

ARITHMETIC GAME DESIGN FOR PRIMARY STUDENTS

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Abstract

Arithmetic is a field or branch of mathematics that studies addition, subtraction, division and multiplication. In schools Arithmetic is most often used in the process of counting the number of objects, counting the number of students, and buying goods/food in cooperatives. In designing the Arithmetic Game, the author uses the ADDIE development method, which is divided into 5 development stages, namely (Analysis-Design-Development- Implementation-Evaluation). The design of this Arithmetic Game is based on the problems of elementary/MI students who experience difficulties in learning mathematics. This Arithmetic Game has been tested by Media Experts and Material Experts with validation evidence of 70% for media and 95% for material, which means that the game media can be said to be very suitable to be used as a learning medium. Teachers also feel happy because this game can increase passive students' interest in learning in the classroom. From this research it can be concluded that this Arithmetic Game Design can be used as a learning medium for elementary/MI students, not only that, the design of this Arithmetic Game is certainly not only for playing but students can also learn in a more fun way.

Keywords: Arithmetic, Design Games, Mathematics

1. Introduction

Mathematics is a science that can be used to solve problems in real life. Arithmetic is often equated with mathematics, basically arithmetic is a field or branch of mathematics that studies addition, subtraction, division and multiplication. In other words, arithmetic is a part of mathematics that studies the ability to calculate. In everyday life, arithmetic is often used in the calculation process in trading, one of which is to determine prices and calculate income. [1]. In its application, arithmetic that is used to help in everyday life is usually called social arithmetic [2].

In elementary school, students are required to study mathematics to prepare for a life that is not free from calculations. Addition and subtraction of tens and hundreds is material discussed in class II SD/MI. Some students find it difficult to learn subtraction problems. This is based on the results of observations at MI Plus Darul Fallah Ds. Gambiran District. Mojoagung District. Jombang, students experience difficulty in solving subtraction problems. This condition also occurred in research [3] where when learning mathematics in class IV at SD Negeri 2 Penambongan, students were still passive and paid little attention to the teacher who was explaining. Apart from that, students' willingness to be able or make an effort to learn mathematics is still lacking, especially when the teacher explains about multiplication problems. Students are not yet fully able to do multiplication and students will not study at home if the teacher does not give them homework.

Several studies discuss designing arithmetic games to overcome students who have difficulty learning mathematics so that students can learn easily and have fun. The first research conducted by [4] produced an interactive multimedia learning application with a mathematics theme, which aims to introduce mathematics to children aged 6-9 years in a fun way. Therefore, with this application it is hoped that children who play gadgets will not only play general games, but there will be an educational element in the game. The second design

produces a snakes and ladders mathematical board game for SLB-B Karya Murni Medan with the aim of allowing students to express themselves using learning media or as an alternative for solving problems [5]. The third research states that the use of game media can facilitate the learning process and optimize student learning outcomes. In this case, technology can be used to create learning media so that it can foster enthusiasm and attract students' interest in learning. Therefore, this research will design learning media in the form of recognition and number calculation games using construct 2 with the aim that teachers are able to convey the material to students and that students can accept it in a more enjoyable way [6].

Currently, games have become an alternative that can be used in the learning process. [7]. Games are a recreational activity that has the aim of having fun or filling free time. Games can also be a medium for conveying messages to the public in the form of fun games, of course with existing rules. In a game where all players have the same goal, namely achieving victory.

The reason the author uses games as a learning medium is because apart from entertainment, games can also add content for education, apart from that, the technology in games also makes it possible for players to play and learn in groups [8]. For this reason, the author created an Arithmetic Game which can later be used as a learning medium so that students can learn mathematics in a more enjoyable way. Apart from that, from research results [9] the most interesting learning media at the moment is through games because basically games function as entertainment, which is very suitable for elementary school children who still like to play, so games can be a solution as a learning medium for children. So learning can be more fun because students can play and learn at the same time

2. Method & Procedure

The method used in designing the Arithmetic Game for Elementary Students uses the ADDIE development method, which is divided into 5 development stages, namely (Analysis-Design-Development-Implementation-Evaluation), [10]. The reason the author uses the ADDIE method is because at each stage there is a revision or evaluation, so that the results obtained are good and effective products. Apart from that, ADDIE development is very easy to implement because it is sequential and interactive. Of the 5 stages, this article will discuss the first 2 stages, namely Analysis and Design.

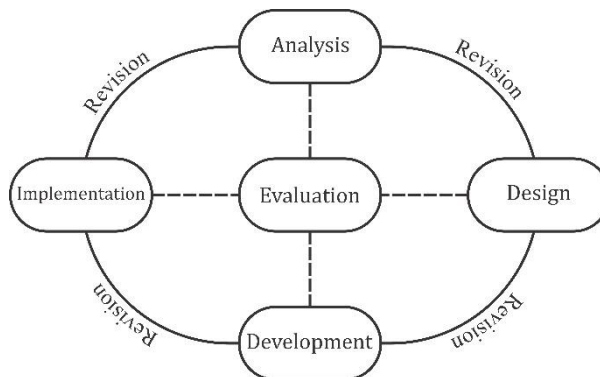


Figure 1 Diagram ADDIE

The following is an explanation of the ADDIE (Analysis-Design-Development-Implementation-Evaluation) flowchart:

1. **Analysis:** To analyze a problem and find the right solution. Based on the results of the author's research, for the problems experienced at the MI PLUS DARUL FALAH school, students found it difficult to do subtraction problems. The solution that we will implement so that students can work on subtraction problems and have enthusiasm for learning mathematics is to create an arithmetic game media to encourage students' enthusiasm for learning and help students who have difficulty working on subtraction problems.
2. **Design:** To design a game that can be used as a learning medium with the aim of attracting students' interest in learning mathematics. This arithmetic game is a platform genre that can be played by students by inserting questions at several levels.

3. Finding and Discussion

The development of this learning media was based on the problem that as a result of mathematics learning in SD/MI, many students experienced difficulties in working on subtraction and multiplication problems, so to make it easier for students to learn mathematics, the author designed an arithmetic game as a learning medium by applying the ADDIE development method so that it could produce Games that can be used by a wider environment.

3.1 Analysis

At this stage, an analysis process will be carried out on the data that has been collected. Here the author analyzes a problem and the solutions that will be used to deal with this problem. From the results of the author's observations, there are several problems experienced by students in learning, one of which is as follows:

3.1.1 Reasons why students have difficulty learning mathematics

Lack of student interest in studying mathematics

A teacher's way of teaching can influence students' interest in learning. From the results of observations carried out at MI PLUS DARUL FALLAH, all students have different interests in learning and the ways to foster interest in learning are also different. Some students sometimes don't pay attention to the teacher who is explaining, especially if the mathematics lesson is in the last hour before going home from school. Students feel tired and less active in learning, so the material received by students is less than optimal. The low interest of students in studying mathematics makes students feel that they have difficulty in learning and their learning results are also less than optimal because students do not pay enough attention to the teacher when explaining the material. Students also appear to be less active in asking questions when they feel that they have difficulty in studying the material provided by the teacher [3].

Learning strategies used by teachers

From the results of the author's observations at the MI PLUS DARUL FALLAH school, learning strategies greatly influence the learning process in the classroom. One of them is the lack of learning media used to convey material so that it cannot support an effective and efficient learning process. The learning system implemented by the teacher is usually a lecture method and practice questions. Meanwhile, direct practical learning, such as measuring objects in class, is only done a few times in the learning process. The learning model presented by the teacher has a big influence on students' interest in learning, in this case the use of teaching aids can help teachers to increase students' interest in learning, one of which is by playing games that match the characteristics of elementary school students who like to play [11]. The learning media also one of factor that influence student motivations towards learning process in class [12]. From the problems above, the author makes conclusions to overcome students who have difficulty learning, one of which is as follows:

3.1.2 Efforts to overcome students' learning difficulties

The difficulties experienced by MI PLUS DARUL FALLAH students must immediately find a solution so that students do not have more difficulty understanding the material provided by the teacher. If there is no help from teachers, parents, or the will of the students themselves, the problems students face will continue to increase. One way to increase students' interest in learning can start from the way parents educate their children. If parents always pay attention to the child's learning process by giving them study time at certain hours, it will become a habit for the child. If children feel used to the learning process at certain times, students will study actively by themselves [12].

Looking at the problems above, the author has strong reasons to be able to help students in the mathematics learning process, one of which is by providing learning media in the form of arithmetic games, so students can play and learn mathematics in a fun way.

3.2 Design

The second stage in the ADDIE method is Design. In the game development process, the design stage refers to the creation of a game design document which consists of 9 components.

- **Title** : The game title chosen is FUNMATH which means fun mathematics. This title wants to show that students can learn mathematics easily and happily using game media
- **Platforms** : The FUNMATH game platform is a web game, where games can be played via a browser on a computer.
- **Type** : Game Type FUNMATH is an educational game platform that takes the main features of platform games but with arithmetic educational content
- **Target Audience** : The target of the FUNMATH game is elementary school students, especially grade 2
- **Language** : The language used is Indonesian

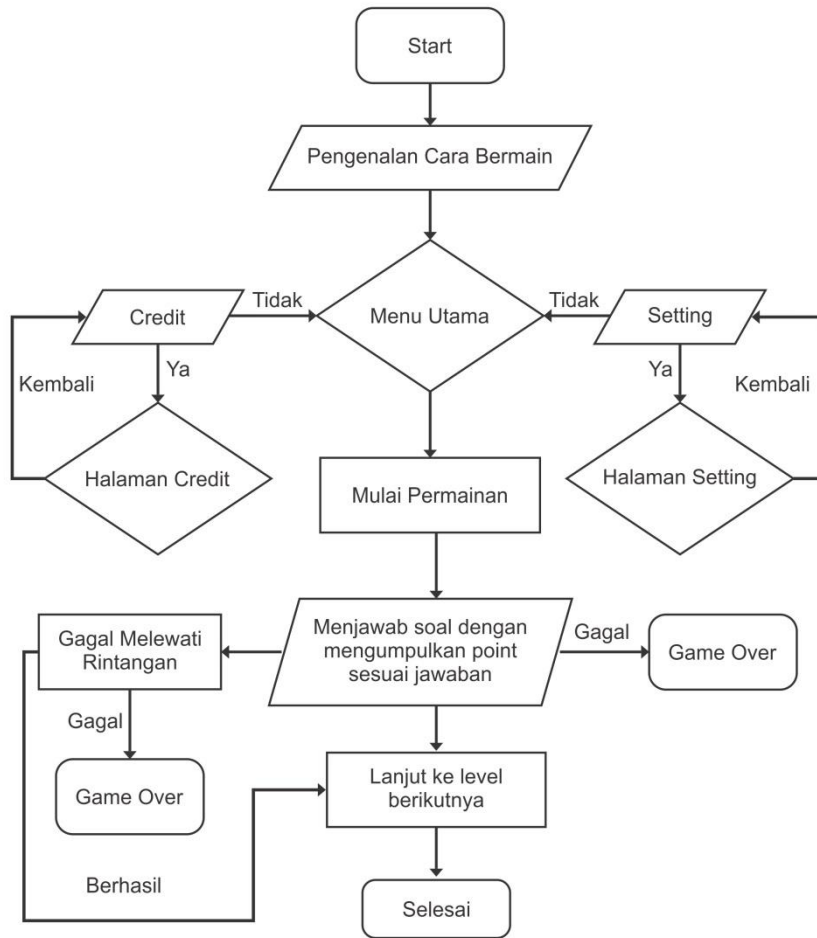


Figure 2 Flowchart Game Yang Dibuat

The explanation of the flowchart in Figure 2 is that before playing and learning, players will be instructed on how to play the game so they can achieve victory. There will be playing tutorials such as how to walk, jump, look for points and enter doors to complete the game. Then there will also be other rules such as when the timer runs out/the player cannot get past the opponent the game will end. There are several level options according to the level of difficulty, players must complete level 1 first to be able to proceed to the next level.

Players must collect points according to the answers to the questions, if the points collected do not match the questions then the game will end. After the points are collected the player can enter the door to complete the game. To add to the challenge of playing, at each level the player must complete the question within 60-120 seconds, if the player fails to complete the question within the specified time the game will end.

Game Interface

The flow diagram that has been created will be used as a reference in creating the interface design. The following are some interface designs used in gaming media

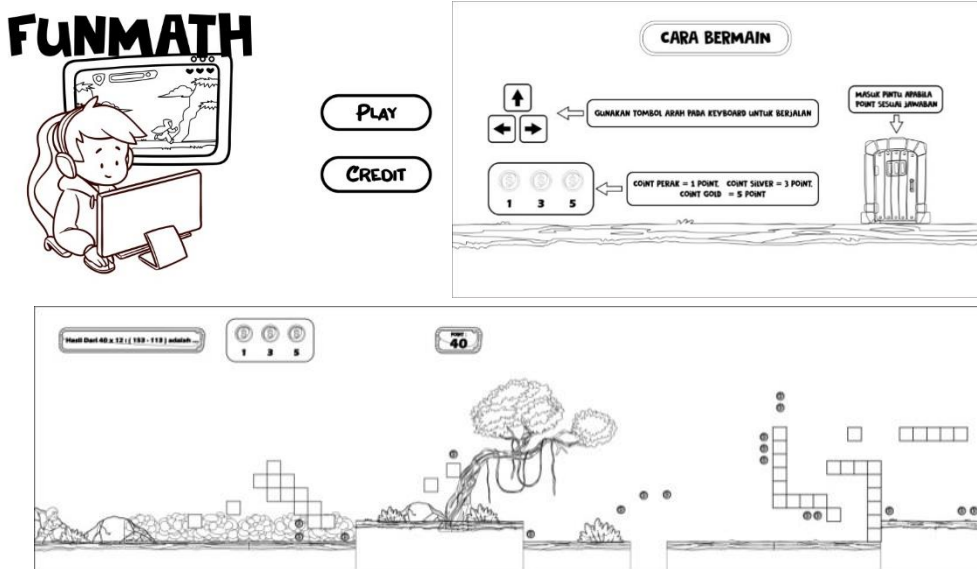


Figure 3. UI/UX Design Game

According to the sequence of images, the interface design shows the interaction between the player and the media. In the first image is the main menu page display, where players can choose to play directly or view the credits which contain information related to game developer data. In the next image is a display of how to play which will explain how the game will be played. This display is used as a guide for players to complete the game correctly. In the last image is a gameplay display which contains the design of the game area that must be completed by the players. In this image, the place to place game assets in the form of bonus objects, obstacles and game information has also been determined.

Conclusion

This Arithmetic Game Design can be used as a reference for creating arithmetic learning media for elementary/MI students. In the future, this Arithmetic Game will of course not only be for playing but students will also be able to learn in a more fun way. Based on the ADDIE model, the next stage is the media development, implementation and evaluation stage. At the development stage, a game prototype will be produced that is ready to be tested. The implementation stage is carried out after the media has been validated by experts and from the test results a media evaluation will be carried out to assess whether the media is suitable for use or not.

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