Published online on the page : https://ejournal.uinbukittinggi.ac.id/educative

Jurnal Educative: Journal of Educational Studies

ISSN | 2549-4139 (Online) - 2549-4120 (Print) |

DEVELOPMENT OF SOCIAL STUDIES MULTIMEDIA LEARNING BASED ON DISCOVERY LEARNING USING KODULAR AT THE JUNIOR HIGH SCHOOL LEVEL

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Article History :
Submission : May 7, 2025
Review : June 18, 2025
Accepted : June 25, 2025
Published : June 30, 2025

Keywords :
Multimedia learning, Discovery Learning, Kodular, ADDIE

DOI :
10.30983/educative.v10i1.9633

Abstract

This study aims to develop interactive learning multimedia based on the Discovery Learning approach using the Kodular application for teaching Demand, Supply, and Equilibrium Price in Economics subjects at SMP Swasta Santo Thomas 1 Medan. The research adopts a Research and Development (R&D) approach, utilizing the ADDIE model (Analysis, Design, Development, Implementation, Evaluation), which is commonly used in educational product development. The development process was carried out systematically through five stages, focusing on creating multimedia that supports student self-directed learning and enhances their understanding of the subject matter. The results of the study show that the developed multimedia was well received by students, as evidenced by its effectiveness in facilitating active learning and increasing student engagement. This is reflected in the significant improvement in the average student scores from 39.28 before the implementation to 94.53 after the use of Kodular-based multimedia. At the evaluation stage, the application was well accepted and provided a deeper understanding of economic concepts to the students, based on positive feedback from expert validators and learners. The study concludes that the implementation of Discovery Learning through Kodular significantly enhances the quality of instruction, providing students with a deeper comprehension of complex topics in Economics.

INTRODUCTION

The development of digital technology in recent decades has had a significant impact on the field of education (Liu et al., 2025; Nsabayezu et al., 2025; Redondo-Sama et al., 2025). One of the most prominent transformations is the integration of mobile devices into the learning process, known as mobile learning (Hamad et al., 2024; Hsu & Chen, 2025; Laumann et al., 2024). The use of these devices in educational contexts offers numerous benefits, including increased student motivation, engagement, and independence in the learning process (Bonsu et al., 2024). With the ease of access to information provided by mobile devices, students can conveniently access learning materials anytime and anywhere, which indirectly enhances their self-directed learning skills (Nahar & Sulaiman, 2025). Previous studies have shown that mobile learning can improve the effectiveness of learning by offering a more flexible and personalized learning experience (Hanif et al., 2018; Sobowale et al., 2024).

However, despite the growing implementation of technology in education, challenges still persist in achieving deep and structured integration of such technology in the learning process (Mark & Emmanuel, 2019). One key challenge is the limited availability of applications that integrate more in-depth learning theories, such as Discovery Learning, into Android-based educational media (Mateos et al., 2021; Novelina Santoso et al., 2022). Discovery Learning, introduced by Jerome Bruner in Ozdem-Yilmaz & Bilican (2020), is a learning approach that encourages students to independently discover concepts through exploration

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and problem-solving. This approach aims to develop students' critical and deep-thinking skills, making it particularly relevant for teaching complex topics (Iskandar & Maeshalina, 2020).

Although Discovery Learning has been widely implemented in traditional classrooms, its application in technology-based media especially Android applications remains limited (Muliyati et al., 2018). Most existing educational applications merely present content passively through text, images, or videos, without incorporating elements that actively engage students in exploration and concept discovery (Karimah et al., 2023). This represents a significant gap in the educational literature, indicating a lack of applications that successfully combine Discovery Learning with interactive elements in a mobile learning platform. Such integration would enable students to access materials independently while fostering a deeper understanding of the content (Kurniawan & Jahro, 2021).

With the rapid advancement of technology in Indonesia especially in the education sector schools such as SMP Swasta Santo Thomas 1 Medan have begun integrating technology into their learning processes. However, student learning outcomes in economics subjects, such as Demand, Supply, and Equilibrium Price, remain low. Based on learning evaluation data, the average student score was only 62.5, which falls below the Minimum Completeness Criteria (KKM) of 75. This indicates that most students have not yet achieved the expected level of competence (Ismail & Mohd Rasid, 2022; Jawad & Christian, 2019). It also suggests that, although technology has been adopted in classrooms, the current educational media have not been optimally effective in facilitating deep and comprehensive understanding of the material (Masso et al., 2025; Wiarda & Doorn, 2023). Therefore, there is a need for innovative development of Android-based educational media that not only delivers content but also integrates the Discovery Learning approach to promote independent and active learning (Ariyanto et al., 2019; Umah, 2023).

Economics learning particularly topics such as Demand, Supply, and Equilibrium Price is often perceived as abstract by students, making it difficult for them to grasp the fundamental concepts. Preliminary observations at SMP Swasta Santo Thomas 1 Medan show that student achievement in these topics is still relatively low, with average scores below the KKM. This condition highlights the urgent need for educational media innovations that can help bridge students' understanding of economic concepts in a more concrete and engaging manner.

Several previous studies have developed various interactive, technology-based learning models and media to enhance students' comprehension, such as interactive multimedia, instructional videos, and PBL-based e-modules. For example, Arnaz et al. (2022) demonstrated that interactive animated media significantly improved students' understanding of economic concepts. Likewise, Chairunisa & Zamhari (2022) developed a digital module on the topic of Demand and Supply, which had a positive effect on students' learning outcomes.

Despite these innovations, there remains a lack of research specifically focused on developing Kodular-based applications for teaching topics such as Demand, Supply, and Equilibrium Price at the junior high school level. Kodular is chosen because it offers an intuitive interface based on visual block programming and allows the creation of Android applications without requiring complex coding skills. Compared to other platforms such as MIT App Inventor, Thunkable, or Flutter, Kodular offers more ready-to-use components and greater design flexibility, making it well-suited for the development of engaging and functional educational media. Therefore, this study aims to fill this gap by creating an Android-based

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educational application that is not only feasible and engaging but also easily accessible to students via mobile devices. Through this approach, it is expected that economics learning will become more interactive and relevant to students' technological contexts.

This study aims to address the existing theoretical gap by developing Discovery Learning-based multimedia using the Kodular application (Safitri & Aziz, 2022). The application is designed to integrate all elements of learning into a single platform accessible through mobile devices (Djuredje et al., 2022). Using Kodular, the application can combine learning materials, instructional videos, quizzes, and evaluations into one easily accessible system. The Discovery Learning approach is expected to contribute to a more interactive and in-depth learning experience, allowing students to explore and discover materials independently while reinforcing their understanding of the concepts being taught (Arnaz et al., 2022).

Based on the background outlined above, the main problem addressed in this study is how to design and develop a Kodular-based learning application that is both feasible and effective for teaching the topics of Demand, Supply, and Equilibrium Price at the junior high school level. Accordingly, the objective of this study is to develop a Kodular-based learning media for these economics topics and to assess its feasibility based on expert evaluations and student responses, particularly at SMP Swasta Santo Thomas 1 Medan (Satriani et al., 2023). Thus, this research is expected to contribute to the advancement of more innovative, interactive, and student-centered educational media that meet the demands of the rapidly evolving digital era.

METHOD

This study aims to develop Social Studies learning multimedia based on the Discovery Learning approach using the Kodular application, focusing on the topic of Demand, Supply, and Equilibrium Price for students at SMP Swasta Santo Thomas 1 Medan. The research was conducted during the even semester, specifically from March to April 2025. This study employed a Research and Development (R&D) design using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation), which is a widely adopted method in the development of educational products (Widyastuti, 2019). The model is designed to produce and test the effectiveness of a product in this case, a Kodular-based multimedia learning application integrated with the Discovery Learning approach. The stages of media development are presented in Figure 1 as follows:

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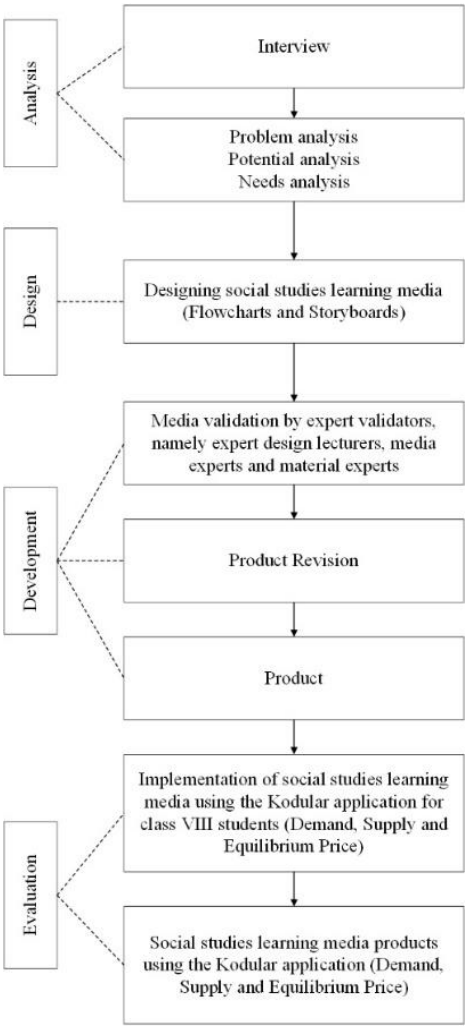

Figure 1. Stages of media development

The development stages of the Social Studies learning multimedia based on the Discovery Learning approach were carried out using the ADDIE development model. In the first stage, a needs analysis was conducted through interviews and discussions with Social Studies teachers at SMP Swasta Santo Thomas 1 Medan to gather information regarding the teaching materials currently in use and the challenges encountered during the learning process.

Subsequently, the development of the multimedia product proceeded to the design stage, which involved the creation of a flowchart to illustrate the application's user flow. The flowchart representing the application's development process is presented in Figure 2 as follows:

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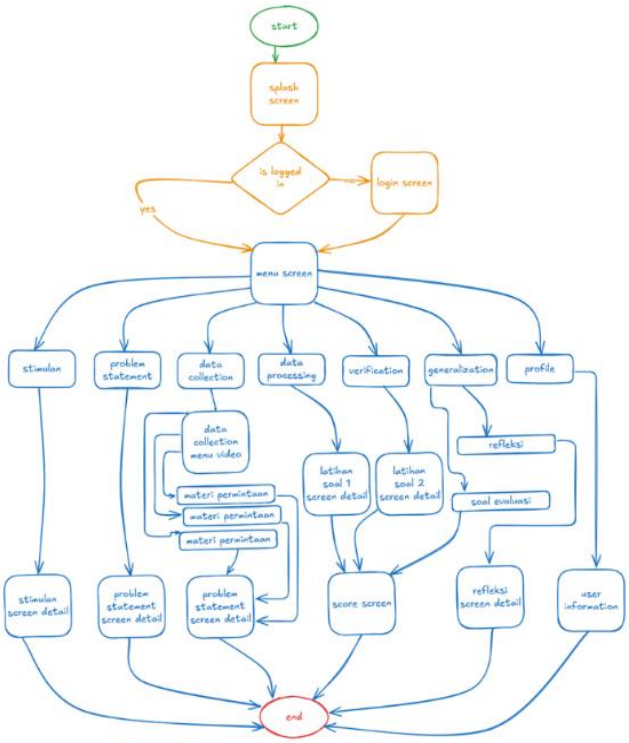

Figure 2. Flowchart Application Development With Codular

The development stage began with the creation of the multimedia application in accordance with the previously designed framework. Once the product was completed, the application was evaluated by validators consisting of subject matter experts, media experts, and instructional design experts.

During the implementation phase, the application was tested at SMP Swasta Santo Thomas 1 Medan. The trial of the Social Studies multimedia learning application was conducted with all 32 students in Grade VIII.

In the evaluation phase, the data obtained from the trial were analyzed to assess the quality of the product and its effectiveness in the learning process. This evaluation involved revising the application based on feedback from the experts, teachers, and students.

The data in this study were collected using a qualitative approach through interviews and observations. Interviews were conducted with teachers, students, and experts involved in the product validation process. A total of six experts were engaged in the feasibility test, consisting of two media experts, two subject matter experts, and two instructional design experts. Each expert provided assessments on aspects relevant to their field of expertise.

The subject matter experts evaluated aspects such as content presentation, content accuracy, content evaluation, language use, clarity of information, and the media's ability to motivate students. The instructional design experts assessed display performance, interface suitability, media presentation, and ease of use. Meanwhile, the media experts evaluated content relevance, usability, visual appeal, and media efficiency.

The expert assessments were conducted using a Likert scale ranging from 1 to 5, where a score of 1 indicated very poor quality and a score of 5 indicated excellent quality. In addition to interviews, classroom observations were conducted during the implementation phase to gain a deeper understanding of how students interacted with the developed application.

For data analysis, descriptive analysis techniques were employed. Data were collected from test scores and classroom observations to describe the general condition of the application's use in the learning process. This study is expected to contribute to the development of more interactive Android-based multimedia learning tools that can enhance student learning outcomes, particularly in the topics of Demand, Supply, and Equilibrium Price.

RESULT AND DISCUSSION

In this study, the development of Discovery Learning-based multimedia using the Kodular application was carried out to enhance students' understanding of the topics of Demand, Supply, and Equilibrium Price at SMP Swasta Santo Thomas 1 Medan. The study adopted the ADDIE development model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. Each stage was carried out systematically to ensure the feasibility and effectiveness of the resulting product.

Result

1. Phase 1: Analysis

In the analysis stage, the learning problems and needs at SMP Swasta Santo Thomas 1 Medan were identified. Interviews with Social Studies teachers revealed that although technology had been utilized in the learning process, the available media were not sufficient to support students' independent learning and did not present the material in a deep and meaningful way. Therefore, the development of Discovery Learning-based educational media using the Kodular application was proposed as a solution.

Further analysis showed that more than 90% of students at the school use Android devices and have easy access to the internet. This makes the use of Android-based applications a highly relevant option. Considering the availability of Android devices among students, as well as supporting technological infrastructure such as projectors and the school's Wi-Fi network, the Discovery Learning model integrated with self-directed learning was deemed an appropriate choice.

Phase 2: Design

The design stage began with the development of the application's structure and user interface layout. A flowchart was created to illustrate the user navigation flow within the application. Each interface was designed with careful consideration of the learning objectives and the integration of the Discovery Learning approach, which consists of six phases: stimulation, problem statement, data collection, data processing, verification, and generalization.

Scenarios for each phase within the application were also developed by aligning the Learning Outcomes (Capaian Pembelajaran or CP) and Learning Objectives (Tujuan Pembelajaran or TP) with the curriculum implemented at SMP Swasta Santo Thomas 1 Medan. The elements integrated into the application include text, images, videos, student worksheets (LKPD), practice questions, and reflection activities all of which are designed to support students in gaining a comprehensive understanding of the topics of Demand, Supply, and Equilibrium Price.

Phase 3: Development

In the development stage, the multimedia application for Social Studies learning was realized using the Kodular platform. The application consists of various elements such as videos depicting real-world economic phenomena relevant to the subject matter, explanatory

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texts, illustrative images, and a variety of practice questions designed to help students process and test their understanding. The interface of the Social Studies multimedia learning application is presented in Figure 3 as follows:

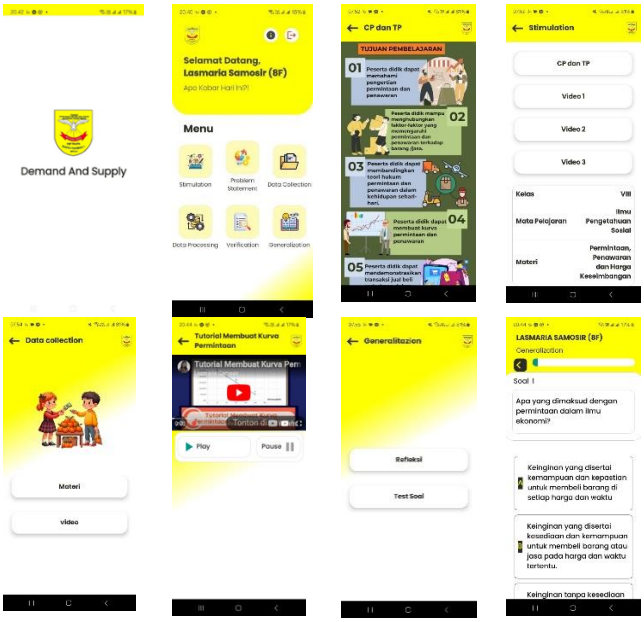

Figure 3. Multimedia Learning Social Sciences

After the application was developed, a feasibility test was conducted by a subject matter expert, a media expert, and an instructional design expert. Tables 1 to 3 present the results of the feasibility assessments conducted by each of the experts.

Table 1. The results of the feasibility test by the material expert

No.	Aspect	Expert		Average	Value	Criteria
		1	2			
1	Presentation of material	4,5	4,8	4,7	94	Very Feasible
2	Fill in the material	4,7	4,7	4,7	94	Very Feasible
3	Evaluation of material	4,7	4,7	4,7	94	Very Feasible
4	Languange	4,5	5	4,8	96	Very Feasible
5	Clarity of information	4,7	4,7	4,7	94	Very Feasible
6	Motivation	5	4,7	4,9	98	Very Feasible
Average		4,7	4,8	4,8	95	Very Feasible

Table 2. The results of the feasibility test by the learning design expert

No.	Aspect	Expert		Average	Value	Criteria
		1	2			
1	Display performance	5	4,7	4,9	98	Very Feasible
2	Display adjustment	5	4,7	4,9	98	Very Feasible
3	Media presentation	5	5	5,0	100	Very Feasible
4	Ease of use	5	4,3	4,7	94	Very Feasible
Average		5	4,7	4,9	97	Very Feasible

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Table 3. The results of the feasibility test by media experts

No.	Aspect	Expert		Average	Value	Criteria
		1	2			
1	Suitability	4,7	4,7	4,7	94	Very Feasible
2	Ease of use	4,5	5	4,8	96	Very Feasible
3	Attractiveness	5	5	5,0	100	Very Feasible
4	Efficiency	5	5	5,0	100	Very Feasible
Average		5	4,9	4,9	98	Very Feasible

Table 1 presents the evaluation results from the subject matter expert regarding the learning media. The assessed aspects included content presentation, content accuracy, evaluation components, language use, clarity of information, and motivational appeal. An average score of 4.8 (equivalent to 95) indicates that the media is highly feasible in terms of content quality and completeness.

Table 2 summarizes the assessment by the instructional design expert, which covered aspects such as display performance, interface consistency, media presentation, and ease of use. An average score of 4.9 (equivalent to 97) suggests that the media is highly feasible from a design and visual presentation perspective.

Table 3 contains the media expert's evaluation of technical aspects, including content relevance, usability, visual appeal, and efficiency. The average score obtained was 4.9 (equivalent to 98), indicating that the media is highly feasible in terms of interface and technical performance.

Overall, all aspects assessed by the three experts fall into the "Highly Feasible" category, indicating that the developed learning media is appropriate for use and ready to be tested with students.

Phase 4: Implementation

In the implementation stage, the developed application was tested at SMP Swasta Santo Thomas 1 Medan. This stage involved 32 students. During the trial, students interacted with the application and accessed the learning materials provided. The results of the application trial are presented in Table 4 as follows:

Table 4. Student trial results

No	Aspect	Averaga	Value	Criteria
1	Clarity of Targets and Learning Materials	4,83	96,6	Very Good
2	Organizing and presenting material	4,82	96,4	Very Good
3	Use of Learning Media	4,8	96	Very Good
4	Visual and aesthetic elements	4,8	96	Very Good
5	The effectiveness and involvement of learning applications	4,83	96,6	Very Good
6	Relevance and accuracy of practice questions	4,8	96	Very Good
Average		4,81	96,27	Very Good

Table 4 presents the results of the learning media trial conducted with students. The evaluation covered six aspects: clarity of objectives and content, organization and presentation of material, media usability, visual and aesthetic elements, application effectiveness and engagement, and relevance of practice questions. The average score of 4.81 (equivalent to 96.27) indicates that the media was rated as "Excellent" by the students.

The effectiveness of the media in achieving learning objectives was measured through pre- and post-tests administered by the researcher. These tests were designed to assess students' understanding of the economic topics taught. The results showed an increase in the average score from 68.2 on the pre-test to 82.6 on the post-test. This improvement reflects that the Kodular-based learning media had a positive impact on students' learning outcomes, particularly in enhancing their understanding of economic concepts.

Phase 5: Evaluation

In the evaluation stage, data obtained from the application trial were analyzed to assess the quality of the product and its effectiveness in the learning process. The evaluation took into account feedback from subject matter experts, teachers, and students, all of whom played an essential role in providing input for the further development of the application. Feedback from academic experts focused on the relevance of the presented content, the alignment of the design with learning principles, and the overall feasibility of the application within the context of the implemented curriculum. Teachers provided input on the practicality of using the application in classroom settings and its impact on student engagement. Meanwhile, student feedback centered on user experience, ease of access to learning materials, and the level of interactivity offered by the application.

Discussion

This study demonstrates that the development of Social Studies multimedia based on the Discovery Learning model using the Kodular application successfully addresses the need for interactive, contextual, and self-directed learning media particularly for the topics of Demand, Supply, and Equilibrium Price at SMP Swasta Santo Thomas 1 Medan. The innovation of this learning media is especially relevant considering the abstract nature of economic concepts, which often hinders students from gaining a comprehensive understanding. Initial observations and interviews revealed that previously used learning media remained conventional and failed to facilitate active engagement or independent exploration in the learning process.

The use of the ADDIE development model enabled each stage to be carried out systematically and in a measurable manner, from needs analysis to product evaluation. The main advantage of this study lies in the comprehensive integration of Discovery Learning pedagogical design with the utilization of Kodular as an Android-based mobile application platform. Unlike previous studies such as Anderson et al. (2016), which focused solely on product feasibility this research adopts a comprehensive approach involving expert validation, student engagement testing, and learning outcomes analysis to evaluate the overall effectiveness of the media.

Kacetl & Klímová (2019) criticize that most educational applications merely function as tools for presentations or assessments, without promoting critical thinking or deep exploration. Similarly, Syawaludin et al. (2022) argue that the majority of digital media still fall short of supporting meaningful self-directed learning. Addressing these limitations, this study offers a

concrete contribution by developing an application that explicitly integrates the six stages of Discovery Learning: stimulation, problem formulation, data collection, data processing, verification, and generalization. With this approach, the application not only delivers content but also guides students to think scientifically in a systematic and reflective manner.

At the analysis stage, data from teacher interviews and student questionnaires indicated that the previously used learning media failed to stimulate in-depth, self-directed learning. These findings reinforce the urgency of developing digital media that is not only visually appealing but also aligned with sound pedagogical strategies. The design phase focused on integrating various interactive components including text, images, videos, worksheets, quizzes, and reflection features into a cohesive learning experience. This marks a significant improvement compared to the study by Lam et al. (2018), which did not fully align media interface design with the instructional approach employed.

Feedback from experts, teachers, and students confirmed that the developed application was not only technically and visually feasible but also effective in achieving instructional goals. Expert validations indicated that content quality, information clarity, visual appearance, and navigational ease were rated in the "very good" category. A key strength of this study also lies in the comprehensive data collection, which includes not only formative validation but also empirical field-testing data.

The implementation results showed a significant improvement in students' understanding of economic concepts, as evidenced by the increase in post-test scores compared to pre-test scores. These findings are consistent with those of Lestari et al. (2022) and Drljević et al. (2024), who highlighted the effectiveness of technology-based media in enhancing learning. However, the original contribution of this study lies in the comprehensive application of the Discovery Learning model within an Android-based application not merely as a supplementary instructional approach.

The evaluation phase highlighted the importance of feedback from all stakeholders in refining the media. Subject matter experts emphasized curriculum alignment and content accuracy; teachers provided insights regarding practical classroom implementation; and students offered feedback on visual appeal and ease of use. These inputs were incorporated into the application's refinement, ensuring that it is not only academically valid but also practically applicable within the school context.

Overall, this study makes a concrete contribution to the development of technology-based learning media that responds to curriculum needs and the characteristics of today's digital-age learners. The Kodular application developed in this research proved to be feasible, practical, and effective in enhancing student engagement and understanding of economic concepts. The success of this implementation is influenced by supporting factors such as school infrastructure readiness, device availability, and teacher competence in integrating technology into instruction. With adequate support, this application holds strong potential to be widely adopted as an innovative solution to improve the quality of Social Studies education at the junior high school level.

CONCLUSION

This study successfully developed a Discovery Learning-based social studies multimedia application using Kodular, which has been proven to be feasible, practical, and effective in enhancing students' engagement and understanding of economic concepts. The

primary novelty of this research lies in the comprehensive integration of all six stages of the Discovery Learning model into an interactive Android application, making it not only a visual aid but also a tool that systematically promotes scientific thinking and independent learning. This approach distinguishes the study from previous research, which typically focused only on visual aspects or end-product evaluations without incorporating a robust instructional model.

Moreover, validation by six experts and direct classroom trials indicate that the application effectively addresses the need for interactive and contextual learning media aligned with the characteristics of 21st-century learners. The study also demonstrates that pedagogical designs integrated with simple technologies like Kodular can serve as alternative solutions in schools with significant infrastructure limitations.

However, the study is limited by the small-scale trial conducted in only one school and with a relatively small number of participants. Therefore, further research with a broader scale and diverse learning contexts is needed to examine the consistency of the application's effectiveness.

Acknowledgments

The author would like to express sincere gratitude to Universitas Negeri Medan and the Educational Technology Study Program for the support provided throughout the course of this research. Special thanks are also extended to SMP Swasta Santo Thomas 1 Medan for granting permission and the opportunity to conduct this study. The support from the university, the study program, and the school has been invaluable and played a crucial role in the success of this research.

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