product Validity Analysis

The validity of the product is determined by the evaluator's assessment of the validation questionnaire. In Table 1, the following product validation criteria are presented:

Table 1. Product Validation Criteria

Criteria	Remarks
80% < N ≤ 100%	Highly Valid
60% < N ≤ 80%	Valid
40% < N ≤ 60%	Quite Valid
20% < N ≤ 40%	Invalid
0% < N ≤ 20%	Highly Invalid

Analysis based on Table 1., E-LKPD is declared valid if the assessment results >60%, are included in the category of "Valid" to "Very Valid". If it meets these criteria, the product can be tested after being revised according to expert advice. Conversely, if the result is ≤60%, the product must be revised and revalidated. After the product validity test was carried out, the researcher made content improvements, improved appearance, added multimedia elements, and prepared usage guidelines for teachers so that implementation in the classroom was more effective.

2. Product Practicality Analysis

The practicality of the product was obtained from the students' responses to the questionnaire. The following in Table 2 are the criteria for evaluating the practicality of the product:

Table 2. Product Practicality Assessment Criteria

Criteria	Remarks
80% < N ≤ 100%	Very Practical
60% < N ≤ 80%	Practical
40% < N ≤ 60%	Quite Practical
20% < N ≤ 40%	Impractical
0% < N ≤ 20%	Very Impractical

Based on Table 2. If the results of the student questionnaire are >60%, then the E-LKPD is included in the category "Practical" to "Very Practical". If the result is ≤60%, the product needs to be revised and retested for practicality according to the students' suggestions. The next thing that is done is to include socialization of E-LKPD to teachers, training on the use of media, limited trials in the classroom, and

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monitoring and evaluation of the use to ensure that media can be applied effectively in learning.

In addition to quantitative validity, qualitative inputs from teacher and student interviews were analyzed to assess user experience of E-LKPD. This analysis includes responses regarding multimedia and educational game elements, engagement levels, ease of use, and barriers encountered during the trial. The results are used to refine the content, display, and interactivity of the product to better suit learning needs.

Results and Discussion

Development Results

1. Analysis Stage

In the *analysis* stage, the researcher conducted a preliminary survey at SMP Negeri 5 Terbanggi Besar through interviews and observations to identify the needs and problems of mathematics learning, especially in integer material. It was found that learning was still dominated by lectures, the LKPD used was not interesting, and the application of *the Problem Based Learning* (PBL) model was not optimal. Students consider mathematics boring because it is only presented in the form of counting problems without interesting context or supporting visuals. Even though schools have ICT and internet facilities that have not been utilized to the fullest. Based on these findings, the researcher concluded the need to develop an interactive and contextual PBL-based E-LKPD, equipped with *educational games*, so that the learning process is more interesting, meaningful, and in accordance with the needs of students. This solution is also supported by research from Supriatna et al. (2022), Purnama and Suparman (2020), which shows that the use of Problem-Based Learning-based E-LKPD can increase student engagement, concept understanding, and motivation to learn through the presentation of material that is contextual, interactive, and supported by relevant digital media.

2. Design Stage

At this stage, the researcher designed a learning medium in the form of Mathematics E-LKPD for class VII integer material with *a Problem Based Learning* (PBL) approach. Development began by collecting material from three main textbooks, namely *the Encyclopedia of Mathematics Formulas for Junior High School Grades 7, 8, 9* by Badriyah (2016), *Junior High School Mathematics Class VII* by Marsigit and Susilo (Yudhistira), and *Preparation for the National Mathematics Exam for Junior High School / MTs* by Riyadi (Grafindo Media Pratama). The material is arranged following the PBL syntax, such as problem orientation, group work, investigation, presentation, and reflection. E-LKPD is equipped with a link or QR code to the Wordwall educational game which contains multiple-choice questions as a final exercise. The design of E-LKPD includes parts such as covers, instructions, learning objectives, materials, student activities, bibliography, and developer profiles, and is supported by visual elements such as images and animations to appear attractive and easy to understand.

Before being submitted to subject matter experts and media experts, the E-LKPD is first designed through several stages, starting with creating a custom size design in Canva and supporting visual elements, then downloading in PDF format

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and uploading it to the Liveworksheet platform for interactive elements to be added. After that, the E-LKPD link is integrated through Heylink.me so that it is easily accessible to students. This final product is then revised based on needs and prepared for the validation process by experts. The following in Figure 2, Figure 3, Figure 4, Figure 5, Figure 6, and Figure 7 are presented the results of product development in this study.

Figure 2. Cover E-LKPD
Attractive covers to motivate students to use media and give a professional impression.

Figure 3. Foreword of E-LKPD
Explain the purpose, benefits, and how to use E-LKPD, prepare students before learning.

Figure 4. Integer Material Summary
Provide a summary of important concepts to facilitate understanding and self-learning.

Figure 5. Contents of E-LKPD
Complete materials are presented systematically and interactively, supporting PBL flow and student understanding.

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Figure 6. Sub subject matter Divide the material into focused sections so that students understand the concepts gradually.

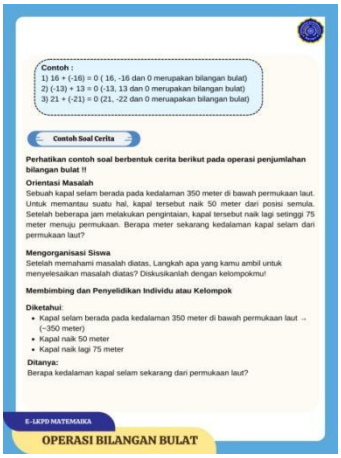

Figure 7. Example of Integer Material Problems with PBL Syntax Questions according to PBL syntax to train students' critical thinking, collaboration, and problem-solving.

3. Development Stage (Design)

The development stage aims to showcase products that have been designed to be validated by experts. The material validation test was carried out by three validators, namely two mathematics education lecturers from the University of Muhammadiyah Metro and one mathematics teacher from SMP Negeri 5 Terbanggi Besar. The media evaluation also involved three validators with the same background. The following in Figure 8 is presented the results of the material validation assessment.

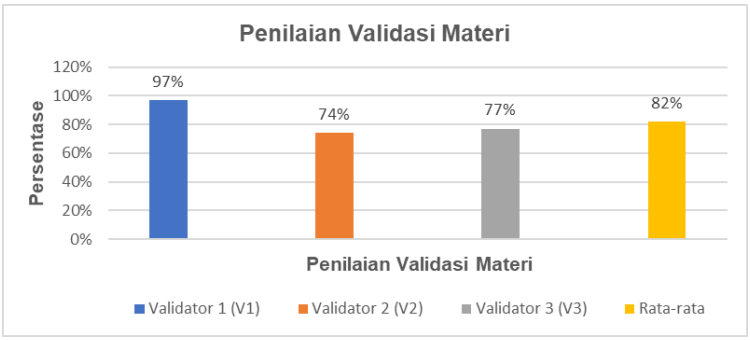

Figure 8. Expert Assessment

Based on Figure 8, validator 1 gave an assessment of 97%, validator 2 of 74%, and validator 3 of 77%, so that the average assessment of the three reached 82%, in the category of very valid. Thus, the E-LKPD product based on *Problem Based Learning* and supported by an integer material educational game for class VII is considered very valid for practical tests. However, the product still needs to be refined based on feedback and recommendations from validators. Figure 9 below is the result of the media validation assessment.

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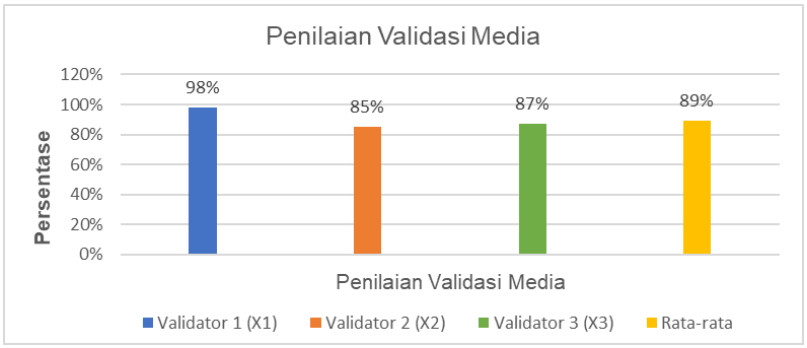

Figure 9. Media Expert Ratings

Based on Figure 9, three media validators gave assessments with percentages of 89%, 85%, and 87%, respectively, so that the average assessment reached 87% and was included in the very valid category. This shows that the Problem Based Learning-based E-LKPD product which is equipped with educational games on integer materials for grade VII students is very valid in terms of content practicality. While the product is already usable, further development is still needed in response to feedback and recommendations provided by media validators.

After the validation test was carried out by the validator of material and media experts, the average validation results presented in the following 10 figures were obtained:

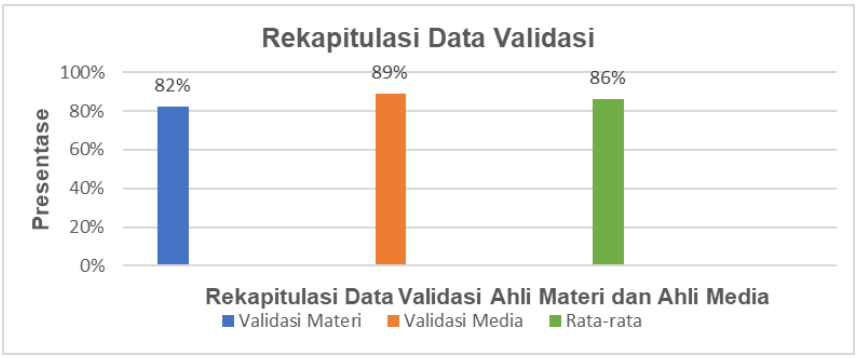

Figure 10. Data recapitulation of Validation Results

Based on Figure 10, the validation of materials and media reached 82% and 89%, respectively, both of which were categorized as very valid. The overall average of 86% shows that Problem Based Learning-based E-LKPD products with class VII integer material educational games are very valid in terms of material and media, and are worthy of being tested for practicality.

After the product was declared very valid through revision and assessment, it was followed by a small-scale trial on Saturday, May 3, 2025, in class VIIE SMP Negeri 5 Terbanggi Besar with 28 students. Of these, 10 participants were randomly selected as samples for the study. From these results, it is presented in Figure 11 which can be seen below.

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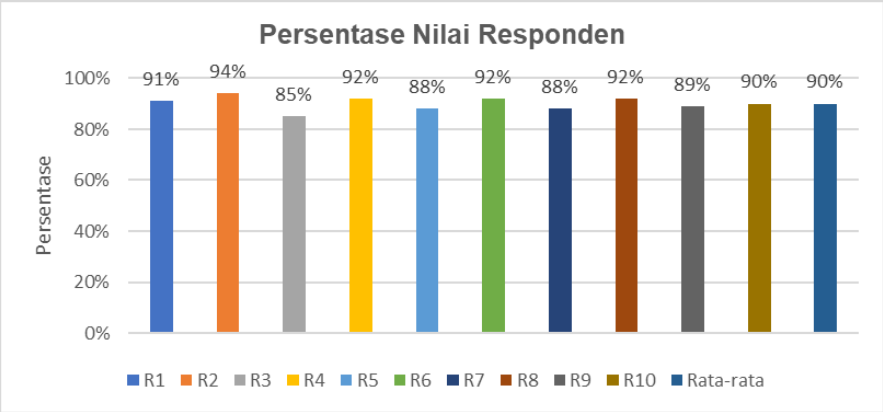

Figure 11. Percentage of Respondent Score

Based on Figure 11, ten respondents gave ratings between 85% and 94%, all of which were categorized as very practical. The average assessment score was 89%, showing that E-LKPD based on Problem Based Learning and equipped with educational games for class VII integer material is considered very practical and suitable for learning. Feedback from students, such as additional requests for contextual sample questions, color combination adjustments, and simplification of instructions, is then integrated into the product revision. This ensures that E-LKPD is not only engaging and interactive, but also easier to understand, relevant to the student experience, and supports a more effective learning process.

4. Implementation

At the development stage of the ADDIE model, the researcher did not carry out the implementation stage because the focus was only on developing products that met the criteria of validity and practicality through expert assessments and limited trials. The implementation stage is usually used to test the effectiveness of the product broadly in the classroom, as explained by Sariani and Suarjana (2022), but this has not been the focus of this research. To overcome the limitations of access to premium features and unstable internet connections, the product can be prepared in an offline version with material that remains complete and interactive, as well as providing alternative supporting media such as PDFs and local videos. Compared to previous research, this PBL-based E-LKPD equipped with educational games shows advantages in the integration of multimedia and interactivity, allowing students to learn more independently, solve problems contextually, and significantly increase engagement, so that this product offers more comprehensive and interesting innovations than conventional learning media. Full implementation can be carried out in follow-up research to evaluate the impact of the use of E-LKPD on learning outcomes and overall student motivation.

5. Evaluation

The evaluation stage in the ADDIE model is carried out at each step of product development. At the analysis stage, the researcher revised the interviews to strengthen data related to teaching materials and learning media at SMP Negeri 5 Terbanggi Besar, finding that students need more interesting learning media because the existing LKPD and printed books are less aesthetically pleasing and PBL learning is not optimal. Furthermore, in the design stage, researchers faced obstacles in using Canva's paid features so they had to subscribe to access them. In

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the development stage, the product is revised based on the input of material and media expert validators, such as writing improvements, consistency of mathematical symbols, font adjustments, and color combinations and illustration layouts to make them more attractive. The results of the assessment of material experts, media experts, and students show that E-LKPD based on *Problem Based Learning* with the addition of an educational game of integer material for grade VII is valid and practical for use in learning.

Final Product Discussion

This research and development uses the ADDIE model starting from the stage of analyzing the needs of students at SMP Negeri 5 Terbanggi Besar. The results of the pre-survey show that students need more interesting learning media because mathematics learning still uses boring printed books and conventional LKPDs. In addition, the implementation of *the Problem Based Learning* (PBL) model has not been maximized and the available technology facilities have not been utilized optimally. To answer these needs, the researcher designed PBL-based E-LKPD that is interactive, visually appealing, and equipped with educational games. The E-LKPD design was created using Canva, a platform that is considered user-friendly and supports multimedia (Yuliandriati et al., 2019), then uploaded to Liveworksheet so that it can be used online and interactively (Supriatna et al., 2022; Widiyarsih et al., 2023). The product is further published through a Heylink.me that brings together various learning links in a single access page, and is enriched with an educational game from Wordwall that provides interactive quizzes to support learning evaluation (Silalahi et al., 2024).

The development stage continued with validation by three material experts and three media experts. The validation results showed an average score of 82% from material experts and 89% from media experts, both of which were considered very valid. This indicates that the E-LKPD developed meets the eligibility criteria as a learning medium that supports the PBL approach in an effective, interesting, and in accordance with the needs of students. These findings are supported by research by Phatona et al. (2024) which shows the effectiveness of technology-based PBL media in improving conceptual understanding and mathematical problem-solving skills. Similar research by Cholid & Peni (2024) also shows that products validated by experts with scores above 80% are able to encourage active engagement of learners and increase learning motivation.

After being declared valid, the product was tested for practicality on 10 students. The results of the practicality test showed an average score of 90% and were categorized as very practical. Students consider E-LKPD to be easy to use, attractive in appearance, and easy to understand, and the educational games help in understanding the material in a fun way. This is in line with the research results of Azhari & Yudha (2022), Putri & Raharjo (2024), which show that interactive E-LKPD can significantly increase students' understanding of concepts and learning interests. The main advantage of this product lies in the integration of multimedia and the PBL approach that encourages active, exploratory, and reflective learning (Firdaus & Pahlevi, 2022). However, the limitations of the product lie in the need for a stable internet connection and limited access to Wordwall's premium features.

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Overall, this E-LKPD is suitable for use as a teaching material in grade VII mathematics learning, especially in integer material.

In addition to the findings of validity and practicality, the effectiveness of the use of multimedia-based E-LKPD has also been widely proven in various studies. Awe and Ende (2019) stated that the development of multimedia-filled E-LKPD is able to significantly improve students' cognitive abilities because it presents the material visually, interactively, and interestingly. Damayanti (2020) found that interactive multimedia-based learning media has a positive impact on learning outcomes, especially when adjusted to students' learning styles. Research by Firtsanianta and Khofifah (2022) strengthens these findings, concluding that E-LKPD integrated with the Liveworksheet platform is effective in improving learning outcomes and facilitating access in online learning. In addition, the use of Wordwall educational games has been shown to increase student understanding and engagement, as shown by Aprilia et al. (2024), where students experience an increase in average scores on the IPAS concept comprehension test after using educational game media. Thus, the combination of PBL-based E-LKPD, multimedia, and educational games not only makes learning more interactive and fun, but also has the potential to significantly improve academic grades and mathematical problem-solving skills, creating a more active, meaningful, and impactful learning experience for students.

The combination of PBL-based E-LKPD with multimedia and educational games creates a more interactive, fun, and meaningful learning experience. However, this study still has limitations, including focusing on validity and practicality tests on a small scale so that it has not assessed its long-term application in a wider classroom. Nevertheless, these findings provide evidence that educational technology can improve student engagement, concept understanding, and motivation to learn. Going forward, this model has the potential to be applied in other schools that face similar challenges, especially in improving the quality of PBL-based learning, utilizing interactive media, and integrating educational games to support the development of 21st-century skills, such as critical thinking, collaboration, and creativity.

Conclusions and Suggestions

Based on the results of the research, it can be concluded that the development of Problem Based Learning *(PBL)-based E-LKPD* which is equipped with an educational game on integer material for grade VII at SMP Negeri 5 Terbanggi Besar using the ADDIE model has succeeded in producing a very valid and very practical learning media.

This research has several limitations, namely the development of E-LKPD is only limited to integer material and specifically for grade VII junior high school. The media developed is in the form of E-LKPD based on *Problem Based Learning* (PBL) assisted by educational games, but can only be accessed online and is not yet available in an offline version. In addition, the educational game used, namely Wordwall, has full features that are mostly only available on the paid version, thus limiting the variety of games that can be applied. Product development is also only carried out up to the trial stage in small groups and has not been widely

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disseminated due to the limitations of researchers. Therefore, it is recommended that the development of E-LKPD in the future include a wider range of materials and grade levels, provide offline versions to be accessible without an internet connection, explore alternative educational game platforms that are more flexible and free, and conduct larger-scale trials to test the effectiveness and acceptability of the product more comprehensively.

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