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Development of Algebra Monopoly Game Media Based on Rolling Questions for Junior High School

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ABSTRACT

To create an interactive learning atmosphere in the classroom, one way is to use game media that is integrated into learning. There have been many efforts to develop monopoly game media in mathematics learning. However, no research has been found that attempts to develop monopoly game media in mathematics using a learning approach that involves students. Therefore, this research aims to describe the development of monopoly game media on rolling question-based algebra material and analyze the validity and practicality of the media. The development model used in this research is the ADDIE model, an acronym for Analysis, Design, Development, Implementation, and Evaluation. The subject of this research was a class of private junior high school students in Surakarta. The data collection technique uses a response questionnaire obtained from expert validators, teachers, and students. The collected data is then analyzed to determine the validity and practicality of the media that has been developed. The results of data analysis provided by media expert validators obtained an average percentage of 97.6%, while data obtained from practitioners showed an average percentage of 85.6%. Based on the results of this research, it was concluded that the algebra monopoly game media based on rolling questions was declared valid and practical for use as a mathematics learning media in junior high school algebra material.
***Keywords**: Gamification, Monopoly, Algebra, Rolling Questions, ADDIE Model.*

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INTRODUCTION

Mathematics is a very important subject (Ishartono et al., 2022) and emphasizes concepts (Deviana & Prihatnani, 2018). Understanding mathematical concepts is fundamental to understanding the subject matter in more depth (Murtiyasa & Sari, 2022). This is useful for students to solve math problems easily (Radiusman, 2020). Algebra is a mathematical study that must be understood in depth because it contains abstract concepts (Yusrina & Masriyah, 2019). Algebra is a branch of mathematics that contains numbers, letters, and symbols that do not have definite values and are then manipulated and generalized according to rules to make it easier to solve a problem (Hayati & Marlina, 2021; Hervilia et al., 2023; Rangkuti, 2022; Rahayu et al., 2021; Kurniawan et al., 2023). The role of algebra is quite crucial to study because it a support further studies and is useful in everyday life (Jupri et al., 2020; Siegler et al., 2012). However, in reality, students experience obstacles in learning such as not understanding the problem (Pramesti & Retnawati, 2019), errors in the problem-solving process (Munthe & Hakim, 2022), and the basic thing is not understanding the concept of the material (Novianti & Riajanto, 2021). In fact, in mathematics, concepts must be understood so that it is easy to accept new material which is still related.

Deviana & Prihatnani (2018) believes that understanding the material in depth can be done through practice questions. According to Lismawati et al., (2023) varied evaluations can reduce student boredom and anxiety in mathematics subjects. Practice questions given regularly have the impact of honing your ability to master the material (Suryanti et al., 2024), the benchmark for learning progress (Susiyanto, 2021), improve learning outcomes (Purwantoro & Saryantono, 2021), and increase self-efficacy (Ningsih & Hayati, 2020). However, due to the intensity of the presentation of practice questions that teachers often carry out (Rofiah & Bahtiar, 2022) or teacher-centered results in learning activities becoming monotonous (Hasanah et al., 2019; Nugroho et al., 2024) students become passive (Muliandari, 2019) and limited creativity (Setyaningsih et al., 2019) thus causing boredom (Harefa et al., 2020). Therefore, teachers must be innovative in creating a new learning atmosphere and can stimulate students to play an active role in learning activities, one of which is by utilizing game-based learning media.

Learning media are physical or non-physical tools (Mahardika et al., 2021) used as alternative media (Uswatun et al., 2021) in delivering teaching materials to achieve the expected learning objectives. As time goes by, there are innovations in learning media, namely game-based learning media or gamification. Gamification itself is a learning strategy that combines elements of games or games (Syuhada et al., 2023; Pehlivan & Arabacioglu, 2023). So game-based learning media is a learning tool that integrates games into the learning process. Apart from attracting students' interest in learning (Permata & Kristanto, 2020), This can encourage students to be active and motivated because learning is packaged in a fun and challenging way (Sari et al., 2022). One of the game media that can be implemented in learning is Monopoly . Monopoly is a board game consisting of area tiles, the aim of this game is that players compete to acquire area tiles by

carrying out each instruction or question available on the game board in turns (Wulandari & Sukirno, 2012; Sibuea & Handayani, 2019). Based on the basics of playing Monopoly in general, the game is then modified according to the learning needs that will be delivered, one of which is by implementing the presentation of various mathematical problems in the game.

There is a learning method that can be integrated into the game regarding the presentation of various questions, namely the rolling question method. According to Kusnati (2018) rolling questions are a learning method by rolling questions between students continuously. Meanwhile, according to Gultom et al. (2022) States that rolling question is a teaching method that aims to encourage students to think, ask, and work on questions or problems within a predetermined time. So it can be concluded that rolling questions is a learning method that can be used to hone thinking and problem-solving skills by involving students in rolling questions or problems with each other in a series of activities. This is in line with Ashari, et al. (2023) in the Wahyuhidayati & Argarini (2024) states that playing Monopoly can manifest children's creativity in it. So indirectly, learning activities in the classroom create good collaboration between students and teachers.

Several previous studies attempted to develop Monopoly game media that was implemented in mathematics learning. Some of these studies are Parsianti et al. (2020) developing Monopoly learning media on arithmetic material. (Lena et al., 2021) developing Monopoly learning media on two-variable linear equation systems. Furthermore, Listiana et al. (2022) developing a Monopoly game on the subject of chance. However, from several of these studies, no research has been found that attempts to develop Monopoly game media by integrating learning methods in the form of rolling questions that involve students in the game system. To complement this research gap, this research aims to develop Monopoly game media on algebra material at the junior high school level based on rolling questions.

The meaning of this research is expected to have a positive impact on students in the form of attracting students' interest in learning and being able to practice questions regularly, especially on algebra material, motivating teachers to create more enjoyable mathematics learning through game-based learning media, for stakeholders, it is hoped that it can enrich learning models, especially in mathematics learning, and for education, it is hoped that it can support the development of gamification-based mathematics learning.

Based on the description above, the research question that arises is how to integrate game media in the form of Monopoly into algebra material using a valid and practical rolling question method. Therefore, this research aims to describe the development of rolling question-based algebra Monopoly game media for junior high school students.

METHOD

This research is a type of R&D (Research and Development) research with the ADDIE model. According to Sukmadinata (2009) in (Sidarta & Yunianta, 2019) R&D (Research and Development) research is a procedure for developing new products or improving a previous product that can be accounted for. Then according to Aldoobie (2015) in (Budoya et al., 2019) stated that the use of the ADDIE model is a model that is commonly

used, especially in the field of education because it helps teachers to create efficient and effective learning media. In line with what was stated by (Hidayati et al., 2023) the ADDIE model is a model whose procedures are simple but whose application is structured. This is in line with the aim of the research, namely to develop rolling question-based Monopoly game media that is good for learning. ADDIE is an acronym for Analysis, Design, Development, Implementation, and Evaluation which are the stages of the model (Astuti et al., 2017).

Analysis

This stage is an important stage in the development process. This stage is structured based on an analysis of students' needs in learning mathematics, curriculum analysis which includes material in the syllabus to create media in accordance with the expected learning outcomes, as well as analysis of the quality of learning media that is appropriate to conditions in the field.

Design

This stage is the design stage of the product to be developed. Meanwhile, the stages carried out include designing sketches and media components for the Monopoly game according to the desired criteria, selecting the right materials according to your needs, as well as preparing materials and questions that will be integrated into the Monopoly game.

Development

The development stage is the realization stage of making a product based on a predetermined design. This stage includes making the initial product, and assessment of product suitability by validators before use, then the assessment in the form of suggestions given by the validator is used as a basis for revising the Monopoly game media.

Implementation

At this stage, the research will be carried out in one of the schools in Surakarta. Monopoly game media that is ready to use will be tested on students and assessed by teachers to see the response to the Monopoly game media that has been developed.

Evaluation

At the evaluation stage, researchers calculated the results of questionnaires from validators, teacher responses, and student responses that were distributed to determine the level of validity and practicality of the media that had been developed. A questionnaire is a data collection technique by provides a set of statements or questions that must be answered by respondents. The data obtained was then analyzed to determine the validity and practicality of using the formula proposed by (Arikunto, 2010) that is:

$$P = \frac{\sum n_i}{N} \times 100\%$$

Description:

P = Assessment Score Percentage
$\sum n_i$ = Score obtained
N = Maximum Score

Grouping of assessment score criteria that have been calculated to determine the level of qualification and suitability of the media (Arikunto, 2010), can be seen in Table 1.

Table 1. Media Qualification and Eligibility Levels

Percentage Rate	Qualification	Description
81 - 100%	Very good	Very valid/Very Practical
61 - 81%	Good	Valid/Practical
41 - 61%	Pretty good	Quite Valid/Quite Practical
21 - 40%	Not good	Invalid/Not Practical
< 20%	Very bad	Very Invalid/ Very Impractical

Criteria that respondents can choose as a questionnaire assessment using a Likert Scale (Arikunto, 2010), The criteria can be seen in Table 2.

Table 2. Respondent Assessment Criteria

Score	Description
1	Not good
2	Enough
3	Good
4	Very good

RESULTS AND DISCUSSION

This research is a type of R&D (Research and Development) research using the ADDIE model. The ADDIE model used in the development of rolling question-based algebra Monopoly game media products includes several stages, namely analysis, design, development, implementation, and evaluation. The following is a description of the results of the development stages that have been carried out.

Analysis

At this stage, the aim is to analyze the problems that occur in the class. Based on the results of the interview, information was obtained that there was a lack of interest in learning and student activity in learning. Apart from that, it was found that students had quite low abilities in understanding algebra material and solving problems resulting in students' low understanding of algebra material in depth. Analysis of the problem continued by investigating the learning methods used by teachers and it was found that learning activities were still teacher-centered, and it was found that teachers had not maximized the use of learning media as a tool to support learning activities. This influences the learning atmosphere in the classroom to become monotonous and boring. According to (Stanciulescu et al., 2024) in his research said that active learning activities in the classroom can be influenced through interactive media. Based on this, a needs analysis was found for students, namely that they needed innovative learning media that could support them in exploring algebra material and hone their abilities in solving algebra problems. In connection with the analysis of the material that will be studied in algebra, it emphasizes basic algebraic exploration in the form of variables, coefficients, constants, and algebraic terms, as well as solving algebraic operations. The preparation of the material also pays attention to the syllabus of the learning objectives to be achieved so that it is more structured. In analyzing the quality of learning media, according to (Arsyad, 2014) in its development it must be adapted to field conditions by paying attention to: (1) In accordance with the goals to be

achieved; (2) Appropriate to support lesson content such as facts, concepts, principles, or generalizations; (3) Practical, flexible and durable; (4) Teachers are skilled in its use. So, based on the explanation above, a learning media tool will be developed that can attract students' interest in learning, activeness, and deepening of algebra material by paying attention to the quality of the media needed.

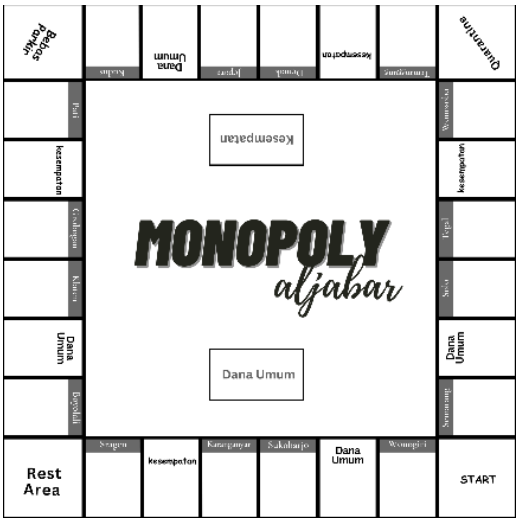


Figure 1. Media Sketch of Algebraic Monopoly Game

Design

This stage is part of the design of the product to be developed. Product design starts from an initial sketch accompanied by the components contained therein. Figure 1 is the design of the Algebra Monopoly game media. In this media, there are components that will complete it, such as a Monopoly game board, game pawns, area plot cards, chance and general fund cards, step cards, game manuals, material books that have been modified to become quarantine agendas, as well as answer keys to questions that are already available in an algebra Monopoly game.

The selection of materials for the Algebra Monopoly game media uses paper materials with consideration to make it easier for teachers to care for and the practicality of packaging for learning activities. The material topic integrated into the Monopoly game is algebra with material covering elements, operations, and simplifying algebraic forms. Apart from the composition of the material, the Monopoly game media also presents a variety of questions and applies a rolling question approach. The rolling question method is an approach that involves students in the learning method by rolling questions to other players. The implementation of the algebraic Monopoly game is that when a player stops on an area plot that has been acquired by another player, the player must answer questions asked by the owner of the area plot. The questions asked in the Algebra Monopoly game are questions relating to elements, operations, and simplification in algebraic form. Meanwhile, the teacher's role is as a guide so that the game can run according to the game guide.

Development

After the design stage, the next step is the development stage realizing the product design into a product that is ready to be used. The development includes activities for creating Monopoly game media, assessing product feasibility by validators, then the revision process based on suggestions after the product feasibility assessment has been carried out. The following are the stages of the process of developing rolling question-based algebra Monopoly game media.

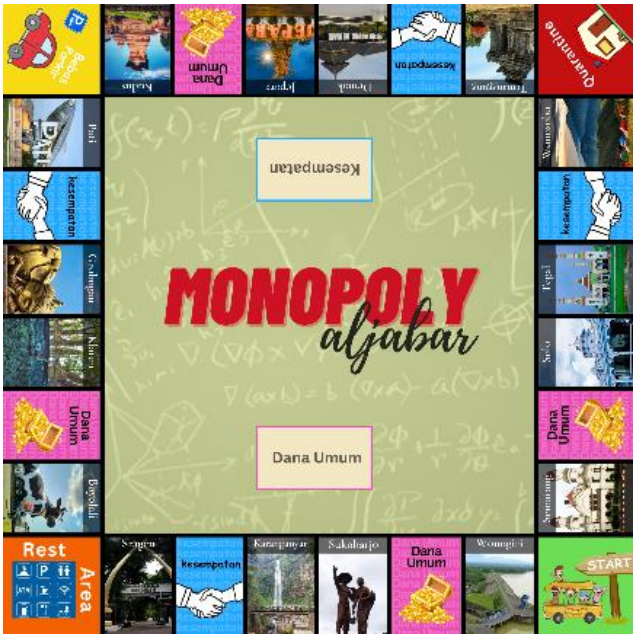


Figure 2. Algebraic Monopoly Game Board

Figure 3. Algebra Monopoly game Handbook

First, design an algebraic Monopoly game board. The algebra Monopoly board is rectangular with dimensions (50x50) cm. Use duplex paper because the material is thick and sturdy. The theme raised on the Algebra Monopoly game board is cities in Central Java which are regional plots on the Algebra Monopoly game board. The area plot contains algebra questions with a selling price in the form of value points that students must collect as players in the Algebra Monopoly game. The rolling question-based algebra Monopoly game board design is shown in Figure 2.

Second, the design of the Algebra Monopoly game guidebook. The guidebook contains learning objectives and achievements, rolling question-based game systematics, game rules, and algebra Monopoly game developer profiles. The design of the Algebra Monopoly game guide is presented in Figure 3 .

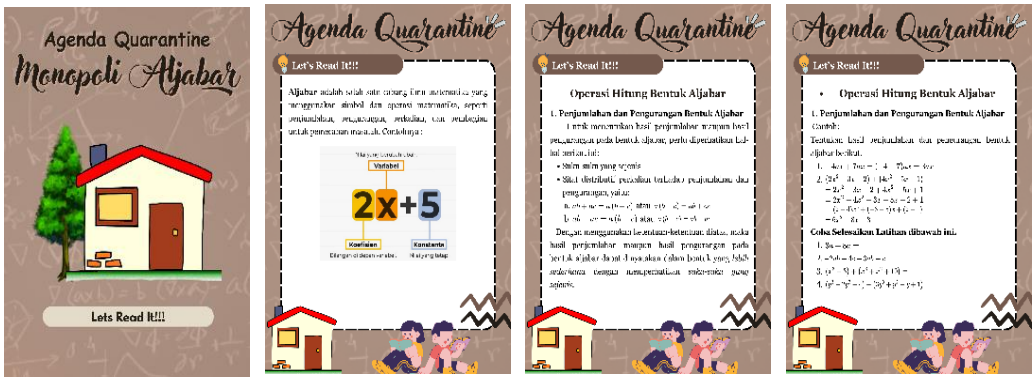


Figure 4. Quarantine Agenda Book

Third, designing a material book that is modified to be a quarantine agenda. The quarantine agenda book contains material, examples, and practice algebra questions specifically for players who stop at the quarantine square on the Monopoly game board. The quarantine agenda book is presented in Figure 4.

Figure 5. Chance Card and General Funds

Fourth, design chance and general fund cards. There are 26 cards in each category. Chance and general fund cards contain statements, questions, and instructions that players must carry out regarding algebra material. The opportunity card and general fund are presented in Figure 5.

Fifth, design regional plot cards. The regional plot card consists of 16 cards that have points. This is because the regional plot card contains one algebra problem which is used as a certificate of ownership of the regional plot card for players who successfully solve the problem in it. Then the submission of questions is continued by the owner of the regional plot card. The

card is presented in Figure 6

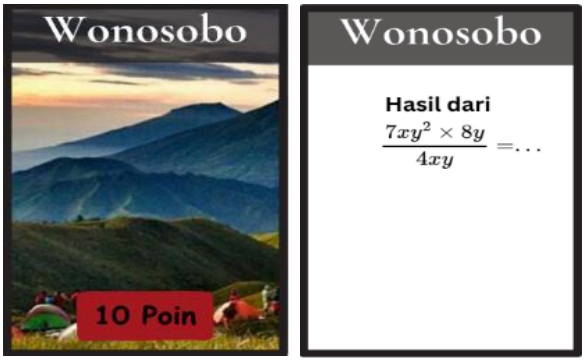


Figure 6. Regional Plot Card

Sixth, design the player's move cards and pawns. Step cards are cards used to run algebraic Monopoly players' pawns. This card consists of 12 cards which contain three types of instructions, namely forward, backward, or stop in place instructions. Meanwhile, the algebraic Monopoly player's pawns consist of 4 pawns with different colors, namely red, blue, green, and yellow. The player's move cards and pawns are presented in Figure 7.

Figure 7. Player's Move Card and Pawn

Seventh, design the answer key book. The answer key book is a collection of answer keys for questions found in the Algebra Monopoly game such as the quarantine agenda, regional plot cards, as well as chance and general fund cards. The answer key book is presented in Figure 8.

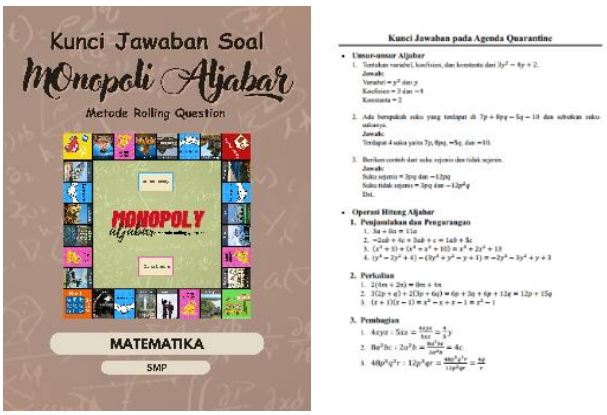


Figure 8. Answer Key Book

Eighth, design the packaging. The rolling question-based algebra Monopoly game will be packaged effectively so that it is easy to carry anywhere. The square-shaped game board was then modified into a board that can be divided into two so that it is easy to store. Then, there is a tote bag that collects all the items in the rolling question-based algebra Monopoly game. The media packaging for the Algebra Monopoly game is presented in Figure 9.

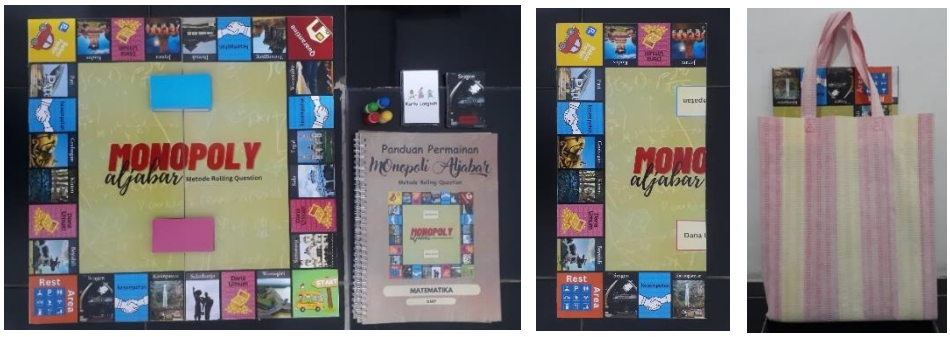
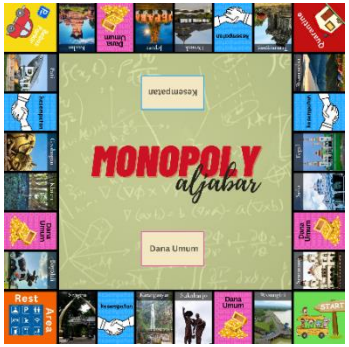
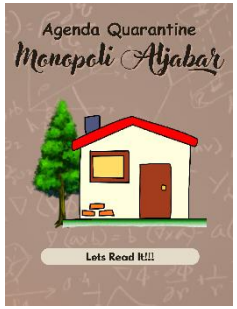
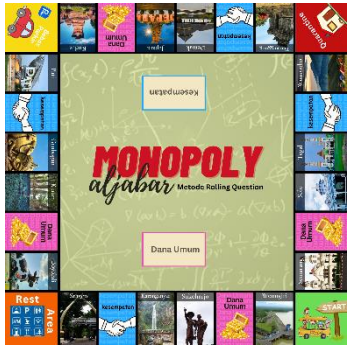
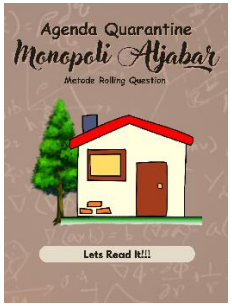
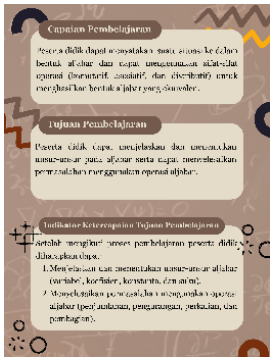
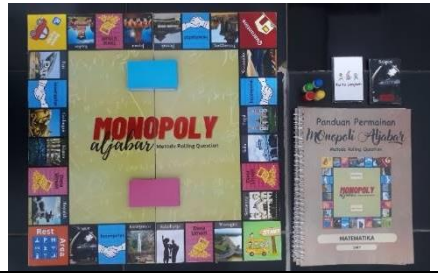


Figure 9. Algebra Monopoly game Media Packaging

After product development is complete, the next step is product assessment by validators before conducting trials. Product assessment was carried out using a questionnaire to see the feasibility of the rolling question-based algebra Monopoly game media that had been created. Table 3 shows the suggestions given by validators in the product validation process. This is part of the revision of the Algebra Monopoly game product with the aim of making the learning media a good and appropriate media in accordance with the expected achievements.

Table 3. Before and After Revision of the Algebra Monopoly Game

No	Before	After	Description
1	 	 	Equating the titles found on all items in the Algebra Monopoly game media. The title is "Monopoli Aljabar Metode *Rolling Question*".

2			Completeness on the developer profile page.
3			Adjustment of the layout sequence between learning objectives and achievement indicators, as well as adjusting indicators of achievement of learning objectives into one goal so that it is easy to measure and add degrees to learning objectives.
4			The Algebra Monopoly game media packaging is equipped with a woven container to store the game cards and pawns and there is a storage box for collecting books and a woven container which is an item from the Algebra Monopoly game media.

Implementation

At this stage, the algebra Monopoly game media based on rolling questions is ready to be used and tested on students. The implementation phase was carried out in February in SMP Daarul Qur'an Surakarta. Before students try to use the Algebra Monopoly game media, the researcher explains the purpose of making the media and provides a demonstration of how to play Algebra Monopoly based on rolling questions. Then, it continues with the use of algebra Monopoly game media by students. When using the Algebra Monopoly game media, there are no obstacles during the game process. This is because students are quite familiar with Monopoly games in general so they can run smoothly with enthusiastic responses. After the game ended, students and teachers were asked to fill out a response questionnaire distributed by researchers to determine the level of practicality of the rolling question-based algebra Monopoly game media that had been developed.

Figure 10. Implementation of Rolling Question-Based Algebra Monopoly game Media

Evaluation

After conducting trials, this stage is an evaluation stage in the form of a response questionnaire given by validators, teachers, and students to the rolling question-based algebra Monopoly game media that has been developed. This aims to determine the level of validity and practicality of the media. The following are the results of testing the Algebra Monopoly game media based on rolling questions: (1) Validation results from material experts who have been analyzed obtained a score of 97.5% with the criteria "Very Valid" while media experts obtained a score of 97.7% with the criteria "Very Valid". Based on the assessment of the two experts, an average score of 97.6% was obtained, so it can be concluded that the algebra Monopoly game media based on rolling questions is very valid; (2) The practicality of the media is obtained based on data provided by teachers and students. Based on the responses given by the teacher, a score of 92.5% was obtained with the criteria "Very Practical" and then the responses given by students to the media obtained a score of 78.7% with the criteria "Practical". Based on the assessments of the two practitioners, an average score of 85.6% was obtained, so it can be concluded that the Algebra Monopoly game media based on rolling questions is very practical. A summary of the results of data analysis in this study is presented in Table 4.

Table 4. Results of Media Data Analysis for Algebraic Monopoly Games Based on Rolling Questions

No	Data analysis	Score	Criteria
1	Material expert validation	97,5%	Very Valid
2	Media expert validation	97,7%	Very Valid
3	Teacher Response	92,5%	Very Practical
4	Student Response	78,7%	Practical

Based on the results of this research, it can be stated that the algebra Monopoly game media based on rolling questions is valid by validators and practical based on the results of teacher and student response questionnaires so that this media can be used as a learning medium in schools, especially in mathematics, algebra material.

CONCLUSION

This research describes the development process and analyzes the level of validity and practicality of the rolling question-based algebra Monopoly game media. This development process uses the ADDIE model which includes analysis, design, development, implementation, and evaluation. The data collection technique in this research uses a response questionnaire from expert validators, teachers, and students. The results of the analysis of these data can be concluded that the Monopoly game media based on rolling questions is declared valid and practical for use as a mathematics learning media in algebra material. Apart from that, as a form of support for the wealth of research in the field of education, it is recommended to continue this research by analyzing the effectiveness of the media. or develop Monopoly game media on other materials with different methods.

ACKNOWLEDGMENT

This research was possible thanks to assistance from various parties, For this reason, the researcher would like to thank the Principal of SMP Daarul Qur'an Surakarta and Mrs. Rahmatica Nur Mutatohirina, S.Pd. as a Mathematics Teacher at SMP Daarul Qur'an Surakarta who has permitted the time and place so that the research can be carried out successfully.

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