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Development of Interactive Multimedia Based on Edutainment and Problem Solving for Magnetism Learning in Elementary School

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Abstract

Teacher and student evaluations also revealed that the multimedia was highly practical due to its user-friendly interface, attractive design, and ability to enhance students' learning motivation. Overall, these findings confirm that the developed multimedia is appropriate for use in elementary science instruction, as it fulfills the established criteria of validity, practicality, and effectiveness. This study aimed to develop interactive multimedia based on edutainment and problem-solving approaches for magnetism learning among fifth-grade elementary school students. The research employed the ADDIE development model, which includes the stages of Analysis, Design, Development, Implementation, and Evaluation. The multimedia was validated by two media experts and one subject matter expert before being implemented through a limited trial involving 10 students and a field trial involving 28 students at SD Negeri Kliwonan. The findings showed that the developed multimedia achieved a validity score of 94.40%, indicating that it was highly valid for classroom use. Practicality evaluation revealed very positive responses from teachers and students, demonstrating that the multimedia was easy to operate, engaging, and capable of supporting the learning process. In addition, the effectiveness test produced an average N-Gain score of 0.841, indicating a high level of effectiveness in improving students' conceptual understanding of magnetism. These results demonstrate that the developed multimedia is valid, practical, and effective for supporting science learning in elementary schools.

Keywords Multimedia, Edutaiment and Troubleshooting, Magnetic Materials, SD N Kliwonan

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INTRODUCTION

Students should be able to grasp concepts, think critically, and solve problems in order to understand natural events through science education in elementary school. Many science subjects, however, continue to be difficult for primary school students to grasp because they include abstract concepts that cannot be directly seen. Magnetism is one such area where students frequently hold misconceptions regarding the characteristics of magnets, magnetic fields, and magnetic forces. Students' capacity to apply scientific ideas in real-world scenarios is constrained by these misunderstandings, which also impede worthwhile learning (Hermansah, 2025; Prahasdita et al., 2025; Wijayanti, 2025).

To tackle these conceptual learning difficulties, interactive multimedia has emerged as a crucial educational advancement. Multimedia may turn abstract scientific notions into concrete visual depictions by combining text, pictures, animations, audio, video, and interactive activities, making them simpler for students to understand. In primary school, interactive multimedia has been repeatedly found to improve students' conceptual understanding, motivation for learning, participation in class, and overall science learning outcomes (Kadek et al., 2021; Muharani, 2024; Inawan et al., 2022).

According to a preliminary study at Kliwonan Public Elementary School, interactive learning media are rarely utilized, and the instruction of magnetism is still primarily based on textbooks and lectures. As a result, many kids have difficulty grasping abstract concepts like magnetic fields, magnetic forces, and magnetization. Furthermore, classroom education offers few chances for students to hone their problem-solving and critical thinking abilities through active learning exercises. These findings indicate the necessity for learning media that can present concepts of magnetism in a more visual, interactive, and contextual way that corresponds to the traits of elementary school (Aviyanti, 2025).

Previous studies have consistently shown that interactive multimedia makes a positive contribution to science learning at the elementary school level by enhancing students' conceptual understanding, motivation to learn, and overall learning quality (Kadek Ariani et al., 2021) Furthermore, integrating problem-solving activities into science instruction has been shown to improve students' critical thinking skills, while animation-based multimedia creates a more engaging learning environment, thereby enhancing students' motivation to learn (Syabrina & Sulistyowati, 2020). Nevertheless, recent studies continue to report that misconceptions related to

magnetism—particularly regarding magnetic fields and magnetic forces—remain common among elementary school students(Karlina et al., 2026) Overall, these findings suggest that while interactive multimedia holds significant potential for enhancing science learning, a more comprehensive instructional design that combines engaging learning experiences with structured problem-solving activities is still needed to effectively reduce misconceptions and strengthen students' conceptual understanding.

Despite how encouraging these findings are, past research has typically concentrated on either interactive multimedia or problem-solving strategies in isolation. There is still a lack of research that combines edutainment and problem-solving in a single interactive multimedia environment, especially when it comes to teaching magnetism in elementary school. It is hoped that the combination of these two methodologies would foster a fun learning atmosphere and encourage students to develop a conceptual understanding via organized problem-solving activities(Agengtirtayasa & Serang, 2025).

The development of an interactive multimedia instrument that integrates edutainment and problem-solving techniques specifically for instructing fifth-grade elementary school students on magnetism is what distinguishes this study. This created product combines interactive quizzes, videos, animations, and contextual problem-solving exercises into a single learning platform, in contrast to earlier multimedia tools. The purpose of this blend is to encourage students' active involvement and conceptual understanding, as well as to minimize errors and portray abstract scientific ideas (Susilowati et al., 2025).

Although previous studies have demonstrated the positive contribution of interactive multimedia to students' motivation, engagement, and science learning outcomes, most have focused on multimedia as a general instructional tool without integrating multiple pedagogical approaches within a single learning environment. In particular, limited research has combined edutainment and problem-solving strategies in interactive multimedia specifically designed to improve elementary students' conceptual understanding of magnetism. Furthermore, only a few studies have comprehensively evaluated such multimedia in terms of validity, practicality, and effectiveness using the ADDIE development model. These limitations indicate the need for further research to

develop multimedia that responds directly to classroom learning needs while promoting meaningful conceptual learning.

This study aims to develop an interactive multimedia tool based on edutainment and problem solving for teaching magnetism to elementary school students in the fifth grade, as well as to evaluate its validity, practicality, and effectiveness, based on the problems that have been identified, prior research, and existing research gaps.

METHODS

This study employed a Research and Development (R&D) approach using the ADDIE instructional design model to develop interactive multimedia integrating edutainment and problem-solving approaches for teaching magnetism to fifth-grade elementary school students. The development process followed five sequential stages: Analysis, Design, Development, Implementation, and Evaluation (Charlina et al., 2024). in Figure 1

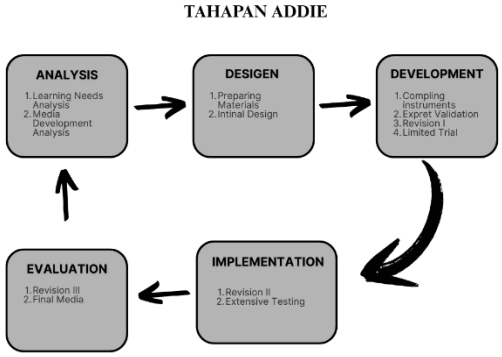

Figure 1. ADDIE Model Flowchart

(Adapted from (Wicaksono et al., 2025)

The research was conducted during the 2025–2026 academic year at SD Negeri Kliwonan. Participants were selected through purposive sampling and involved fifth-grade students studying magnetism. The multimedia was evaluated through a small-group trial involving 10 students to assess its practicality and a field trial involving 28 students to examine its effectiveness. The product was validated by three experts consisting of a science education expert, an educational technology expert, and an Indonesian language expert, who evaluated the content quality, media design, and language appropriateness of the multimedia (Dhea Deviani Gracia, 2024).

The development process followed the five stages of the ADDIE model. The Analysis stage identified learning needs, student characteristics, curriculum requirements, and learning problems related to magnetism. During the Design stage, the multimedia framework, learning activities, and

research instruments were prepared. The Development stage involved producing the multimedia and revising it based on expert validation. The multimedia was subsequently implemented through small-group and field trials, while formative and summative evaluations were conducted to improve the product based on the validity, practicality, and effectiveness findings (Habibatuzzahro & Istianah, 2025).

Data were collected using expert validation sheets, teacher and student response questionnaires, classroom observation sheets, and a conceptual understanding test administered as pretests and posttests. The conceptual understanding test consisted of ten essay questions developed according to the fifth-grade science curriculum on magnetism. The test assessed students' ability to explain magnetic concepts, identify magnetic and non-magnetic materials, apply concepts in everyday situations, analyze magnetic phenomena, and draw scientific conclusions. Prior to data collection, all research instruments were reviewed and validated by experts to ensure their content validity and suitability (Kayla & Muthi, 2025).

Table 1. Validation Analysis (Sari et al., 2024)

Presentation	Group
81%–100%	Very valid
61%–80%	Applicable
41%–60%	Quite valid
21%–40%	Invalid
0%–20%	Not very valid

The percentage scores obtained from expert validation were interpreted according to the validity criteria presented in Table 1. Multimedia categorized as very valid was considered suitable for classroom implementation without major revisions, whereas multimedia in lower categories required revisions according to the validators' recommendations.

Table 2. Practical Analysis (S. Eko Putro Widoyoko, 2025)

Achievement Rate	Qualifications	Remarks
75%-100%	Very Valuable	No need
50%-74,99%	Worthy	Slightly revised
25%-49,99%	Less Worthy	Much revised
0-24,99%	Not Eligible	Total revision

The practicality scores obtained from teachers' and students' questionnaires were interpreted using the criteria presented in Table 2. A multimedia product categorized as very practical indicates that it is easy to use, attractive, and feasible for classroom learning with no major revisions required.

Data were analyzed using descriptive quantitative techniques. Multimedia validity was determined from expert validation scores, while practicality was evaluated based on teacher and student response questionnaires following implementation. The effectiveness of the multimedia was assessed using the normalized gain (N-Gain) calculated from students' pretest and posttest scores to measure improvements in conceptual understanding. The multimedia was considered effective when the N-Gain score reached the moderate or high category according to the established criteria.

Table 3. Analysis of the effectiveness of the N-Gain Test

N- Gain Score	Categories
N-Gain ≥ 0.7	Height
0.3 ≤ N-Gain < 0.7	Medium
N-Gain score ≤ 0.3	Low

The effectiveness of the multimedia was assessed using the N-Gain categories shown in Table 4. An N-Gain score in the moderate or high category indicates that the multimedia effectively improves students' conceptual understanding of magnetism.

FINDINGS AND DISCUSSION

Findings

This research aims to develop teaching materials in the form of learning modules and interactive multimedia. This teaching material is designed by integrating edutainmet-based approaches and problem-solving. The development process is carried out by following the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model (Ade Rahayu, 2025).

The analysis stage involved classroom observations, teacher interviews, and curriculum analysis at SD Negeri Kliwonan to identify instructional needs. The findings indicated that science instruction was still largely teacher-centered, with limited use of interactive learning media. Students also experienced difficulties in understanding magnetism concepts, particularly in distinguishing magnetic from non-magnetic materials and applying these concepts in everyday contexts. Teachers highlighted the need for interactive learning resources capable of presenting abstract concepts more concretely and engaging students more actively. These findings support previous studies (Wijayanti, 2025) and (Prahasdita et al., 2025), (Inawan et al., 2022) and (Muharani,

2024.), which reported that interactive multimedia can minimize misconceptions by providing meaningful visual representations and interactive learning experiences. Therefore, interactive multimedia integrating edutainment and problem-solving was developed to address these instructional needs.

During the design stage, the multimedia was planned by integrating problem-solving activities with edutainment elements while considering the characteristics of elementary school students and multimedia learning principles. The learning sequence guided students through identifying problems, exploring information, developing solutions, and evaluating their understanding. To support active learning, the multimedia incorporated animations, instructional videos, illustrations, interactive quizzes, and immediate feedback, enabling students to visualize abstract magnetism concepts more effectively. Figure 2 illustrates the main interface of the developed multimedia (Nabila et al., 2024).

The front Cover view can be seen in Figure 2 (a) and Table of Contents Figure 2 (b). Magnetic materials are arranged in a way that is concise, clear, and relevant to everyday life, and is complemented by (Tanama et al., 2023)

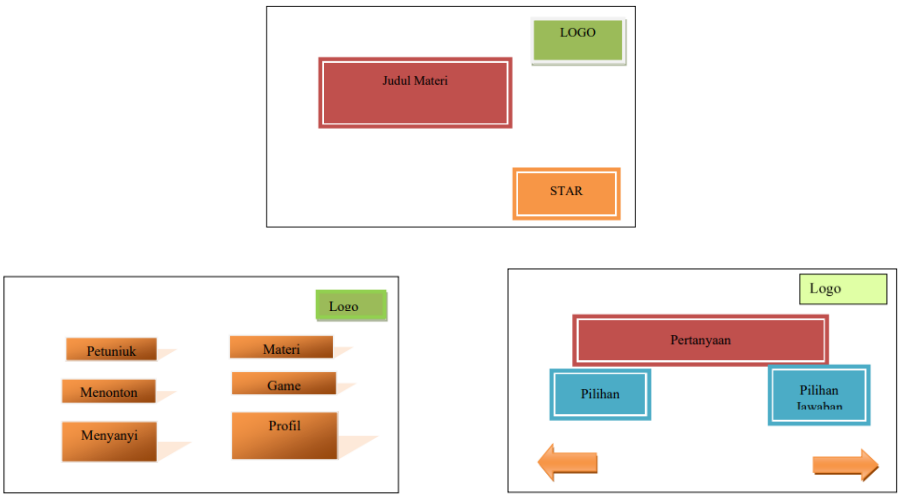

Figure 2. (a) Front Cover, (b) Table of Contents, (c) Questions

At the development stage, the multimedia was produced and subsequently evaluated by experts in science education, educational technology, and Indonesian language. The validation process generated recommendations regarding navigation, language clarity, visual consistency, instructional guidance, and assessment items. These suggestions were incorporated into the revised product before classroom implementation. Following revision, the multimedia obtained an overall

validity score of 94.40%, indicating that it met the criteria for high validity and was appropriate for elementary science instruction. These results demonstrate that the systematic application of the ADDIE model contributed to the development of a pedagogically sound and technically feasible multimedia product.(Ricky, 2025) (Anggraeni et al., 2021). The product that has been developed then goes through the validation stage by material experts, media experts, and linguists to determine the level of feasibility.

Figure 3. (a) Front Cover, (b) Table of Contents

Table 4. Expert Validation Results

Validation	Indicator	Validation Results	Categories
Media Members	Visual Display Presentation Information	81,8%	Applicable
Language Subject 1	Content Eligibility Material Adaptation	94,40%	Highly Valid
Lesson Subject 2	Content clarity Language proficiency in accordance with the material	94,40%	Highly Valid
N-Gain Score Average		94,40% 4,72%	

The multimedia was implemented through small-group and field trials during science learning. Teachers facilitated classroom activities by guiding students through problem-solving tasks supported by animations, instructional videos, illustrations, interactive quizzes, and immediate feedback. Students actively explored the learning materials, completed problem-solving activities, and participated in classroom discussions (Education et al., 2023). After implementation, teacher and student response questionnaires were administered to assess practicality, while posttests were conducted to evaluate improvements in students' conceptual understanding. The multimedia was classified as highly practical and highly effective, achieving an average N-Gain

score of 0.841, which indicates a substantial improvement in students' understanding of magnetism.

Students responses also demonstrated the practicality of the multimedia. In the first implementation cycle, the practicality score increased from 83% in the limited trial to 90% in the field trial. Similar improvements were observed in the second cycle, with scores increasing from 82.22% to 91.19%. These results indicate that the multimedia was easy to use, engaging, and capable of encouraging students' active participation throughout the learning process (Arimas et al., 2022).

Table 5. Multimedia Product Trials

Stages	Quantity	Average
Limited trial 1	830	83%
Extensive trial 1	1894	90%
Limited trial 2	822	82,22%
Extensive trial 2	1915	91,1904%

Table 6. Post-Pretest Results

Stages	Average		N-Gain Score	Criteria
	Prates	Post-tests		
Limited Trial 1	36	75	62,34%	Height
Extensive Trial 1	40,95	79,52	65,35%	Height
Limited Trial 2	52	80	56,83%	Height
Extensive Trial 2	53,80	83,80	66,03%	Height

Evidence from the effectiveness test showed that the developed multimedia had a positive impact on students' academic performance in learning magnetism at SD Negeri Kliwonan. Regardless of the trial stage, students consistently achieved higher posttest scores than pretest scores. The recorded learning gains ranged from 56% to 66%, reflecting a high level of improvement as proposed by (Hardiningrum, 2022). Both the limited and large-scale trials exhibited the same pattern, with students progressing from low or moderate levels of prior knowledge to considerably better achievement after using the multimedia. These results indicate that integrating edutainment and problem-solving into the multimedia effectively supports conceptual learning and serves as a suitable instructional resource for elementary science education.

The evaluation stage was conducted by reviewing expert validation results, teacher observations, student responses, and learning outcome data obtained during implementation. Based on this evaluation, several revisions were made to improve navigation, learning instructions, visual presentation, language clarity, and assessment items. These refinements enhanced both the pedagogical quality and technical usability of the multimedia. As a result, the final product satisfied

the predetermined criteria for validity, practicality, and effectiveness, indicating its suitability for teaching magnetism to fifth-grade elementary school students (Desty Kurniasari, Lukman hakim, 2023) .

Discussion

The findings of this study demonstrate that the interactive multimedia developed using the ADDIE model fulfilled the criteria of validity, practicality, and effectiveness for elementary science learning. The integration of edutainment and problem-solving approaches provided meaningful learning experiences that enhanced students' conceptual understanding of magnetism while encouraging active participation throughout the instructional process.

The high level of validity achieved by the developed multimedia can be attributed to the systematic development procedures implemented throughout the ADDIE model. During the development phase, the product underwent comprehensive evaluation by experts in learning media, science content, and language, resulting in recommendations related to navigation, language clarity, visual design, instructional guidance, and assessment items. Incorporating these recommendations improved both the pedagogical and technical quality of the multimedia prior to classroom implementation. Similar findings have been reported by(Inawan et al., 2022), (Candra Kurniawan et al., n.d.), (Zaid et al., 2022), (Hardiningrum, 2022), and (Supriyono et al., 2022), who concluded that iterative expert validation plays an important role in improving the quality and feasibility of instructional multimedia. However, the present study extends previous research by integrating problem-solving activities with edutainment elements to address elementary students' conceptual difficulties in learning magnetism. These findings are also consistent with Mayer's Cognitive Theory of Multimedia Learning, which suggests that the integration of verbal explanations and visual representations promotes more effective cognitive processing and deeper conceptual understanding.

The practicality findings indicate that the multimedia was well accepted by both teachers and students during classroom implementation. Its ease of use was supported by intuitive navigation, engaging visual displays, interactive animations, contextual learning activities, instructional videos, quizzes, and immediate feedback, enabling students to participate more actively while learning independently. Comparable who found that interactive multimedia contributes to greater learning motivation and classroom engagement. Nevertheless, this study provides additional evidence that combining edutainment with structured problem-solving

activities not only increases students' interest in learning but also supports the construction of scientific concepts through exploration, discussion, and reflection. This finding aligns with constructivist learning theory, which emphasizes that knowledge is actively constructed through meaningful learning experiences.

The effectiveness of the multimedia was reflected in the considerable improvement in students' conceptual understanding following classroom implementation. This improvement was influenced not only by the use of digital technology but also by the integration of interactive visualizations, contextual problem-solving tasks, and immediate feedback that enabled students to recognize and correct misconceptions during learning. Similar findings have been reported by (Inawan et al., 2022), (Candra Kurniawan et al., n.d.), (Zaid et al., 2022), (Hardiningrum, 2022), and (Supriyono et al., 2022), who likewise demonstrated that multimedia-assisted instruction contributes positively to science learning outcomes. However, the present study further highlights that integrating edutainment with problem-solving strategies creates richer learning experiences by simultaneously strengthening conceptual understanding and student engagement. These findings are supported by Mayer's Cognitive Theory of Multimedia Learning and constructivist learning theory, both of which emphasize meaningful cognitive processing and active knowledge construction during learning.

Overall, the findings indicate that the effectiveness of the developed multimedia resulted from the integration of sound instructional design, multimedia learning principles, problem-solving strategies, and edutainment elements that addressed the learning needs identified at SD Negeri Kliwonan. Rather than functioning solely as a digital instructional tool, the multimedia facilitated meaningful learning experiences that enhanced students' conceptual understanding, classroom participation, and learning outcomes. Therefore, integrating interactive multimedia with edutainment and problem-solving approaches offers a promising instructional alternative for teaching abstract science concepts while supporting more student-centered learning in elementary schools.

CONCLUSION

This study developed interactive multimedia integrating edutainment and problem-solving approaches for teaching magnetism to fifth-grade elementary school students using the ADDIE development model. The findings indicate that the developed multimedia is valid, practical, and

effective in enhancing students' conceptual understanding while promoting active participation in science learning. These results suggest that integrating interactive multimedia with problem-solving activities and edutainment provides meaningful learning experiences for teaching abstract science concepts at the elementary level.

The findings contribute to multimedia-based science education by providing empirical evidence that combining multimedia learning principles with problem-solving and edutainment supports meaningful conceptual learning. Practically, the developed multimedia offers teachers an alternative instructional resource for delivering abstract science concepts through interactive and student-centered learning. Nevertheless, this study was limited to one elementary school and focused only on magnetism; therefore, the findings should be interpreted within this context. Future research is recommended to evaluate the multimedia in more diverse educational settings, apply it to other science topics, and examine its effects on broader learning outcomes, such as critical thinking, scientific literacy, learning motivation, and long-term conceptual understanding.

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