

DEVELOPMENT OF DEEP LEARNING-BASED TEACHING MODULES IN MATHEMATICS FOR GRADE VI STUDENTS

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ABSTRACT

This study was conducted to identify the shortcomings of learning tools that have not been widely used at the elementary school level. These limitations motivated educators to develop learning tools in the form of animated learning modules that engage students' interest, particularly in the mathematics subject "Fractions" in sixth grade. This study used the ADDIE model. However, this study only reached the development stage. The subjects consisted of teachers or practitioners acting as subject matter and media experts. Data collection used a questionnaire using a Likert scale. Validation results indicated that the deep learning-based learning module with an animated concept was highly suitable for use in learning, with a percentage of 93,75% product, 98% material, and 97,5% language. This study reinforces the theoretical foundation that interactive, multimedia-based learning resources are essential for supporting students' conceptual understanding in mathematics. It also highlights opportunities for further research to extend the implementation phase, evaluate effectiveness in real classroom settings, and examine the long-term impact of animated modules on students' learning outcomes.

Keywords: Deep Learning, Animation, Mathematics, Learning Module

INTRODUCTION

One of the focuses in education is improving the quality of teaching by identifying student needs. Learning quality can be defined as good if the available learning tools support student activities at school. The success of education can be influenced by learning tools and a supportive environment (Utami et al., 2022). This can be considered part of developing human resources through improving educational quality standards in Indonesia (Taufiqurrahman et al., 2023). Mathematics is considered a difficult subject for students (Jalal, 2022). Mathematical material needs to use various solution formulas, so students need strategies to be able to understand and solve mathematical problems well. In the school environment, motivation is very important because it is useful as a driver for students to actively participate in learning activities (Mustari, 2022). Student learning motivation is an important aspect in achieving learning success (Husna & Supriyadi, 2023).

Students who are highly motivated in learning are likely to achieve high learning outcomes, so the higher their motivation, the higher the intensity of their learning efforts and attempts (Fernando et al., 2024). Consistent motivation can influence the achievement of learning objectives from both the teacher's and the student's perspectives. A person's enthusiasm for an activity is determined by their motivational strength (Emda, 2018). This underlies the importance of having engaging learning tools that can foster student motivation, especially in difficult subjects like mathematics. For teachers today, it's crucial to develop or structure creative, innovative, and engaging lesson plans to minimize student boredom during the learning process. Teachers often rely solely on the learning tools

provided by the education department and then adhere to them without modifying them to suit student needs and challenges.

A teaching module is a document that contains objectives, learning steps, learning media, and assessments that are arranged based on the flow of learning objectives (Kemendikbudristek, 2022). According to Primayana (2022), states that a teaching module is a systematically organized instructional document that includes learning objectives, instructional steps, assessment methods, and learning resources designed to facilitate effective and independent learning. Deep learning-based learning modules with animation concepts are one learning tool that can be used as a solution to this problem. Students are less expressive and participatory in mathematics learning activities due to a lack of motivation, influenced by learning tools that seem monotonous or uninteresting. Using learning tools that are not appropriate for their needs can make it difficult for students to understand the material. Students can easily grasp the core of the subject matter if there are interesting learning concept features (Haryanto, 2025). Therefore, the development of such learning modules is necessary.

LITERATURE REVIEW

In learning activities, students cannot simply receive knowledge, but are required to be active in building their own knowledge through the process of combining existing knowledge with new knowledge (Adnyana, 2024). Students are required to understand context, analyze information in detail and critically, and find solutions to problems. Deep learning involves several aspects, such as knowledge integration, application, reasoning, and problem-solving skills (Otto et al., 2020). The application of deep learning in educational practice shows broad positive impacts, ranging from improving conceptual understanding and learning motivation to developing student character, in the form of project-based learning, exploration, and the use of technology in various subjects and levels of education (Kharisma et al., 2025). Deep learning has a significant positive impact on the learning process (Kusuma et al., 2026). This statement aligns with the opinion of Sari & Arta (2025) in their research, which states that the use of deep learning in education can improve learning effectiveness, increase student motivation, and help teachers identify student learning needs more accurately. Implementing deep learning in learning can strengthen learning motivation, increase student engagement, and improve thinking skills (Azzahra et al., 2025). Thus, deep learning not only prepares students academically but also provides them with the skills they need to face challenges.

A teaching module is a document containing objectives, learning steps, learning media, and assessments, structured based on the learning objectives (Kemendikbudristek, 2022). According to other research, a teaching module is a learning plan similar to a lesson plan (RPP) but more comprehensive, consisting of learning materials, student activity tables, and assessments (Indrayana et al., 2022). So it can be concluded that a teaching module is a document compiled by a teacher as a guideline for learning activities consisting of learning steps, media, and assessments. The literature review section discusses any theories that are relevant to the research title or reference book to strengthen the validity of the research. Theories are taken from reference books, scientific journals, research data, and theoretical studies from other reliable sources. Books, journals, or any sources are prioritized for the latest publications in the last 7 years to follow the development of scientific studies that have been carried out before.

METODOLOGY

This study adapted the ADDIE development model popularized by Branch (2010). This model consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. This study's limitations were limited to the Analysis, Design, and Development

stages. The first stage of analysis began with an initial needs analysis. Data found that students were passive in learning activities due to the limited availability of complete learning tools that were attractive and motivated to learn mathematics. The second stage is design, which involves designing a product that can provide a solution to the problem. This stage is supported by product selection based on data collected through interviews with teachers and school practitioners to ensure it accurately meets the needs in the field. The resulting product is a deep learning-based teaching module with an animation concept. In the third stage, development, the product creation process is carried out as described previously. After the product is complete, an average score is calculated using Likert scale conversion criteria.

Table 1. Likert Scale Guidelines

No	Percentage %	Category
1	85 – 100	Very valid / Very feasible
2	70 – 84	Valid / Feasible
3	55 – 69	Less valid / Less feasible
4	<54	Very invalid / Very inadequate

(modified from source: Haryanto, 2025)

RESULT AND DISCUSSION

The purpose of this research is to create a learning tool in the form of a deep learning-based teaching module with an animation concept. The application used in the product's development is Canva. The ADDIE model paradigm, which consists of several stages of analysis, design, development, implementation, and evaluation, was used by the researchers. However, this research is limited to the development stage, which focuses on mathematics subjects.

Developing a Deep Learning-Based Learning Module for Animation Concepts

Analysis Stage

Based on the results of an initial needs analysis conducted at one of the parent schools, SD Negeri 1 Sukorejo, researchers obtained data from classroom observations focusing on teachers and students, followed by interviews with sixth-grade teachers. The study found that learning activities were too monotonous and unengaging, resulting in students feeling bored and tired. Furthermore, learning activities appeared teacher-centered, with minimal student participation.

Design Stage

Design is the second stage in the ADDIE research model which has several research activity points including: 1) determining the concept of the product to be created; 2) analyzing the material to be included in the product; 3) compiling a learning design related to the teaching module product such as RPP, LKPD instruments, media, test instruments; 4) creating a layout for the deep learning-based teaching module product. The concept of the deep learning-based teaching module product contains: 1) cover; 2) foreword; 3) concept map; 4) learning objectives; 5) learning outcomes; 6) learning materials; 7) example questions and their solutions; 8) practice questions; and 9) author biodata.

Table 2. Deep Learning-Based Teaching Module Design With Animation Concept

No	Elemen	Gambar
1	Deep Learning-Based Teaching Module Book Cover	

Part (a) is the front cover of the book. Part (b) is the back cover, which contains motivational sentences for students.



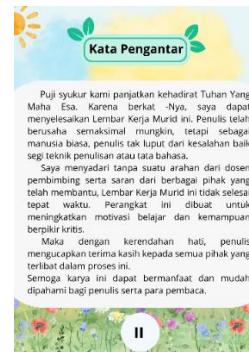
(a). the front cover of the book



(b). the back cover

2

Foreword

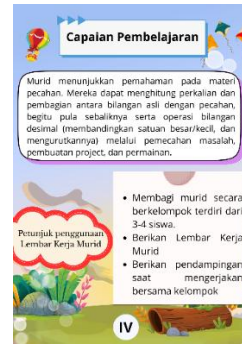


3

Concept Map.
Contains simple instructions for the material in this deep learning-based teaching module.



- Learning Outcomes.
- 4 This deep learning-based teaching module contains three learning outcome descriptions, located in each sub-chapter on a separate page.



- Table of Contents.
- 5 Contains instructions on the contents of the deep learning-based teaching module, along with page numbers.



- Course Material.
- 6 Consists of three sub-chapters, each with sample questions and solutions.



(a). Sub-chapter 1 material



(b). Sub-chapter 2 material



(c). Sub-chapter 3 material

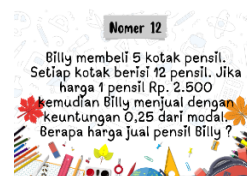
- 7 Sample Practice Questions.
 Each subchapter contains practice questions with interesting concepts adapted to different learning models.



(a) Example of Sub-Chapter 1 Practice Questions Adapted to the PBL Model



(b). Example Practice Questions for Sub Chapter 2 Adapted to the Guided Discovery Learning Model Game



(c). Example of Sub-Chapter 3 Practice Questions Adapted to the PjBL Model Puzzle Game



Development Stage

The use of engaging learning tools can increase student motivation in schools. The development of this deep learning-based teaching module with an animation concept was created using the Canva application. After the product was completed, validity testing was conducted at this stage to determine its suitability for use in learning activities.

Table 3. Validation Test Score Results

No	Product Validation	Material Validation	Language Validation
1	45	54	39
2	45	56	39

Table 4. Validation Test Score Results in Percentage Format

No	Product Validation	Material Validation	Language Validation
1	93,75%	96%	97,5%
2	93,75%	100%	97,5%
Rerata	93,75%	98%	97,5%

Based on the validity test results, the deep learning-based teaching module achieved a score of 93.75% for product validators, 98% for material validators, and 97.5% for language validators. Therefore, it is categorized as very suitable for use in learning activities and can increase student motivation and participation. Furthermore, it can serve as a valuable resource for teachers, encouraging them to create more enjoyable learning activities.

DISCUSSION

Based on initial findings from the needs analysis, there is a lack of supporting learning tools for mathematics. Learning activities are too monotonous and unengaging, causing students to lose interest or motivation to learn. Teachers' learning models lack variety and remain teacher-centered, which also hinders students' reactive learning patterns. To achieve learning objectives, teachers must be professional by creating engaging, innovative, and contextual learning plans tailored to student needs (Azzahra et al., 2022). Researchers have developed a deep learning-based teaching module with an animation concept as an alternative solution to this problem. This module was developed to support student learning. The module incorporates animation concepts with a variety of colors, shapes, and images that have the potential to naturally foster students' motivation to learn. Furthermore, it contains learning guidance and directions adapted from three models modified with games.

Previous relevant research has been conducted by Zulkarnain et al (2024), who developed a teaching module to improve early reading skills, and it was declared successful because the module obtained an N-Gain score of 0.68 in the moderate category, or the teaching

module product was worthy of being used effectively. In addition, research conducted by Rahmawati et al (2025), who developed a STEM-based e-module to improve learning outcomes, obtained very valid product validity results with a percentage of 95.1% and an N Gain score of 0.59 in the moderate category or proven effective in improving learning outcomes. According to research by Hapsari et al (2025), who developed a PBL-based teaching module to improve conceptual understanding, the product successfully obtained a very good category and can help students' conceptual understanding. The research above is the basis for the development carried out by the current researcher. The update of the current research is to develop a deep learning-based teaching module that is focused on improving students' problem-solving abilities in mathematics by raising the concept of animation that can increase student learning motivation.

This deep learning-based teaching module product is considered highly suitable for use in learning activities because it has received assessments from several experts, including material experts, product experts, and language experts. Each subsection of the assessment was carried out by two validators, so the percentage value written in this article is taken from the average score of both validators. The product validator assessment category includes the module's visual appearance, design clarity, suitability for deep learning, and the practicality and durability of the module product. The material validator assessment category includes the suitability of the material to learning objectives, material depth, suitability for deep learning, the relevance of problem-solving skills, and the material's relevance to students' lives. Then, the language validator assessment category includes language readability, suitability for Indonesian language rules, suitability for student characteristics, and language support for deep learning.

This research contributes to the development of educational theory, particularly in the integration of deep learning approaches within primary education. First, deep learning is not merely about content mastery but involves higher-order thinking skills, such as critical analysis, problem-solving, and knowledge integration. The findings support previous theories stating that deep learning enhances students' conceptual understanding and learning motivation. Second, this research expands the theoretical framework of instructional design, especially in the context of the ADDIE model. Although the study only reached the development stage, it demonstrates how the integration of deep learning media within teaching modules can align with deep learning principles. This suggests that combining cognitive engagement (deep learning) with visual and interactive elements (animation) can create more meaningful learning experiences. Third, the study strengthens the theory that learning motivation plays a crucial role, particularly in subjects perceived as difficult, such as mathematics. The use of engaging and innovative teaching modules supports constructivist learning theory, where students actively construct knowledge through interaction with meaningful learning resources.

Practically, this research provides several important implications for educators, schools, and curriculum developers. For teachers, the results suggest that developing deep learning-based teaching modules with animation features can significantly improve student motivation and participation, especially in mathematics learning. For schools, this research highlights the importance of providing support and resources for the development of innovative learning tools. Schools should facilitate training for teachers in designing and implementing technology-based teaching materials to improve the overall quality of learning. Additionally, the high validation results indicate that the developed module is feasible and ready to be implemented in classroom settings, particularly for sixth-grade mathematics on fraction material. Therefore, it can serve as a reference or model for developing similar instructional materials in other subjects and grade levels. Lastly, this study encourages further research to proceed to the implementation and evaluation stages, so that the effectiveness of the module in improving learning outcomes can be empirically tested in real classroom contexts.

CONCLUSION

Developing learning tools can optimally support student learning activities at school. One aspect that must be maintained is student motivation. To support this important aspect, a deep learning-based teaching module with an animation concept was developed, primarily for sixth-grade elementary school mathematics. Validation results indicate that this deep learning-based teaching module with an animation concept is highly suitable for use. This module can facilitate students in understanding the material, increase learning motivation, and make students more active participants during learning activities.

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