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DEVELOPMENT OF A PROBLEM-BASED LEARNING-BASED MATHEMATICS E-MODULE USING FLIPBOOK MAKER ON NUMBER PATTERN MATERIAL

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ABSTRAK

Rendahnya minat siswa memahami konsep matematika di SMPN 2 Batanghari berdasarkan hasil wawancara dan pengamatan. Penggunaan teknologi dalam pembelajaran belum maksimal, meskipun alat pembelajaran seperti tablet dan jaringan Wi-Fi sudah ada dan dapat diakses oleh siswa. Tujuan penelitian adalah mengembangkan media pembelajaran berupa E-Modul Matematika yang berbasis Problem Based Learning dengan bantuan Flipbook Maker tentang materi pola bilangan yang memenuhi kriteria valid dan praktis. E-modul yang dikembangkan memuat ringkasan materi, contoh soal, serta kode QR yang terhubung dengan video pembelajaran untuk mendukung pemahaman siswa. Metode penelitian yang digunakan adalah Research and Development dengan model ADDIE yang mencakup tahap analisis, desain, pengembangan, implementasi, dan evaluasi. Hasil penelitian menunjukkan bahwa E-Modul Matematika yang dikembangkan memperoleh nilai rata-rata validasi materi sebesar 85% dengan kategori sangat valid, serta validasi media sebesar 91% yang juga termasuk kategori sangat valid. Dengan demikian, dapat disimpulkan bahwa E-Modul Matematika yang berbasis PBL dengan bantuan Flipbook Maker pada materi pola bilangan dinyatakan sangat valid dan praktis untuk digunakan dalam pembelajaran.

***Kata Kunci**: e-modul matematika, flipbook maker, pola bilangan.*

ABSTRACT

The low interest of students in understanding mathematical concepts at SMPN 2 Batanghari is based on the results of interviews and observations. The use of technology in learning is not optimal, even though learning tools such as tablets and Wi-Fi networks are already available and accessible to students. The purpose of this research is to develop learning media in the form of a Mathematics E-Module based on Problem Based Learning with the help of Flipbook Maker on the material of number patterns that meet valid and practical criteria. The developed E-module contains a summary of the material, example questions, and QR codes connected to learning videos to support student understanding. The research method used is Research and Development with the ADDIE model which includes the stages of analysis, design, development, implementation, and evaluation. The results of the study show that the developed Mathematics E-Module obtained an average value of material validation of 85% with a very valid category, and media validation of 91% which is also included in the very valid category. Thus, it can be concluded that the Mathematics E-Module based on Problem Based Learning with the help of Flipbook Maker on the material of number patterns is declared very valid and practical for use in learning.

Keywords: development; digital comics; learning media; trigonometry

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Introduction

Learning is a process through which individuals undergo changes in behavior, encompassing knowledge, attitudes, and skills, as a result of new experiences (Faizah & Kamal, 2024). It can also be understood as a transformation in one's personality that involves the enhancement of knowledge, behavior, skills, cognitive abilities, understanding, and attitudes, as well as other competencies. In the learning process, educators are required to carefully select appropriate instructional media to ensure effective learning. The use of diverse and relevant learning media can encourage student engagement and facilitate a more effective learning environment, enabling students to participate actively and meaningfully (Maimunah, 2016). Learning media are not limited to printed materials but can also be developed by utilizing increasingly advanced digital technologies to meet students' needs. In addition, the instructional methods applied by educators play a crucial role in influencing students' learning outcomes.

A common problem in mathematics is a lack of student interest in understanding mathematical concepts and the importance of utilizing existing technology. At SMPN 2 Batanghari, mathematics learning is limited to printed media, while the technology, facilities, and infrastructure are quite comprehensive. At SMPN 2 Batanghari, students are provided with tablets and access to Wi-Fi. Although print media is quite effective in learning, the use of other learning media, such as e-modules, will enhance their effectiveness. The mathematics e-modules are presented with child-friendly designs and attractive color combinations (Maniq et al., 2022). In order to help learners deal with real-life problem-solving difficulties, learning media that incorporates authentic everyday contexts is necessary. Problem-Based Learning (PBL) is considered an appropriate model to be implemented in this media (Sugiharti et al., 2025). The PBL learning paradigm actively involves students in the process of solving real-world problems (Darojah et al., 2025). The results of the study show that the way students understand and solve problems varies (Ningrum et al., 2025).

Providing additional educational resources is crucial to ensure students' continued efforts to understand and conceptualize new information. Additional education can take the form of tutoring, private lessons, or other resources, including e-modules. E-modules are electronic educational tools consisting of interconnected learning facilities designed to be as engaging as possible, fostering interest in learning and helping students overcome difficulties in understanding the material (Raqzitya & Agung, 2022). Educators are required to be creative in delivering materials and creating learning media so that students can access them quickly and easily. The compact format of e-modules, such as those for number patterns, makes it easy for students to study them anywhere, unlike printed textbooks that contain tens or hundreds of pages, which can be cumbersome to carry and limit learning opportunities due to their limited practicality.

A flipbook maker is software that allows each page to open like a book (Haryanti and Saputro, 2016). This flipbook maker makes e-modules more engaging because students can open them like a book, even when accessed from their mobile phones or laptops. The advantages of flipbooks include alleviating student boredom due to the more creative and varied learning media used. They are easily accessible

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for independent learning, prevent students from getting bored with reading while studying, and provide diverse experiences in accessing the media they use. Students can access them without an internet connection because these flipbook maker-assisted e-modules can be used anytime, according to their needs.

Several relevant studies support the development of problem-based learning (PBL) e-modules using flipbook makers. Jayanti et al. (2022) developed a trigonometry e-module with a STEAM-based Project-Based Learning model. The similarities lie in the type of media, while the differences lie in the learning model. Hidayatulloh (2016) developed a PBL-based mathematics e-module assisted by GeoGebra, which is similar in the use of media and models, but differs in supporting applications. Friska et al. (2022) developed a PBL-based science e-module assisted by Flipbook maker at the elementary school level, relevant in terms of media, models, and applications, but different in material and level. Kahfi et al. (2021), through a quasi-experiment, demonstrated the effectiveness of the Interactive Flipbook in improving mastery of the concept of number patterns in junior high school. Furthermore, Andari & Setyadi (2023) developed a number pattern e-module with the ADDIE model, which was declared valid, practical, and effective. Based on this research, the development of a PBL-based e-module assisted by Flipbook maker has the potential to support mathematics learning, especially in the material of number patterns in junior high school.

Research Methods

The development model used in this research is ADDIE because it is simpler and easier to understand than other models (Branch, 2009). Its stages include Analysis, Design, Development, Implementation, and Evaluation, as presented in Figure 1.

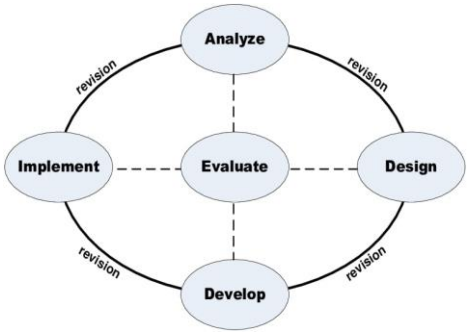

Figure 1. *The ADDIE concept* oleh Branch (2009)

The ADDIE stages in this study are:

Analysis Stage

This stage aims to identify students' learning needs and problems (Kurnia et al., 2019). The analysis results indicate low student interest in mathematics, limited learning resources to printed textbooks and worksheets, and unmotivating conventional methods. The material analysis focused on eighth-grade number patterns, structured according to learning outcomes, to form the basis for developing a Problem-Based Learning (PBL)-based e-module using Flipbook Maker.

Design Stage

The teaching materials design stage aims to develop an e-module that aligns with learning outcomes and objectives (Kurnia et al., 2019). The steps for creating a

Problem-Based Learning (PBL)-based e-module using Flipbook Maker include: creating an attractive cover, developing learning outcomes (CP) and learning objectives (TP) according to the curriculum, developing a concept map of the number pattern material, compiling materials, sample questions, and practice questions according to PBL syntax, and adding a QR Code that links to related learning videos.

Development Stage

The development stage aims to produce a product in accordance with the research design. The learning media were validated by material and media experts to obtain input before the trial. Next, a practicality test was conducted on 10 grade VIII A students at SMP Negeri 2 Batanghari using a satisfaction questionnaire to assess the product's practicality.

Implementation Stage

The media was used in actual learning by teachers and students, followed by questionnaires to assess the media's practicality, ease of use, and effectiveness.

Evaluation Stage

The evaluation stage was conducted to assess the quality of the mathematics product by collecting data from validation questionnaires from media and material experts, as well as student responses after the trial. The evaluation results were used to improve the product to make it more valid and practical.

Data Collection Instruments

The instruments employed for data collection in this study consisted of interviews and questionnaires. Interviews were conducted with mathematics teachers to identify students' difficulties in learning mathematics at SMPN 2 Batanghari. Meanwhile, questionnaires were distributed to gather students' responses and to facilitate expert validation of the developed product. The validation instruments were administered to subject matter experts, media experts, and design experts to evaluate aspects such as content accuracy, language appropriateness, alignment with the Problem Based Learning approach, as well as the overall quality and presentation of the learning media (Apsari & Rizki, 2018). In addition, student response questionnaires were designed to assess the relevance of the material to learning objectives, clarity of instructions, level of comprehension, ease of use of the e-module, visual layout of text and images, color and background design, and the accessibility of following the Problem Based Learning stages through the e-module (Apsari & Rizki, 2018). The data obtained from these instruments were utilized to revise and enhance the e-module, ensuring that it meets the criteria of validity, practicality, and effectiveness.

Data Analysis Techniques

Data analysis was conducted to determine the validity and practicality of the product through questionnaires completed by experts and students. The collected

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data consisted of qualitative input and quantitative calculations to assess the product's feasibility.

1. Product Validity Analysis

According to Krisnanti et al. (2020), the formula for managing data per group from all items is shown in Table 2 as follows.

Table 2. Product validation criteria

Criteria	Description
80% < N ≤ 100%	Very Valid
60% < N ≤ 80%	Valid
40% < N ≤ 60%	Quite Valid
20% < N ≤ 40%	Invalid
0% < N ≤ 20%	Very Invalid

Based on the table above, if the percentage obtained is >60%, then the e-module is categorized as at least "valid" and at most "very valid." After meeting these criteria, the product is deemed suitable for small-group testing.

2. Product Practicality Analysis

Based on the small-group testing, the product's practicality is analyzed and categorized according to interpretation criteria. According to Krisnanti et al. (2020), data per group for all items is calculated using the formula in Table 3 below.

Table 3. Product practicality assessment criteria

Criteria	Description
80% < N ≤ 100%	Very Practical
60% < N ≤ 80%	Practical
40% < N ≤ 60%	Quite Practical
20% < N ≤ 40%	Not Practical
0% < N ≤ 20%	Not Very Practical

Based on the table above, if the student response rate is >60%, the developed e-module meets the minimum criteria of "Practical" and the maximum of "Very Practical." Therefore, the product can be considered practical and suitable for use, with revisions still needed if necessary.

Results and Discussion

1. Analysis Stage

The analysis stage was conducted to obtain an overview of the problems experienced by students in learning mathematics, particularly regarding number patterns. Needs analysis is crucial to ensure that the developed product aligns with real-world problems (Sugiyono, 2016), while simultaneously aligning the e-module with learning outcomes and objectives (Kurnia et al., 2019). Interviews with educators and students at SMP Negeri 2 Batanghari revealed that despite the implementation of the Independent Curriculum, students still struggled to understand the concept of number patterns and solve word problems. The teaching materials used, in the form of printed textbooks and worksheets (LKS), were conventional and lacked interactive capabilities, while digital tools such as Wi-Fi and tablets were not optimally utilized. Therefore, the development of a Problem-Based Learning (PBL) e-module using a Flipbook Maker was necessary to allow students

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to practice solving contextual problems according to PBL syntax, gain interactive learning experiences, and learn independently. The second interview evaluation confirmed the high need for digital teaching materials that utilize everyday technology, and it is hoped that this e-module will improve students' understanding of number patterns.

2. Design Stage

In the design stage, the product is developed based on the needs analysis results by structuring the e-module, including the cover, concept map, learning objectives, materials, sample questions, and evaluation. This e-module is designed based on Problem-Based Learning (PBL) and is supported by the Flipbook Maker application so that it can be accessed digitally via smartphones, tablets, or laptops with an interactive display resembling a printed book. The design steps include: creating an attractive cover, compiling learning outcomes (CP) and learning objectives (TP), creating a concept map, organizing materials and questions according to PBL syntax, and adding a QR Code containing a learning video. After the module is created in Microsoft Word, the file is exported as a PDF, then uploaded to Flipbook Maker, and finally, a link to the resulting flipbook is shared with students for use as an interactive learning tool. Figures 1–10 represent the design results from this development:

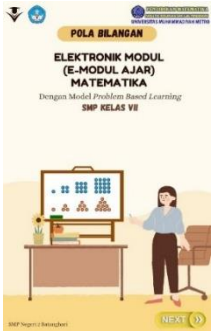

Figure 1. Initial view of the e-module cover
Shows the e-module cover page, which serves as an identity and initial attraction for users.

Figure 2. E-module foreword
Contains a greeting and the purpose of the e-module, expressing the author's hope that this e-module

Figure 3. Display of the e-module user manual for teachers and students

Figure 4. Display of the concept map page for the number pattern material in the e-module

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Provides user guidance so that teachers and students can understand how to use the e-module effectively.

Figure 5. CP and TP page displays and PBL syntax learning steps

Explains the learning objectives and steps of the PBL model as a guide in the learning process.

Shows the relationships between the number pattern sub-materials to help students understand the flow and interconnectedness of the concepts.

Figure 6. Arithmetic sequence sub-topic display

Presents arithmetic sequence material as a foundation for students' understanding of number patterns.

Figure 7. Arithmetic sequence sub-topic display

Contains an explanation of arithmetic sequences to help students understand the concept of adding arithmetic sequences.

Figure 8. Practice question instruction display

Provides direction before students work on the exercises so they understand how to answer correctly.

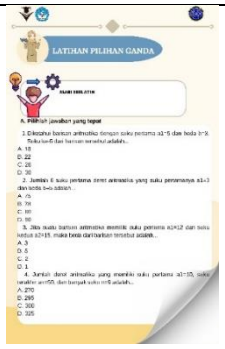

Figure 9. Multiple-choice practice page display in the e-module

Displays objective exercises to measure students' understanding of number patterns.

Figure 10. Essay practice page display in the e-module

Contains essay exercises to train students' critical thinking and problem-solving skills.

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3. Development Stage

The development stage was conducted after the product design was completed, followed by a validity test by two material experts and two media experts to assess the validity of the content and presentation before implementation (Kristana et al., 2020). Next, a practicality test was conducted on 10 respondents to assess the product's ease of use.

Material Expert Validation Results

Material validation aims to evaluate the practicality of the product before it is tested on students. This process was conducted by two validators: a Mathematics Education lecturer at Muhammadiyah Metro University and a Mathematics teacher at SMP Negeri 2 Batanghari. The validation findings from both validators are shown in Table 1 below.

Table 1. Material Expert Validation Results

Material Expert Validation Results			
Aspect	**Percentage**		**Percentage Per Aspect**
	Validator (V1)	**Validator (V2)**	
Content and Material	85%	85%	85%
Language Quality	76%	84%	80%
Use of the PBL Model	80%	100%	90%
Average	**80%**	**90%**	**85%**
Description			**Very Valid**

Based on Table 1 the results of the material validation, the analysis showed that the average percentage of each aspect assessed by validator 1 was 80%, and by validator 2, 90%. Thus, the overall average percentage for both validators reached 85%. These results indicate that the developed e-module was categorized as "Very Valid" based on the appropriateness of the content and material, language quality, and use of the PBL model.

Media Expert Validation Results

Media validation was conducted to determine the appropriateness of the product prior to its implementation with students. This process involved two media expert validators, consisting of a lecturer in Mathematics Education from Muhammadiyah Metro University and a mathematics teacher from SMP Negeri 2 Batanghari. The results of the validation carried out by both experts are presented in Table 2.

Table 2. Media Expert Validation Results

Media Expert Validation Results			
Aspect	**Percentage**		**Percentage Per Aspect**
	Validator (V1)	**Validator (V2)**	
General Quality	87%	93%	90%
Specific Quality	85%	90%	88%
Media Presentation	93%	100%	97%
Average	**88%**	**94%**	**91%**
Description			**Very Valid**

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Each Table 2 aspect scored by validator 1 was 88%, and by validator 2 was 94%. Thus, the overall average percentage across the three validators reached 91%. These results indicate that the developed e-module was categorized as "Very Valid."

Practicality Trial Results

Based on the assessment results, the validators declared the revised product to be very valid. The research continued with a small-scale trial (practicality test) conducted on Monday, September 14, 2025, in class VIIE of SMP Negeri 2 Batanghari with a total of 22 students. Of these, 10 participants were randomly selected as a sample. The results of the practicality test are presented in Table 3.

Table 3. Practicality test results (students)

Student Response Results (In Percentage)											
Aspect	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**Rata-rata persentase per aspek**
Content and Material	92	80	72	96	80	84	76	72	96	88	83
Appearance	80	100	60	80	80	100	100	100	80	100	89
Use of the PBL Model	100	60	100	80	40	80	100	60	100	80	78
Average Per Respondent	**91**	**80**	**77**	**85**	**67**	**88**	**92**	**77**	**92**	**89**	**83**
					Category						**Sangat Praktis**

Based on Table 3 practicality data were obtained through an assessment of the responses of 10 randomly selected seventh-grade students at SMP Negeri 2 Batanghari to the Problem-Based Learning (PBL)-based e-module using a questionnaire covering three aspects: content and material, presentation, and use of the PBL model. The content and material aspect comprised five indicators, with an average percentage of 84%, categorizing them as very practical, although the understanding of the concept of number patterns was only 66%. The presentation aspect had two indicators with an average score of 88%, indicating that the e-module was visually appealing and the layout supported understanding of the material. The use of the PBL model aspect comprised one indicator with a score of 80%, indicating that the PBL approach was quite effective but required further adaptation by students. Overall, the average score for all three aspects reached 84%. Therefore, the PBL-based e-module was considered very practical, able to help students understand the material on number patterns, visually appealing, and quite effective to use, although understanding of the concept and application of PBL could still be improved.

4. Implementation Stage

In this study, the implementation stage was not carried out. This is because

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the research focused only on the development stage, namely, producing a problem-based learning e-module product that meets validity and practicality criteria. According to Branch (2009), the implementation stage is usually conducted to assess the effectiveness of the media in the classroom. However, because this research only reached the development stage, implementation was considered the scope of further research. Therefore, the research was stopped at the development stage, while implementation and measurement of product effectiveness could be conducted in further research.

5. Evaluation Stage

The final phase of the ADDIE development model is evaluation, which is carried out at every stage to examine the quality of the product and to provide a foundation for revisions, ensuring that the developed learning media aligns with the research objectives. The evaluation process incorporated feedback from subject matter experts, media experts, and students' responses obtained through practicality questionnaires. During the analysis phase, the evaluation confirmed that students required e-modules, as the learning process still depended largely on printed textbooks and worksheets, while available digital resources had not been optimally utilized. In the design phase, improvements were made by refining the layout using a premium Canva account, aligning the e-module content with learning outcomes and objectives, and integrating concept maps as well as QR codes linked to instructional videos.

In the development phase, expert validation was conducted, resulting in recommendations for enhancing mathematical notation, ensuring consistency in terminology, improving layout and color composition, and optimizing the Flipbook display, which ultimately led to the e-module being categorized as valid. The implementation phase involved a small-scale trial with 10 students, indicating that the e-module was practical, engaging, and supportive of students' understanding, although minor challenges related to internet connectivity were identified. Overall, the Problem Based Learning-based e-module supported by Flipbook Maker fulfilled the criteria of validity and practicality, in accordance with the intended research goals.

This study used the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model to create a mathematics e-module using PBL, assisted by Flipbook Maker. During the analysis phase, interviews were conducted with teachers and seventh-grade students at SMP Negeri 2 Batanghari to determine learning needs and difficulties. The results showed that teachers still rely on less representative teaching materials, such as textbooks and student worksheets (LKS), which often lack interactive learning activities. At the same time, students face challenges in understanding the concept of number patterns, especially when dealing with contextual problems or word problems. Furthermore, the teaching

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materials do not cover real-life contexts, and available digital tools, such as tablets and Wi-Fi, are not effectively utilized in learning. These findings align with previous studies by Meika et al. (2021) and Purnama (2016), which showed that the use of e-modules can improve conceptual understanding and student learning engagement. Therefore, the creation of interactive e-modules based on the Problem-Based Learning approach is expected to address the shortcomings of current teaching materials and increase student motivation in learning mathematics.

During the design phase, researchers began designing the e-module, considering its appearance, content, language, and interactive features. The e-module was designed using Canva to facilitate the integration of text, images, videos, and external links that support learning. After that, the e-module was converted into a digital flipbook using Heyzine to make it more engaging and easily accessible through digital devices. This design allows for coherent, communicative, and interactive delivery of the material, tailored to the characteristics of digital-age learners. The addition of QR codes for learning videos and concept maps helps students understand the number pattern material visually and contextually. This approach aligns with research by Haryanti (2016), which states that the use of Canva can increase the visual appeal and accessibility of the e-module. With this design, students not only receive the material but also have a more enjoyable learning experience, relevant to everyday life, and encourage independent learning.

The development phase was conducted after the design was finalized, followed by validation by two material experts and two media experts. The validation results showed an average validity percentage of the e-module of 90%, categorized as highly valid. The material validator assessed that the e-module's content was coherent, clear, and aligned with the learning objectives. The media validator assessed the e-module's attractive appearance, with a combination of colors, images, and simple yet effective navigation. This validation, according to Budiarti and Riwanto (2021), is crucial for ensuring the quality of the teaching materials before the pilot test. Next, the e-module was piloted on a limited basis with 10 seventh-grade students at SMP Negeri 2 Batanghari. The pilot test results showed an average practicality score of 91%, with aspects of appearance, ease of use, usefulness, and contextual orientation rated highly practical, although internet connection was a minor obstacle when accessing videos via QR Code.

The implementation phase was not fully implemented because the research focused on developing the product to ensure its validity and practicality. Evaluations were conducted at each previous stage. During the analysis phase, interview items were added to enhance the data collection. The design phase was evaluated by addressing the limitations of Canva's paid features. The development phase was evaluated with revisions based on validator suggestions, such as improving the consistency of mathematical symbols, adding contextual examples, and adjusting color combinations for visual comfort. Implementation evaluation through a small-scale trial demonstrated that the e-module was easy to use, had an attractive appearance, and helped students understand number patterns. Overall, the evaluation confirmed that the product met the criteria for validity and practicality, in line with the research objective of producing appropriate, interactive learning media that facilitates student understanding. This aligns with the findings of Safrina et al. (2024), who emphasized the importance of continuous evaluation in ensuring

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the quality of digital learning products, and Feriyanti et al. (2019), who stated that the success of an e-module is determined by the appropriateness of its content, ease of use, and attractive appearance, which can increase student engagement and understanding.

The final e-module product has several advantages. First, the digital flipbook design is attractive and interactive, complete with illustrations, learning videos, and contextual practice questions. Second, it can be accessed through various devices, making it flexible for use anytime and anywhere. Third, it supports independent learning while facilitating teachers' interactive delivery of material. Its weaknesses include limited access due to unstable internet connections and the inability to optimally measure changes in student attitudes. Overall, the e-module complies with the Minister of Education, Culture, Research, and Technology Regulation Number 22 of 2022 concerning the criteria for good teaching materials: easy to understand, interesting, and communicative. This finding supports the statement of Afifah et al. (2023) that digital-based interactive e-modules can increase student learning motivation while facilitating more creative and independent learning. Problem-based learning e-modules can improve problem-solving skills (Uli et al., 2024). The effectiveness of e-modules has been proven to be effective in improving students' problem-solving abilities. (Setiawan et. al., 2024). This product is expected to be the right solution to overcome students' difficulties in understanding mathematics material, especially on the topic of number patterns, while also answering teachers' needs for more effective and interesting learning media than conventional methods.

Conclusions and Recommendations

Based on the research and development of a problem-based learning (PBL) mathematics e-module using a flipbook maker for number patterns in eighth-grade students at SMP Negeri 2 Batanghari, it can be concluded that this e-module is highly valid and practical. The Analysis phase demonstrated students' need for interactive media, as learning still relies on printed textbooks and worksheets (LKS), while digital resources are underutilized. The Design phase produced an e-module with concept maps, materials, sample problems, problem-based exercises, and QR codes for learning videos, which were then converted into an interactive flipbook format. The Development phase showed material validation results of 84–85% and media validation of 91%, categorizing it as highly valid. Practicality testing on 10 students showed a positive response with a percentage above 90%, proving the e-module is easy to use, engaging, and promotes understanding and problem-solving skills. This product utilizes technology, enriches teaching materials, and encourages active and independent student learning in accordance with the Independent Curriculum.

Teachers are advised to utilize this e-module as a supplement to printed textbooks or LKS, optimizing the use of tablets and Wi-Fi for technology-based learning. Students are expected to use e-modules independently at home to strengthen conceptual understanding and critical thinking skills; schools should support the provision of devices, stable networks, and short teacher training to maximize the use of e-modules; further researchers can continue to the Implementation and Evaluation stage, exploring other materials or subjects, and

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involving a wider trial group so that the impact of e-modules on learning outcomes can be measured comprehensively.

References

Afifah, D. N., Ratu, N., & Pratama, F. W. (2023). Pengembangan E-Modul OTAN Berbantu PhET Simulation Berbasis *Flipbook Maker* Pada Materi Operasi Hitung Pecahan. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 12*(1), 1018–1025. https://doi.org/10.24127/ajpm.v12i1.6629

Apsari, P. N., & Rizki, S. (2018). Media Pembelajaran Matematika Berbasis Android Pada Materi Program Linear. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 7*(1), 161–170. http://dx.doi.org/10.24127/ajpm.v7i1.1357

Andari, D. P., & Setyadi, D. (2023). Pengembangan E-Modul Sebagai Bahan Belajar Untuk Siswa SMP Pada Materi Pola Bilangan. *Histogram: Jurnal Pendidikan Matematika, 7*(1), 544–558 . https://journal.matappa.ac.id/index.php/histogram/article/download/2691/pdf/8226

Branch, R. M. (2009). *Instructional design: The ADDIE approach.* Springer. https://doi.org/10.1007/978-0-387-09506-6

Budiarti, W. N., & Riwanto, M. A. (2021). Pengembangan Modul Elektronik (E-Modul) Keterampilan Berbahasa dan Sastra Indonesia SD Untuk Meningkatkan Keterampilan Menyimak Mahasiswa PGSD. *Elementary School: Jurnal Pendidikan dan Pembelajaran ke-SD-an, 8*(1), 97–98. https://doi.org/10.31316/esjurnal.v8i1.996

Darojah, A. U. H., Vahlia, I., & Anwar, R. B. (2025). Pengembangan LKPD Berbasis Model Pembelajaran Problem Based Learning (PBL) Terintegrasi Nilai-Nilai Islam. *Jurnal Pendidikan Matematika Universitas Lampung*, 13(1), 41-53. https://jurnal.pbs.fkip.unila.ac.id/index.php/jpm/article/view/303/298

Faizah, H., & Kamal, R. (2024). Belajar dan pembelajaran. *Jurnal Basicedu, 8*(1), 466-476. https://doi.org/10.31004/basicedu.v8i1.6735

Feriyanti, N., Hidayat, S., & Asmawati, L. (2019). Pengembangan E-Modul Matematika Untuk Siswa SD. *JTPPm (Jurnal Teknologi Pendidikan dan Pembelajaran: Edutech and Instructional Research Journal), 6*(1), 1-12. https://jurnal.untirta.ac.id/

Friska, S. Y., Nurhalida, N., & Susilawati, W. O. (2022). Pengembangan E-modul IPA Tema 6 Subtema 2 Materi Siklus Hidup Hewan Berbasis Problem Based Learning Berbantu Flipbook Maker Di Kelas IV Sekolah Dasar. *JEMS: Jurnal Edukasi Matematika dan Sains, 10*(2), 377–382. https://api.semanticscholar.org/CorpusID:277875349

Haryanti, F., & Saputro, B. A. (2016). Pengembangan Modul Matematika Berbasis Discovery Learning Berbantuan Flipbook Maker Untuk Meningkatkan Kemampuan Pemahaman Konsep Siswa Pada Materi Segitiga. *Kalamatika: Jurnal Pendidikan Matematika, 1*(2), 147–161. https://doi.org/10.22236/KALAMATIKA.vol1no2.2016pp147-161

Jayanti, A. D., Nova, T., & Yunianta, H. (2022). Pengembangan Emometri (E-modul Trigonometri) dengan Project Based Learning berbasis STEAM. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 11*(2), 1116–1126. http://dx.doi.org/10.24127/ajpm.v11i2.4881

e-ISSN 2746-5594
p-ISSN 2746-5608

Kahfi, M., Setiawati, W., & Ratnawati, Y. (2021). Penggunaan Media Flip Book Interaktif Berbasis Kvisoft Flipbook Maker Dalam Meningkatkan Penguasaan Konsep Pola Bilangan Pada Pembelajaran Matematika. *Edutech, 20*(1), 779-790. http://ejournal.upi.edu/index.php/edutech/index

Krisnanti, D. A., Rizki, S., & Vahlia, I. (2020). Pengembangan Modul Matematika Berbasis Discovery Learning Disertai Nilai-Nilai Islam Materi Pertidaksamaan Rasional dan Irasional. In *Prosiding SNPPM-2: Seminar Nasional Penelitian dan Pengabdian Kepada Masyarakat* (hlm. 78–88). https://doi.org/10.24127/emteka.v4i2.3878

Kurnia, T. D., Lati, C., Fauziah, H., & Trihanton, A. (2019). Model ADDIE Untuk Pengembangan Bahan Ajar Berbasis Kemampuan Pemecahan Masalah Berbantuan 3D Pageflip. In *Prosiding Seminar Nasional Pendidikan Matematika* (hlm. 516–525). https://rb.gy/tutn5p

Maimunah, M. (2016). Metode Penggunaan Media Pembelajaran. *Al-Afkar: Jurnal Keislaman & Peradaban, 5*(1), 1–24. https://doi.org/10.28944/afkar.v5i1.107

Maniq, L. N. K., Karma, I. N., & Rosyidah, A. N. K. (2022). Pengembangan E-Modul Matematika Pada Materi Pecahan. *Journal of Classroom Action Research, 4*(1), 83–88. https://doi.org/10.29303/jcar.v4i1.1405

Meika, I., Ramadina, I., Sujana, A., & Mauladaniyati, R. (2021). Kemampuan Pemecahan Masalah Matematis Siswa Dengan Menggunakan Model Pembelajaran SSCS. *Jurnal Cendekia: Jurnal Pendidikan Matematika, 5*(1), 383–390. https://doi.org/10.31004/cendekia.v5i1.388

Ningrum, A. P. S., Andayani, S., Vahlia, I., & Dewi, W. U. (2025). Analysis Of Problem Solving In Spldv Material Using Castel Stages Reviewed From Students'learning Styles. EMTEKA: Jurnal Pendidikan Matematika, 6(2), 1006-1018. https://doi.org/10.24127/emteka.v6i2.8803

Purnama, S. (2016). Metode Penelitian Dan Pengembangan (Pengenalan Untuk Mengembangkan Produk Pembelajaran Bahasa Arab). *LITERASI (Jurnal Ilmu Pendidikan), 4*(1), 19–32. https://jbasic.org/index.php/basicedu

Raqzitya, F. A., & Agung, A. A. G. (2022). E-Modul Berbasis Pendidikan Karakter Sebagai Sumber Belajar IPA Siswa Kelas VII. *Jurnal Edutech Undiksha, 10*(1), 108–116. https://doi.org/10.23887/jeu.v10i1.41538

Safrina, K., Darwani, D., Susanti, S., & Nurfaiza, S. (2024). Pengembangan E-Modul Matematika Untuk Pembelajaran Remedial Pada Materi Bilangan. *Jurnal Cendekia: Jurnal Pendidikan Matematika, 8*(3). https://doi.org/10.31004/cendekia.v8i3.3545

Setiawan, H., & Rahayu, E. S. (2024). Development of E-Modules Based on Problem Based Learning Assisted by Flipbook on Environmental Change Material in High School to Improve Problem Solving Ability. *Journal of Biology Education*, *13*(1), 29-35. https://journal.unnes.ac.id/journals/ujbe/article/view/4091

Sugiharti, A., Vahlia, I., & Rahmawati, D. (2025). Pengembangan Aplikasi Android Berbasis Problem Based Learning Berorientasi Kebudayaan Lokal Materi Baris Dan Deret Aritmatika. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *14*(2), 409-423. https://doi.org/10.24127/ajpm

e-ISSN 2746-5594
p-ISSN 2746-5608

Sugiyono. (2017). *Metode penelitian dan pengembangan (R&D).* Alfabeta.

Ula, M., Mastur, Z., & Ridlo, S. (2024). Development Of An E-Module Containing Ethnomathematics In The Problem Based Learning (PBL) Model To Improve Elementary School Students' Problem Solving Abilities. *Tennessee Research International of Social Sciences*, *6*(2), 57-86. http://triss.org/index.php/journal/article/view/56