

Role-playing game (RPG): Educational game for learning mathematics

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ABSTRACT Role Playing Games (RPG) has emerged as an exciting learning medium in the context of mathematics education. This research evaluates an RPG's validity, practicability and effectiveness as a mathematics educational game by applying the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. A needs analysis is conducted to understand the relevant mathematics curriculum and students' needs to understand these mathematical concepts. Game designs and mathematical content that are appropriate to the curriculum and students' level of understanding are designed based on the results of this analysis. Furthermore, game development is carried out by integrating mathematical concepts into the game narrative and gameplay system. Game implementation is carried out in a learning environment, where students' interactions with the game are monitored to evaluate its practicability in real situations. The evaluation was conducted to measure the game's effectiveness in improving students' understanding of the mathematical concepts being taught. Evaluation methods include student response questionnaires after using the game, teacher response questionnaires, and material and media expert assessments of the game. It is hoped that the results of this evaluation can provide a better understanding of the validity, practicability, and effectiveness of using RPG as an educational mathematics game by applying the ADDIE Model. It is hoped that the implications of this research can contribute to developing innovative and effective learning methods in mathematics education.

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1. INTRODUCTION

Learning media are tools or facilities used in the learning process to help students understand and master the material being taught (Anwar et al., 2019; Choirudin, 2021; Darmayanti et al., 2022). Learning media can be physical materials such as books, whiteboards, modules (Choirudin et al., 2021; Halimah et al., 2022), figures and teaching aids, or digital media such as videos (Rachmavita, 2020; Sari & Fathoni, 2022), interactive software and multimedia presentations (Rasiman et al., 2020; Septy Nurfadhilah, 2021). Many people in education use digital technology as a learning medium. These include China, Japan, America and Germany.

Indonesia is also experiencing significant growth in the use of digital technology. According to the "Digital 2023 Indonesia" report from Datareportal.com, the number of internet users in Indonesia continues to increase, estimated to reach 215 million in 2023.

Due to the large number of mobile device users, the trend of using learning media continues to grow along with technological developments. Several prominent learning media trends in recent years include 1) Video-Based Learning (Rachmavita, 2020), 2) Learning and LMS (Washington, 2019); Use of learning platforms (Pangrazio, 2020), 3) Gamification Based Learning (Wang, 2020), 4) Virtual Reality (VR) and Augmented Reality (AR) Based Learning (Jesus & Sil-

veira, 2019), 5) Skills Based Learning, 6) Mobile Based Learning: e-book, learning videos, and educational games such as role-playing playing games (RPG).

RPG with MV Maker is software that allows users to create RPGs without requiring in-depth programming skills (Wijaya et al., 2023). It is part of the RPG Maker series of software that has been around since 1988. With RPG Maker MV, users can create various RPG games, from simple to complex, with various custom features. The software has various intuitive development tools, such as a database editor for organizing characters, items, and skills, a map editor for creating game environments, and an event editor for organizing storylines and in-game events.



FIGURE 1. Data on Internet and social media user trends in 2023 (Riyanto, 2023)

RPGs feature a complex narrative and allow players to experience being a character in the story. One of the popular RPG creation platforms is RPG Maker MV. By using RPG Maker MV, developers can create 2D RPG games that can stand alone and be played directly without the need for dependence on other platforms or programs (Wijaya et al., 2023)

Based on the explanation above, the researcher intends to create learning media in the form of mathematics educational games using RPG Maker MV. Thus, this research aims to develop learning media for mathematics educational games. Researchers hope developing game learning media, role-based education, and playing this game (RPG) can help students understand mathematics lessons.

2. METHOD

The development model applied in this study is the ADDIE development model (Kurt, 2019). ADDIE is an abbreviation for "Analysis, Design, Development, Implementation, Evaluation". The flow of the ADDIE model is as shown below;

In this research, product evaluation was carried out to measure three aspects of media suitability: validity This product evaluation consists of several stages, including 1) trial design, 2) selection of trial participants, 3) data collection methods, 4) data collection instruments; and 5) data analysis techniques.

In the testing step, a trial design is carried out by creating a flow diagram as a guide for implementing the trial. Next, there will be two test subjects: mathematics teachers and several students from class VIII of SMP Islam Plus Sabilunnajah. The selection of subjects was based on analyzing needs related to using the media, laptops/computers.

Data is collected to meet established standards and obtain the information needed to describe the game development process "Math Adventure BR" and evaluate. This research used several data collection techniques, including: a) Field Notes: This method was used to record information related to the game development process. "Math Adventure BR" uses RPG Maker MV as a learning tool for building space material. b) Validation: This technique is used to obtain information about the validity and practicality of the game "Math Adventure BR" in space building material. Data obtained through validation techniques include reviews by material and media experts and validator assessments of the use of the game in practical situations. c) Questionnaire: A response questionnaire was used to collect information from mathematics teachers at SMP Islam

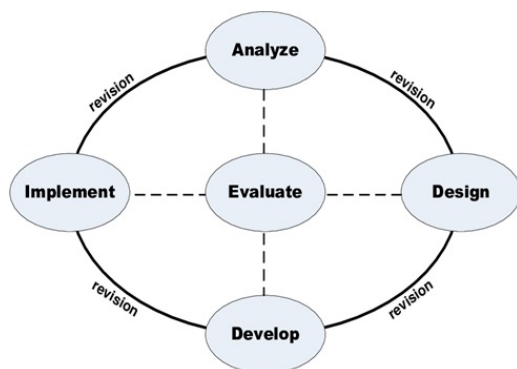


FIGURE 2. ADDIE Development Model (Saidah et al., 2022)

Plus Sabilunnajah to evaluate the practicality of the game "Math Adventure BR". Meanwhile, a student response questionnaire was used to measure the effectiveness of using the game as an independent learning tool in building materials.

The data collection instruments used to collect the information required in this research are: a) Field Sheet Note: Used to record information related to the game development process, "Math Adventure BR" uses RPG Maker MV as an independent learning tool for building space material. It contains a guide to the activities that researchers will carry out. b) Validation Sheet: Given to experts (validators) to assess the validity and practicality of the media being developed. The validity aspect is measured using a Likert-based attitude scale mode. c) Questionnaire Sheet: This consists of two questionnaires: 1) Mathematics Teacher Response Questionnaire: This questionnaire is used to obtain mathematics teachers' responses to the media being developed, especially regarding practical aspects. 2) Student Response Questionnaire: This questionnaire was given to five students to assess their responses to the media developed. The results of student responses were assessed using the Guttman scale.

3. RESULTS AND DISCUSSION

3.1 Results from Learning Media

3.1.1 Storyline in the Game "Math Adventure BR"

The learning media created in this research is an educational game called Math Adventure BR, a Roleplay Game (RPG). The RPG model used is Roguelike, a video game genre with elements such as procedural level mapping, permanent death of characters, and turn-based gameplay in which the player controls a character to explore a random game world and achieve specific goals.

The stages in making the game Math Adventure BR are in Table 1:

3.1.2 Map Design in the Game "Math Adventure BR"

Maps in RPGs not only serve as a navigation tool but also as an essential element in building an immersive game world and providing players with the information needed to explore and experience the adventure within it in Figure ??.

3.1.3 Validation Results

An expert validation sheet is given to each expert (validator) to collect the data needed to describe validity. The validity component refers to the quality criteria of media software, which includes a) the quality of the material and learning targets, b) instructional quality and c) technical quality (Dwipangestu et al., 2018).

Media experts reviewed the game eligibility level Math Adventure BR from the validity aspect and obtained a score of 84.09% in the Valid category. Game eligibility level Math Adventure BR was reviewed from the validity aspect by material experts and obtained a score of 83.33% in the Valid category. Game eligibility level Math Adventure BR was reviewed from the aspect of effectiveness by students and obtained an average score of 94.12% in the Very Effective category.

Role-playing learning media Games (RPGs) have become an increasingly popular research subject due to their

TABLE 1. Storyline in the Game “ Math Adventure BR

No	Storyline	Material inside games
1	Opening. The brave soldiers were given one instruction based on the king’s orders. These instructions are clues as to what is blocking the journey to where the princess is being held hostage	
2	Episod 1 : First Test: the soldier and a cat started walking and were blocked by Examiner 1. The test contained material about building cubes, and the soldier had to pay close attention to the explanation. Then, after listening to the material from the first test, the soldier rises to level 1 and is allowed to continue his journey.	CUBE Cube Surface Area Formula: The Surface Area of the Cube is equal to $6 \times r^2$, then. $LP = 6 \times (r \times r)$ Cube Volume Formula: $V = r^3 = r \times r \times r$
3	Episod 2 : First Test: the soldier and a cat started walking and were blocked by Examiner 1. The test contained material about building cubes, and the soldier had to pay close attention to the explanation. Then, after listening to the material from the first test, the soldier rises to level 1 and is allowed to continue his journey.	BEAM Block Surface Area Formula: $LP \text{ Beam} = (2 \times p \times l) + (2 \times p \times t) + (2 \times l \times t)$ Block Volume Formula: $V = p \times l \times t$
4	Episod 3 : After passing the second test, the soldier and the cat accompanying him will be confronted by examiner 3. Examiner 3 will provide material about building pyramids. The soldier must pay close attention to the material. After completing the material delivery from examiner 3, the soldier rises to level 3 and can continue his journey.	PYRAMID The formula for the surface area of a prism is: $LP = \text{Area of Base} + \text{Area of Four Sides}$. Limas Volume Formula: $V = \text{Base Area} \times \text{Base Height} : 3$
5	Episod 4 : In this episode, the soldier and a cat who always accompanies him will be confronted by examiner 4. Examiner 4 will provide material about prism space construction. The soldier must pay attention to the material after the material is finished. The soldier will level up and be allowed to continue their journey.	PRISM Types of Prisms: 1. Triangular prism, 2. Quadrilateral prism, 3. Pentagonal prism, 4. Hexagonal prism. The shape of the prism is greatly influenced by its base. Prism Surface Area Formula: $LP \text{ Prism} = 2 \times \text{Area of Base} + (\text{Perimeter of Base} \times \text{Height of Prism})$ Prism Volume Formula: $V \text{ Prism} = (\text{Area of Base} \times \text{Height of Prism})$
6	Episod 5 : Meeting the Dragon King, the soldier will be allowed to bring the royal princess if the soldier can answer the Dragon King’s questions. These questions are 8 in total, respectively. Each is about spatial building material that was noted by examiner 1,2,3,4. Suppose the soldier can answer all these questions. Then, the dragon king will hand over the royal princess to the soldiers to take back to the kingdom.	Combining questions about spatial shapes (cubes, blocks, prisms, pyramids), each consisting of 2 questions, containing questions about the surface area and volume of the spatial shape.
7	Game Over : If the soldier has answered the question about geometric shapes (cubes, blocks, prisms and pyramids) and is allowed to take the princess back to the kingdom.	

potential to increase engagement, motivation, and understanding of concepts in learning. Learning Effectiveness: previous research highlights the effectiveness of RPGs as a learning medium. It was found that using RPGs in educational contexts can increase student participation and improve their understanding of lesson material. Comparisons with traditional learning methods often show that RPGs can be more effective in motivating students and producing deeper understanding.

Student Motivation: One crucial aspect often discussed in other research is how RPGs can increase student motivation in learning. Exciting and interactive games tend to make students more enthusiastic about learning. Previous research compared students’ motivation levels between using RPGs and conventional learning methods and found that students were more motivated when using RPGs.

Student Engagement: Research also often discusses the level of student engagement in learning using RPGs. RPGs allow students to actively participate in learning, as

they have to take roles in simulated situations. A comparison with other learning methods shows students are more actively involved when using RPs.

4. CONCLUSION

Based on the research presented by the researchers above, it can be concluded that the development of educational games for learning mathematics with the software Roles Playing Game (RPG) that use the ADDIE model has been completed. The stages used in this research are (Analysis, Design, Development, implementation, and Evaluation). The analysis stage includes performance analysis and needs analysis. The design stage includes creating the game’s storyline, characters, and material adjustments.

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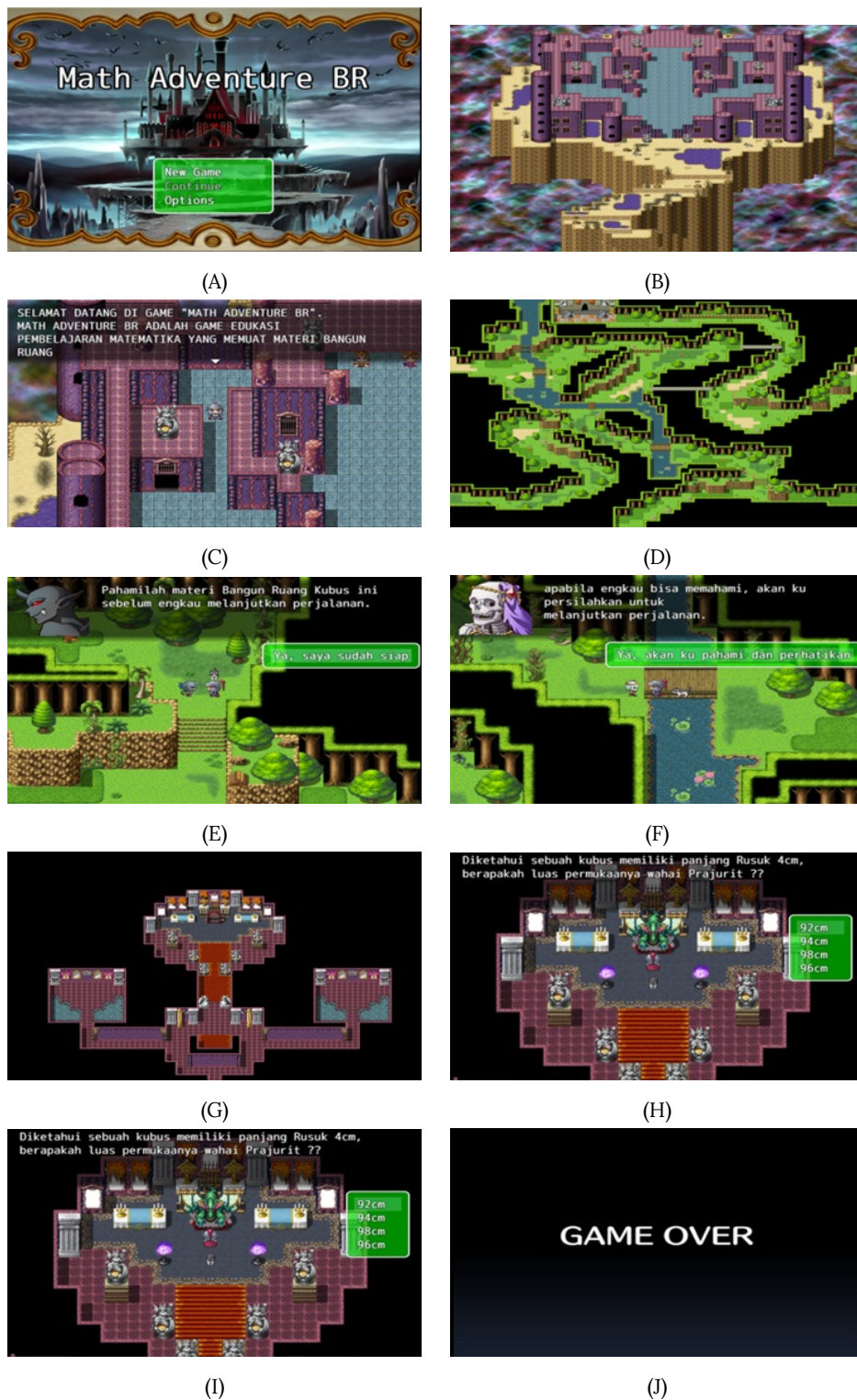


FIGURE 3. Design in the Game “Math Adventure BR”. Figure (A) Design in the Game “Math Adventure BR”, (B) Map Views 1, (C) Game Opening Screens Math Adventure BR, (E) Map View 2, (F) Commands for Understanding Cube Material on Map 2, (G) Commandments for Understanding Block Materials in Map 2, (H) Commands for Understanding Prism Material in Map 2, (I) Folder View 3, (J) Game Over Views.

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