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Development of scratch educational game-based learning media to improve students' problem-solving ability

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Abstract
This study develops Scratch educational game-based learning media to improve students' problem-solving skills in economics subjects regarding financial institutions in class X MA An-Nidhomiyah. The research method used is Research and Development (R&D) with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). Data were collected through questionnaires, observations, interviews, and tests, and analyzed descriptively. The research subjects were 16 grade X students. The results showed that this learning media was very feasible to use, with a validation score of 4.5 from the material expert, 4.6 from the teacher, and the media expert's assessment showed feasibility. In addition, this media is proven effective in improving students' problem-solving skills, with a Gain Score of 1.5 which is in the high category.

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INTRODUCTION

Education is a process aimed at acquiring knowledge, which is undertaken by individuals to develop their abilities and prepare them for active participation in society, typically through formal schooling (Aini et al., 2023). Through education, individuals are afforded opportunities to refine, explore, and optimize their inherent capabilities. Additionally, education can be defined as a process designed to induce changes in the attitudes and behaviors of individuals or groups, with the goal of achieving maturity through various learning, training, and teaching methods (Yusuf, 2018).

Madrasah Aliyah (MA) is an upper secondary educational institution within the Islamic education system in Indonesia. According to Mariatun (2022), MA can also be understood as an educational institution under the auspices of Islamic boarding schools or the Ministry of Religious Affairs, tasked with providing Islamic education, moral development,

and general education. The quality of education at MA significantly impacts student learning outcomes, including the mastery of essential skills necessary for everyday life (Fahlevi & Yuliani, 2021).

One of the primary objectives of education at MA is to enhance students' problem-solving skills. The implementation of the Merdeka Curriculum in schools is intended to improve students' creativity, relevance, and character, with a particular focus on developing these skills. According to Rahman (as cited in Anggraeni & Jailani, 2022), problem-solving is a cognitive skill essential for students, both within and outside the educational environment, involving the identification, analysis, and resolution of issues.

In teaching and learning activities (KBM), the application of problem-solving methods is crucial for improving students' abilities to address various challenges. This is especially pertinent in economics subjects, particularly in the area of financial institutions, which are often perceived as challenging by students. Furthermore, students' limitations in utilizing gadgets pose a problem in accessing information related to these subjects. Consequently, innovations in learning media are necessary to address these issues and enhance student engagement and comprehension. One proposed solution is the use of Scratch educational game-based learning media.

This research aims to improve students' problem-solving skills through the use of Scratch educational game-based learning media that has been developed. The research employs a development methodology or Research and Development (R&D) with the ADDIE model, which includes stages such as Analysis, Design, Development, Implementation, and Evaluation. This model facilitates the development of Scratch educational game-based learning media by guiding the process from problem identification to resolution within educational settings (Sembiring et al., 2022).

The utilization of gadgets plays a crucial role in supporting teaching and learning activities (KBM). Educators can leverage gadgets as alternative learning media to enhance students' problem-solving skills through the application of Scratch educational game-based learning media (Arfiansyah et al., 2019). According to Jaser et al. (2023), the use of Scratch educational game-based learning media can create a conducive learning environment and result in an integrated and enjoyable educational experience. Therefore, this research aims to develop Scratch educational game-based learning media as an alternative resource that can be effectively employed in the digital era to address classroom challenges (Intana et al., 2018).

METHOD

In this study, researchers used the development research method or Research and Development (R&D) with the aim of developing new products that can replace old learning media such as student worksheets (LKS) and package books. The main purpose of this development is to increase student interest and facilitate the learning process. According to Sugiyono (2017), the R&D method is designed to

produce and test the effectiveness of certain products. The product developed in this study is Scratch educational game-based learning media.

The development model applied follows the stages proposed by Robert Maribe Branch, namely Analysis, Design, Development, Implementation, and Evaluation (Irawan et al., 2023).

At the analysis stage, researchers collected the necessary information through literature studies, field studies, and technology analysis to identify the needs in the development of economic learning media. Furthermore, at the design stage, a systematic process is carried out starting from determining learning objectives, designing learning scenarios, creating learning media designs, compiling teaching materials and questions, to designing evaluations to assess the feasibility of the developed media.

The development stage involves making Scratch educational game-based learning media products which are then validated by experts, including material experts, media experts, and field practitioners (teachers). This validation aims to ensure that the learning media developed is feasible to use as an alternative in economics subjects. In the implementation stage, researchers tested the product in class using the problem-solving method and collected students' responses to the effectiveness of the learning media.

The last stage is evaluation, where the researcher gives a problem-solving questionnaire to students to measure the improvement of their problem-solving skills. This research was conducted on March 7-8, 2024 at MA An-Nidhomiyah, Jaddih Village, involving 16 class X students as research subjects. Data were collected through observation, interviews, documentation, as well as the provision of validation sheets using a Likert scale, questionnaires, and practice questions in the form of pre-test and post-test. Data analysis was carried out using descriptive techniques for qualitative and quantitative data, in order to get a comprehensive picture of the effectiveness of the learning media developed.

Feasibility analysis of scratch educational game-based learning media

According to Isnaini et al. (2021), this analysis uses the ideal standard deviation (SBi) method to assess the feasibility of learning media. This method aims to evaluate whether the learning media meets the standards set based on validation assessments by experts. The assessment data obtained is then converted into a score on a scale of five, with the following provisions:

Tabel 1. Conversion of scores into a five-point scale

No	Score Range	Score	Remarks
1.	$X > 4,2$	A	Very Feasible
2.	$3,4 < X \leq 4,2$	B	Feasible
3.	$2,6 < X \leq 3,4$	C	Quite Feasible
4.	$1,8 < X \leq$	D	Not Feasible
5.	$X \leq 1,8$	E	Very unfeasible

According to the score conversion in table 1, scratch educational game-based learning media products can achieve quality standard results in each aspect, namely:

1. The quality of scratch educational game-based learning media can be said to be very feasible (A) if the average score obtained is greater than 4.2.
2. The quality of scratch educational game-based learning media can be declared feasible (B) if the average score obtained is smaller than 3.4 and less than or equal to 4.2.
3. The quality of scratch educational game-based learning media can be declared quite feasible (C) if the average score value obtained is smaller than 2.6 and less than or equal to 3.4.
4. The quality of scratch educational game-based learning media can be said to be not feasible (D) if the average score obtained is smaller and less than or equal to 1.8.
5. The quality of scratch educational game-based learning media can be said to be very unfeasible (E) if the average score obtained is less than or equal to 1.8.

Based on the standard assessment criteria above, learning media is declared good and can be used in the learning process, if the results of the assessment validation from experts at least reach the feasible category (B).

Analyze students' problem solving

1. Calculating the average score of each statement in the form of a questionnaire given to students.
2. Calculating N-gain pretest and post test

The results of the N-gain calculation are then converted into normalized gain with the following criteria:

Table 2. Normalized Gain Criteria

Criteria	Conclusion
$g > 0,7$	High
$0,3 \leq g \leq 0,7$	Medium
$g < 0,3$	Low

RESULT AND DISCUSSION

Based on the research results using the ADDIE model, it is evident that several issues were identified during the analysis phase. Teachers were found to still rely on conventional teaching methods, such as lectures, which aligns with findings by Aini, Lis Mariatun, & Sholeh (2023) that highlight a lack of innovation in teaching practices. Additionally, limited use of learning media was noted, reflecting similar concerns in contemporary educational contexts (Susino, Destiniar, & Sari, 2023).

Table and figure may be used in this section.

Table 3. Model ADDIE

No	Development Procedure	Activity
1	Analysis	a. Literature Study b. Field Study c. Technology Analysis Study
2	Design	a. Determine learning objectives a. Design the learning scenario on the learning media b. Creating learning media design c. Compiling the content of the material and practice questions presented in the learning media d. Making evaluation tools in measuring the feasibility of developing learning media
3	Development	a. Validator Assessment b. Revision

4	Implementation	a. Learning media trial b. Assessment of learning media by field practitioners (teachers)
5	Evaluation	Instrument test

Analysis

At this stage, researchers make observations to find information needed to develop learning media which will later be determined as the main problem felt by students, knowing the teaching and learning activities (KBM) at school consisting of the use of learning media, learning methods used, and so on. In the analysis stage there are several activities ranging from literature studies, field studies, and technology analysis studies. So that some problems are obtained as follows:

1. Teachers still use conventional learning methods such as lectures.
2. Limited use of learning media
3. Students are not allowed to bring gadgets in class, making it difficult for students to find additional information about the subjects.

Design

In the design phase, determining the learning objectives was crucial. The selection of relevant sub-materials for the Scratch application was essential to align with these objectives. The integration of educational games has been shown to significantly enhance student motivation, as supported by Irawan, Kusumah, & Saputri (2023), who discuss the effectiveness of interactive multimedia in modern education.

At this stage, starting with determining the learning objectives to be achieved by students in the learning process, the selection of sub-materials that will be presented in the scratch application in accordance with the flow of learning objectives. The material presented is class X even semester economic learning material about financial institutions. Furthermore, researchers conducted a scratch educational game-based learning media design as follows:

1. Material and practice questions presented

   The initial stage in making this learning media is the selection of material and practice questions that are summarized and then presented in the learning media. It aims to facilitate researchers in designing learning media.
2. Learning media design

   The next stage is to design scratch educational game-based learning media on the material of financial institutions that have been summarized previously in accordance with the learning objectives and the flow of learning objectives. Then, in using this scratch application, which is used as a learning media, researchers choose to use it through the scratch website. Because it can be accessed by everyone. In editing this scratch application, it requires high concentration and patience. Starting from the selection of background, animation, images, colors, letters, backsound in accordance with the material presented.

Development

During the development phase, the validation of the Scratch-based educational game by subject and media experts emphasized the importance of

thorough evaluation before classroom implementation (Fahlevi & Yuliani, 2021). The results of the implementation phase indicated high student engagement and enthusiasm when utilizing the developed media, consistent with prior research advocating for active student participation in learning (Jaser et al., 2023).

Implementation

At this stage, researchers tested the revised product using a learning model in accordance with the predetermined learning outcomes. During the learning process, students were very active and enthusiastic about discussing in groups when the researcher explained the material using the learning media and the researcher gave pretests and posttests and questionnaires as an evaluation in the learning process. Researchers can also find an increase in students' problem-solving skills before and after the learning process.

The results of student assessment in the form of questionnaires obtained before and after the learning process can be seen in table 5 below.

Tabel 3. Results of Student Assessment (Questionnaire)

No	Questionnaire	Score	Remarks
1	Before	3,9	Feasible
2	After	4,6	Very Feasible

Sources: Research data

The student assessment scores, which improved from 3.9 to 4.6, affirm that the Scratch-based educational media is suitable for use in the classroom, reflecting the findings of Yulianisa & Sudihartinih (2022) regarding the effectiveness of technology-enhanced learning. The increase in pretest and posttest scores further supports the conclusion that this media can enhance students' problem-solving abilities, corroborating previous studies (Martanti, Hardyanto, & Sopyan, 2013).

Evaluation

At this stage, researchers provide problem solving instruments in the form of pretests and posttests to determine students' ability in problem solving or problem solving against the use of scratch educational game-based learning media. This pretest and posttest were given before and after the scratch educational game-based learning media was applied in the learning process. In analyzing the results of the pretest and posttest, researchers used a gain score to determine the increase in students' problem-solving skills before and after the learning media was applied. Meanwhile, the average results of calculations obtained from pretests and posttests given to students before and after using scratch educational game-based learning media can be seen in table 6 below.

Tabel 4. Student Pretest and Posttest Results

Pretest	*Post Test*
1179	1360

Source: Research data

Based on the accumulated results, it is known that the pretest value of 1179 then experienced an increase in the posttest value of 1360.

Then, the results of the calculation of the gain score show that there is an increase in problem solving ability of 1.5 with a high category.

The use of scratch educational game-based learning media can improve

problem solving skills with a high category increase.

This is due to several factors that contribute to the successful application of the media, such as scratch educational game-based learning media being one of the first learning media used by utilizing gadgets, thus attracting students to study and learn. Background/appearance, animation and back sound in accordance with the material is a special attraction for students. Loading material and practice questions with easy-to-understand language makes it easier for students to understand and learn the material.

CONCLUSION

The research findings and discussions presented indicate that the development of Scratch educational game-based learning media for the economics subject, specifically the material on financial institutions, involves five essential stages as part of the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation.

Validation assessments conducted by various experts, including material experts, media experts, field practitioners (teachers), and students, demonstrate that the Scratch educational game-based learning media is feasible for use in the learning process. Specifically, material experts rated it 4.5 (very feasible), media experts rated it 3.8 (feasible), field practitioners (teachers) rated it 4.6 (very feasible), and students' ratings increased from 3.9 (feasible) to 4.6 (very feasible) after implementation.

Furthermore, the Scratch educational game-based learning media has been shown to enhance students' problem-solving skills. The pretest results yielded a total score of 1179, which increased to 1360 in the posttest. Analysis of these results using gain scores revealed an average improvement of 1.5, categorized as high. This indicates a significant enhancement in students' problem-solving abilities.

Overall, these findings align with existing literature that underscores the positive impact of technology-based learning media on educational outcomes (Anggraeni & Jailani, 2022). This suggests that Scratch educational media can play a vital role in enriching students' learning experiences and improving their academic achievements.

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