

An E-Module of Math Based on Problem-Based Learning for the Subject of Fractions in Elementary School

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ABSTRACT

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The purpose of the study was to create an electronic module utilizing problem-based learning strategies to aid students in comprehending fractions. The development phase employed the ADDIE model, which involves analysis, design, development, implementation, and evaluation. The research focused on evaluating the e-module's implementation and effectiveness by conducting assessments from media, subject matter, and learning experts, as well as from teachers and students. The feedback indicated that the e-module was highly feasible, with experts rating it as "very feasible" and teachers and students rating it as "extremely feasible." The e-module is considered appropriate for teaching fifth-grade elementary students.

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Introduction

The education sector has been transformed by scientific and technological advancements in the 21st century, which have brought about innovative changes such as e-learning [1]. E-learning is a type of distance learning that utilizes computer technology to allow individuals to learn remotely without physically attending classes. Remote learning has become increasingly important due to the COVID-19 pandemic [2-4], which has resulted in the need for electronic-based teaching materials like e-modules [5]. E-modules are self-study

materials presented in an electronic format containing animations, audio, and navigation that make the learning process more interactive and engaging. One commonly used teaching and learning model is the problem-based learning (PBL) model, which uses real-life problems to develop critical thinking skills and build new knowledge [6-8].

The proposed research aims to develop an e-module based on PBL with local wisdom for 5th grade student. This e-module will utilize the Flip PDF Professional application to enhance its appearance and incorporate local wisdom from Yogyakarta as an example in teaching fractions.

Method

The study follows the Research and Development (R&D) methodology, using the ADDIE model for instructional design. The research uses a combination of qualitative and quantitative data collection methods and evaluates the e-module using both Likert and Guttman scales. The evaluation is done using a survey questionnaire that includes criteria in five categories: expert in material, expert in media, expert in learning, teacher, and student, with different sets of aspects and criteria for each category. The instrument assesses the quality of the e-module based on a total of 78 criteria across all categories. The total number of criteria for each category is: Expert in Material (15 criteria), Expert in Media (13 criteria), Expert in Learning (15 criteria), Teacher (22 criteria), and Student (13 criteria). The e-module can be accessed at <https://online.flipbuilder.com/tzsbn/kinr/>.

Results

A. Media Expert Validation

Based on the assessment obtained from the validation carried out by media expert (LDP) on January 6th, 2021, the media expert's assessment was 76.92 with the criteria "Suitable". With this result, it can be concluded that the development of mathematics e-module based on problem based learning is suitable for use in learning. The media expert has recommended several changes to improve the e-module. These include centering the "e-module" text on the front cover, reducing the size of the picture, increasing the font size and spacing, providing a gap between the box and text, removing the picture at the bottom of the layout, and increasing the font size for the page number. Additionally, they suggest providing explanation videos for each material and adding a synopsis about the e-module on the back cover.

B. Subject Matter Validation

Based on the assessment obtained from the validation carried out by subject matter expert (AMM) on December 17th, 2021, the subject matter expert's assessment was 83.33 with the criteria "Very Suitable". With this result, it can be concluded that the development of

mathematics e-module based on problem based learning is suitable for use in learning. The subject matter expert provided several suggestions for the development of the e-module. Firstly, they suggested that the material should align with the learning achievement indicators. Secondly, they recommended including real-life examples that are relevant to the local wisdom of the area. Thirdly, they noted that the use of problem-based learning is not yet common and should be emphasized. Finally, they advised that the problems presented in the e-module should reflect the daily life of the students, in order to make the learning experience more relatable and practical.

C. Learning Expert Validation

Based on the assessment obtained from the validation carried out by learning expert (STM) on October 9th, 2021, the learning expert's assessment was 81.67 with the criteria "Very Suitable". Based on the results, it can be concluded that the development of the problem-based learning mathematics e-module is appropriate for use in the learning process. The learning expert provided several suggestions, including the need for clear objectives, a detailed explanation of the origin of numbers in problem-solving, the use of appropriate markers for shapes, good contrast for visibility, avoiding inappropriate words, and preventing writing errors.

D. Evaluation of Math E-Module

The evaluation of students towards the problem-based learning math e-module was 93.84 in the small group and 99.04 in the large group, both receiving the "Very Suitable" category. The students expressed their interest in learning through their evaluations, with feedback such as: "I enjoy learning with the e-module," "The module is great, with videos included," "It helps me understand fractions," "Math is now fun," "The images are good," "The e-module is great and engaging."

The teacher evaluation, calculated through a formula, resulted in a score of 97.72, with a "Very Suitable" rating. The e-module's development for teaching math on fraction topics was concluded to be suitable for use in the classroom. The teacher provided feedback such as "The e-module is highly helpful in assisting students' understanding, especially during the pandemic." Fig. 1 shows part of the e-module converging the real problem to the mathematics language.

Discussion

The use of e-modules in education has become increasingly popular in recent years, and for good reason [7]. E-modules are digital educational materials that can be accessed and utilized in a variety of settings, making them an attractive option for both teachers and students. But beyond their accessibility, e-modules have been shown to have a positive impact on learning outcomes and student engagement. In this discussion, we will explore the evidence

that supports the claim that e-modules can improve learning outcomes [9] and student interest [10], and discuss the aspects of e-modules that influence these results.

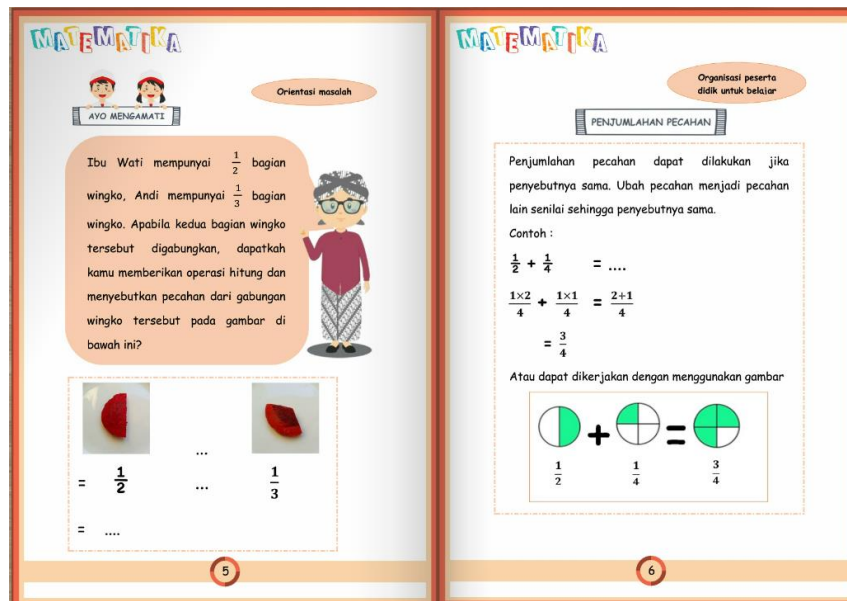


Fig. 1. Converting the real problem to mathematic language

One aspect of e-modules that has been shown to improve learning outcomes is their ability to personalize the learning experience for students [11]. E-modules can be designed to adapt to the needs of individual learners, providing a customized learning experience that is tailored to their unique needs and abilities. This personalization has been shown to increase student engagement, motivation, and achievement [12]. Students who used e-modules with personalized feedback performed significantly better on exams than students who received traditional lecture-based instruction [13].

Another aspect of e-modules that has been shown to impact learning outcomes is their multimedia format. E-modules often incorporate text, images, videos, and audio, providing a more engaging and interactive learning experience for students [14]. This multimedia format has been shown to enhance student learning by making complex concepts easier to understand, and by increasing students' ability to retain information over time [15]. Students who used e-modules with multimedia elements performed better on exams and retained more information compared to students who received traditional lecture-based instruction [16].

Problem-based learning is also a key aspect of e-modules that has been shown to improve learning outcomes and student interest [9]. Problem-based learning is a teaching method that focuses on real-world problems and challenges students to find solutions to these problems. This approach has been shown to increase student motivation, engagement, and

achievement. Students who used e-modules with problem-based learning elements performed better on exams and showed increased motivation and engagement compared to students who received traditional lecture-based instruction [8].

The accessibility of e-modules has been shown to have a positive impact on learning outcomes and student interest. E-modules can be accessed and used at any time and from any location, allowing students to learn at their own pace and on their own schedule. This accessibility has been shown to increase student motivation and engagement, as well as to improve learning outcomes. Students who used e-modules on their own time performed better on exams and showed increased motivation and engagement compared to students who received traditional lecture-based instruction.

In conclusion, the evidence supports the claim that e-modules can improve learning outcomes and student interest. The personalization, multimedia format, problem-based learning approach, and accessibility of e-modules all contribute to their positive impact on student learning. While more research is needed to fully understand the potential of e-modules, these findings suggest that e-modules are a valuable tool for teachers and students alike, and have the potential to revolutionize the way we approach education.

Conclusion

Using the ADDIE model, an e-module for teaching fifth-grade mathematics through problem-based learning was created and evaluated. The module's quality was assessed in terms of media, material, and learning, receiving scores of 76.92, 83.33, and 81.67, respectively, all considered very usable. Testing with a small group of students resulted in a score of 93.84, indicating the module was very usable. Evaluation with a larger group of students and teachers also resulted in high scores, with both groups deeming the module very usable. The average score of expert validation, teacher, and student evaluations was 88.75, also considered very usable. As such, it can be concluded that the e-module is highly suitable for teaching fifth-grade mathematics through problem-based learning.

Conflict of Interest

The authors declare that there is no conflict of interest.

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