



## Research on the Development of Edu Games as Learning Media for Geometry and Arithmetic in Elementary School Children

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**Abstract:** Mathematics is a discipline science that has many influences on the theoretic in the classroom and the practice in everyday life. Some of the branches of mathematics that are important in elementary school are geometry and arithmetic. Along with the development of information and communication technology, the development of mathematics learning has also developed. This research tries to discuss and analyze the development of Edu games that can be used for learning geometry and arithmetic. The research method used in this research is the descriptive analysis method. As a result, educational games for geometry and arithmetic developed from conventional games (played through movements) and games in digital form. Digital games are also growing, starting from using computers, smartphones, to adding augmented reality.

**Keywords:** arithmetic, Edu games, elementary school, geometry

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### INTRODUCTION

Mathematics is a discipline that has a great influence on the theoretical realm in the classroom as well as the practical realm in everyday life. By learning mathematics, it is hoped that learners can solve problems that arise in real life. The purpose of learning mathematics in school is to put pressure on the reasoning and formation of students' attitudes as well as put pressure on skills in the application of mathematics (Alhaddad, 2015). This is also in line with the opinion of Soedjadi in Suyitno (Suyitno, 2000) which states that the purpose of mathematics education for the future must pay attention to (1) the formal objectives, namely the reasoning and personal formation of the child; (2) material objectives, namely the application of mathematics and mathematical skills.

In his life, the child will not miss the lessons of Arithmetic and Geometry, both in the school environment and in the family environment. Simple things he will learn about the shape of the object he sees, then he also learns to perform calculation operations for example when he plays. As the child develops, so does the child's arithmetic and geometry skills.

Formerly a medium for learning mathematics, we had to count one by one even for numbers in large numbers. Then technology evolved to give rise to aids for calculating. Learning mathematics in modern times is characterized by several things,

namely the advancement of current technology such as calculators and computers (Alhaddad, 2015). Calculators are used to aiding the counting process in mathematics. Along with its development, the use of calculators and computers has also become common to use. The use of computers in primary school mathematics learning includes finding random numbers, calculating statistics, calculating probabilities, drawing function graphs, drawing geometry, and many more things in math that can be solved with the help of computers (Alhaddad, 2015).

Furthermore, in the rapid development of technology, computers have also transformed into computers in the form of gadgets, namely smartphones. Today, children have started to become familiar with gadgets and digital games (Ridwan, 2020). Amid the situation of the covid-19 pandemic that hit the world and Indonesia in particular, the number of gadgets uses among children is increasing. This makes the child more familiar with gadgets both for doing tasks, collecting tasks, and playing.

The development of technology until the advent of smartphones can be used as a medium for learning mathematics. Today, technology has produced many digital games as a medium for learning mathematics, especially geometry and arithmetic. This study attempts to describe the development of geometric and arithmetic games that can be used for learning media as well as play.



## LITERATURE REVIEW

### Geometry and Arithmetic in Elementary School

Mathematics is a discipline of logic for mastering the form, composition, quantity, and concepts related to one another with the number of which is divided into three main areas, namely algebra, analysis, and geometry (Ridwan, 2020). Mathematics is one of the sciences that is widely used in everyday life. Both in general and specifically. Almost in every aspect of life, mathematics can be applied.

Geometry has a literal meaning which is the measurement of the earth. Geometry is the part of mathematics that deals with points, lines, areas, and space. Space is a set of points that can form geometric constructions, a line is a set of parts of space that is a set of points that have special properties. Fields are sets of points located on a flat surface (Negoro, 2003).

In addition to geometry, another branch of mathematics among them is Arithmetic. arithmetic is also called arithmetic. In arithmetic is discussed the properties of numbers and the basics of work, such as summing, subtracting, dividing, multiplying, and pulling roots (Negoro, 2003).

Learning geometry and arithmetic for elementary school is possible to be taught though should be more creatively and realistically. Geometry and arithmetic are considered to have many applications in mathematics and real life, which also contain many elements of problem-solving.

Mathematical learning, especially geometry for children, aims to identify, point, name, and collect objects around them based on geometric shapes. The first stage a child learns in geometry is topology. They did not know distance, straightness and so on, so they began to study geometry not to start straight, but with curves, such as closed arches, open arches of arched areas, simple arches, and others. Quoting Van Hiele in Ruseffendi argues that there are five stages for children to learn geometry (Ruseffendi, 1991), namely.

1. Level of Introduction. At this stage, students already know geometric shapes, such as triangles, cubes, balls, circles, etc., but they do not yet understand their properties.
2. Analysis Stage. At this stage, students can understand the properties of geometric concepts or shapes. For example, students

know and recognize that the sides of the front face are the same length, that the lengths of the two diagonals are the same length and cut each other equal lengths, and so on.

3. Sequence Level. At this stage, students can recognize geometric shapes and understand the properties and they can sort the geometric shapes that are related to each other
4. Stage of Dedication. At this stage, deductive thinking has begun to grow but has not yet developed well. Mathematics is a deductive science because inferring conclusions, the proof of the proposition must be done deductively. At this stage, the student can understand the importance of making deductive conclusions, because, for example, he can see that the conclusions drawn inductively may be wrong.
5. Level of Accuracy (Ringor). At this stage, students can understand that the accuracy (precision) of the underlying is important.

The ability skill of geometric shapes in a child is seen from how the child can name and understand geometric shapes, connect and sort geometric shapes, and show, express, and narrate works in geometric shapes.

Mastery of geometric shapes in children can be enhanced with activities that keep children active, one of which is mosaic. Mosaic activity is the act of attaching pieces made of certain materials. Zahra and Wulansuci's research found an increase in the mastery of geometric shapes in early childhood using mosaic activities. The method used is a quantitative method with a quasi-experimental approach. Obtained an average gain value of the experimental class 0.820, while the control class is 0.053 which means that the mastery of the geometric shapes of the children of the experimental class given mosaic activity is higher than the control class given only conventional activities. Therefore, mosaic activities can increase the mastery of geometric shapes in children (Zahra, 2019).

Geometric introduction activities with mosaics can also be used to introduce arithmetic. Children can be guided or invited to play, to sum up, an existing form. Learning mathematics to be packaged according to the child's ability but not leaving the main side that is to encourage the child to be able to think systematically, critically, analytically, logically, and creatively.

### Digital Edu Games for Geometry dan Arithmetic

The world of children will never be free from play and imagination. So that the educational methods

given are more to the game and imaginative. Both elements are packaged and conceptualized into the educational curriculum, as well as being part of educational theory for early childhood. Along with the development of technology, the combination of technology in the world of Education is something that cannot be avoided. In a study, it was found that more than 80% of children in grades 1 and 2 at SD Lab school UPI Purwakarta Campus are familiar with gadgets (Ridwan, 2020). The use of educational games in children to help learn geometry and arithmetic is developed so that children can learn as well as play and play while learning.

Education for children is very different from that of adults and requires several stages, among others: oriented to the needs of the child, learning through play, having a conducive environment, using educational media, continuous learning, and using representative learning. Children's education is based on fun, while education for adults is more serious.

Educational methods for children are play-oriented. Especially with the development of technology, the more the need to play in children. Children will feel comfortable with the presence of technology in the form of gadgets, so they do not know the time and sometimes angry when the gadget is taken. One of the methods that can be an alternative to children's education is to take advantage of technological advantages to improve children's abilities.

Mobile games are games that can be played on mobile or mobile phones so that users can play portable (Shiratuddin, 2010). The term education game comes from the English language, namely Game and Education. Collaboration on these two words is expected to provide insight to its users to learn effectively and persuasively. Panggayudi et al researched the application of educational games has a great contribution to the absorption of children's competencies. Successful use of

Educational game Learning Media in trials of 90.44% (small scale) and 85.19% (large scale) and student learning achievement that shows an average above KKM 75 (Panggayudi, 2017). The results of this research show the effectiveness of electronic media-based game education in improving and absorbing student competence. Besides, Tahani Salem Alanazi in his research shows that electronic-based games can motivate learners. Enhance the use of education that is based on electronic games due to its importance in motivating learners (Alanazi, 2017).

#### METHOD

This research method uses descriptive analysis. Sugiono is a method that serves to describe or give an idea of the object examined through the data or samples that have been collected as it is without doing analysis and making conclusions that apply to the public (Sugiyono, 2009). Research data are some Edu games that the author considers suitable for children either to learn geometry or arithmetic. This research also tries to explain the history of the development of Edu games to the latest technology in Edu games to play geometry or arithmetic

#### RESULTS AND DISCUSSION

Games for children's education become a way for various parties to develop learning media as well as children's play media. From traditional games, computer-based digital games, mobile, and smartphone-based digital games, to games that use augmented reality.

Ridwan researched the Analysis and Design of N-Ram Digital Games for problem-based solving for Early Childhood Geometry Learning Games (Ridwan, 2020). The result is a prototype Games N-Ram. In Games N-Ram, Games are played by the user matching the pattern above with the pattern below. Users will be challenged with many geometric shapes as well as the time to complete.





**Figure 1.** N-Ram Edu games

Next Radu tried to research Cyberchats Shape Quest (Radu, 2015) Cyberchase Shape Quest is an augmented reality math app from PBS KIDS and THIRTEEN that exposes elementary-school children to three-dimensional immersive puzzle worlds, teaching geometry, and engaging spatial cognition skills through the use of augmented reality (AR) technology. Designed for children 6-8 years old, the app features 3 games, Patch the Path, Feed the Critters and Hide & Seek. In Patch

the Path, players use a tablet device's camera and a printable game board to interact with 3D puzzles within five different virtual environments, over 30 different levels. While playing, children must engage their spatial memory, visualization, and planning skills to complete each level of the game.



**Figure 2.** Cyberchase Shape Quest Edu games

In each puzzle, players are given a 3D path with one or more gaps in it. The game builds in difficulty and complexity as the player gains mastery. In the beginning, the puzzles are

relatively easy, and the pieces are low height 3D shapes: one gap, one shape to fill it. Later, they become more challenging: two or three gaps with two or three shapes needed to complete each.



**Figure 3.** Others example Cyberchase Shape Quest Edu games

## CONCLUSION

Educational methods for children are play-oriented. The more familiar the child is with the gadget making sharing parties need to observe it so that the gadget can benefit. Edu games as games for education can be an alternative solution. Edu games for geometry and arithmetic developed from conventional games (played through movements) and games in digital form. Digital games are also growing, starting from

using computers, smartphones, unit mobile games using augmented reality.

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