GAME BASED LEARNING: UTILIZATION OF CROSS MATH GAMES IN IMPROVING PRIMARY SCHOOL STUDENTS' CRITICAL MATHEMATICAL REASONING ABILITIES

Linda Kurnia Sari[1], Nihadhu Adilah[2], Via Livtiana[3], Mahda Satya Kusuma[4]
UIN K.H Abdurrahman Wahid Pekalonagan
Email: [1]lindakey681@gmail.com, [2]nihadhuadilah59178@gmail.com, [3]vialivtiana@gmail.com, [4]madasatya726@gmail.com,

ABSTRAK

Semakin berkembangnya digitalisasi saat ini mengakibatkan banyaknya siswa-siswi pada tingkat sekolah dasar mahir dalam menggunakan *gadget* baik untuk bermain game ataupun hanya sekedar menonton video. Namun, hal tersebut kurang dimanfaatkan untuk menjadi jembatan siswa dalam mengasah kemampuan untuk bernalar kritis. Matematika merupakan salah satu pembelajaran yang kurang diminati siswa tanpa terkecuali siswa pada tingkat Sekolah Dasar. Hal tersebut disebabkan banyaknya konsep matematika yang membutuhkan konsentrasi khusus sehingga siswa dituntut untuk mampu bernalar kritis dalam memahaminya. Alternatif yang dapat digunakan untuk meningkatkan kemampuan bernalar kritis siswa yaitu dengan menerapkan model game based learning dalam pembelajaran matematika. Penelitian ini bertujuan untuk menganalisis keefektifan model game based learning dengan menerapkan *game Cross Math* sebagai media untuk meningkatkan kemampuan bernalar kritis dalam pembelajaran matematika siswa sekolah dasar. Penelitian ini menggunakan pendekatan kualitatif dengan metode penelitian deskriptif kualitatif untuk memperoleh informasi mengenai pemanfaatan game cross math dalam meningkatkan kemampuan penalaran kritis matematika siswa sekolah dasar. Hasil dari penelitian ini menunjukkan bahwa pembelajaran matematika yang disajikan dalam bentuk game based learning dengan media *game Cross Math* dapat meningkatkan kemampuan penalaran kritis dan efektif untuk meningkatkan motivasi siswa Sekolah Dasar.

Kata kunci *:* game based learning, matematika, penalaran kritis

ABSTRACT

The increasing development of digitalization has now resulted in many students at elementary school level being proficient in using gadgets both for playing games and just watching videos. However, this is not used as a bridge for students to hone their ability to reason critically. Mathematics is one of the subjects that students are less interested in, including students at elementary school level. This is because there are many mathematical concepts that require special concentration so that students are required to be able to reason critically in understanding them. An alternative that can be used to improve students' critical reasoning abilities is by applying a game based learning model in mathematics learning. This research aims to analyze the effectiveness of the game based learning model by applying the Cross Math game as a medium to improve critical reasoning skills in elementary school students' mathematics learning. This research uses a qualitative approach with qualitative descriptive research methods to obtain information regarding the use of cross math games in improving elementary school students' mathematical critical reasoning abilities. The results of this research show that mathematics learning presented in the form of game-based learning with the Cross Math game media can improve critical and effective reasoning skills to increase elementary school students' motivation.

Keywords *: game based learning, mathematics, critical reasoning*

INTRODUCTION

Mathematics is an important subject for students to study at every level of education. Mathematics is a mandatory scientific discipline given

to students with the aim of training students' way of thinking to be logical, critical, analytical and systematic (Mulyati & Evendi, 2020). The National Council of Teachers of Mathematics (NCTM, 2000) states that there are five mathematical abilities that must be considered in implementing mathematics learning, namely connection, reasoning, communication, problem solving, and representation.

Elementary mathematics learning is an important phase in the development of students' academic potential. A deep understanding of mathematical concepts at the basic level becomes the foundation for broader reasoning abilities at the next level of education (Paulina et al., 2023). Mathematical reasoning has a very important role in honing students' thinking processes. Through the reasoning process, students can easily develop their knowledge and skills to solve various problems related to mathematics (Permatasari & Marlina, 2022).

In essence, reasoning is an important ability that students must master to solve a problem, both in the learning context and in everyday life. The application of the Game-based learning model is one of the innovative approaches that has received attention in the world of education. At the basic level, the use of the GBL model is carried out by combining game elements in the learning process and creating a modern learning experience, not just monotonous with traditional methods.

Game-based learning is an E-learning system that is able to develop student motivation in learning by playing games (Chen et al., 2015). Game-based learning was created specifically as a way of learning by utilizing games to facilitate the student learning process. The main characteristic of GBL is that it includes game applications which contain learning material with the aim of being able to create learning experiences and knowledge for students (Nazla, 2021). The development of this game becomes more efficient for students, because when learning students do not feel burdened and become more active in the learning process.

In this modern era, educational games appear as the right choice to equip students with critical thinking skills and improve their understanding of mathematics in a fun way. According to Soeheri in (2016), the application of the Digital Game Based Learning (DGBL) method is able to create interesting and motivating learning for students because it is packaged in the form of a game with a mission or problem that interests them. The integration of technology in learning through educational game media encourages student activity in solving problems, increases creative power, and makes it easier to understand lesson material. Through game-based learning, students independently explore knowledge through a process of trial and error in games. Failure encourages them to try again with new strategies and approaches to complete the mission/game objective. Educational games such as Cross Math Puzzle spark curiosity and motivate students to continue learning and look for answers to the material being studied. This math puzzle game comes with various levels and levels of difficulty to train brain abilities, improve math skills, logical thinking, and sharpen the brain and memory.

The application of the Cross Math Puzzle Game in the teaching and learning process is able to create a conducive and enjoyable learning environment, thus encouraging student enthusiasm and motivation to learn. This research aims to evaluate the effectiveness of game-based learning models in improving elementary school students' critical reasoning abilities in mathematics subjects. The media used in this research is the Cross Math game. A qualitative approach with qualitative descriptive research methods was applied to obtain information regarding the use of Cross Math in improving elementary school students' mathematical critical reasoning abilities. The descriptive method is a method used to interpret or analyze research results without making more general conclusions (Sugiyono, 2016).

DISCUSSION

APPLICATION OF GAME BASED LEARNING MEDIA IN PRIMARY MATHEMATICS LEARNING

Game-Based Learning (GBL) is a learning method that combines educational elements with games to attract students' interest in learning (Anggraini

et al., 2021). In the digital era, games have become one of the entertainment media that is in great demand because of its unique appeal to users. With the development of technology and the increase in the number of users, games are now widely used in the learning process through methods such as game-based learning. Based on previous research, it can be seen that the use of game-based learning is a very effective learning method. The advantage is that it can increase a person's interest and motivation in participating in the learning process (Wibawa et al., 2020).

Based on Anugerah and Randi's research, Anggraini et al., (2021) created a digital game media based on Higher-Order Thinking Skills (HOTs) called "Budi's Mathematics Learning Adventure". The concept of this game is to create an adventure experience for a boy who is good at calculating and thinking logically. He always helps solve the problems the local residents face during his adventures by utilizing his mathematical skills, and as a result, he gets a score based on his success in answering all the challenges to help every resident he meets. So this game is able to provide experience for students so they can improve their critical reasoning skills in mathematics.

Based on research by Sari and Ahmad (2022), the majority of mathematics games present challenges with story elements that involve playing experiences as part of learning. In this game, mathematical concepts are presented through problems that are integrated with an adventure theme, so that the learning experience becomes more interesting and enjoyable. In developing game-based learning, the dynamic aspect of the game is very important to create an exciting playing experience and foster students' curiosity in completing game missions. In this case, mathematics games mostly provide benefits in improving critical reasoning skills and also provide fun for students.

According to Anggraini, et.al (2021) the GBL learning model has several advantages. Students can interact and be directly involved in learning, so they tend to more easily understand the material being taught. In addition, learning with a GBL approach can encourage active student involvement and create a learning atmosphere that is fun, cheerful and full of joy. However, there are also several shortcomings in the Game Based Learning model. In its application, GBL requires a longer time because not all students may immediately get used to how to play the

game. Apart from that, if the teacher cannot manage the class well, the class atmosphere can become noisy. Teachers also need to make extra efforts to regulate students' conditions so that the class remains conducive. Apart from that, unstable network constraints can also affect the learning process.

Game-Based Learning (GBL) is a learning method that combines education with games to increase students' interest in learning. In the current digital era, games are very popular as a medium of entertainment and are now widely used in the learning process. Previous research shows that GBL is very effective because it can arouse students' interest and enthusiasm in learning. One example of the application of GBL is through the game "Budi Learning Mathematics Adventure" which is designed to develop high-level thinking skills (HOTs) by combining mathematics in an interesting adventure. This game creates an interesting and enjoyable learning experience by actively and creatively engaging students. Although GBL has advantages such as direct interaction and a pleasant learning atmosphere, this approach also has disadvantages such as requiring more time and challenges in managing the class.

GAME CROSS MATH

Cross Math Game is an interesting math puzzle game. With four different difficulty levels, players can test their math skills while enjoying the challenges presented. Here is a brief explanation of how to play each level.

At the Easy level in the Cross Math game the equations consist of basic mathematical operations such as addition, subtraction, multiplication and division, as well as numbers that are easy to understand. Each equation will have several empty cells that players need to fill in. The numbers that can be used to fill in the empty cells have been provided, so players don't need to look for additional numbers out there. The challenge lies in the player's ability to correctly place these numbers in the equation so that the equation turns out to be correct. This Easy level is designed to introduce players to the basic concepts of the game, allowing them to understand the basic rules and strategies before progressing to higher difficulty levels.

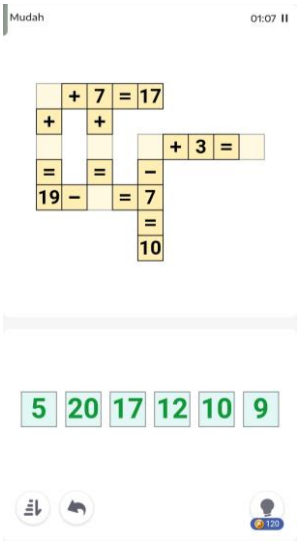

Figure 1. Easy game levels.

The medium level in the Cross Math game presents more complex mathematical equations. At this level, players are faced with equations that require more in-depth and strategic thinking to fill in the blank cells with the right numbers or mathematical operators to make the equation correct. Additionally, the medium level also allows players to hone their math skills by considering various possible combinations of numbers and operators in solving each given equation. This makes the medium level a good step in developing math skills while enjoying the challenges provided in the Cross Math game.

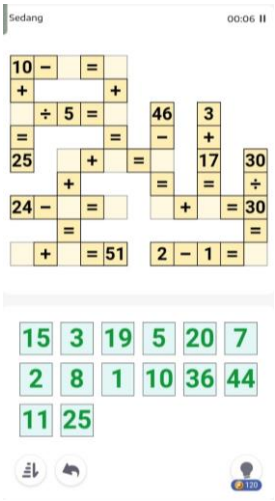

Figure 2. Medium game levels.

The Difficult Level in the Cross Math game has very complicated mathematical equations, this game requires players to use creative and strategic thinking extensively in playing. At this level, it is not just enough to rely on basic mathematical rules, but players must explore various possible strategies to solve existing equations. This involves carefully considering various possible combinations of numbers and operators, as well as testing various hypotheses and alternative solutions. Players will find themselves in positions that require in-depth analysis and careful thinking to ensure each step taken conforms to mathematical logic and the ultimate goal, namely solving the equation correctly. The Hard Level in Cross Math is not only a test of math ability, but also a great exercise for honing complex problem solving and critical thinking skills.

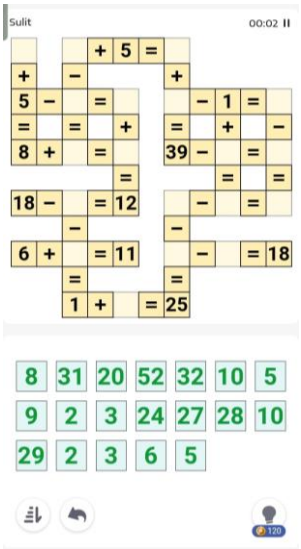

Figure 3. Hard game levels.

The Expert level in the Cross Math game is the pinnacle of challenge that tests players with highly complex mathematical equations and requires a deep understanding of advanced mathematical concepts. At this level, players must be able to correctly apply complex mathematical principles, such as algebra, trigonometry, calculus, and statistics, to solve given equations. Not only that, players must also have skills in solving complex mathematical problems using sophisticated strategies and techniques. Equations at the expert level require in-depth analysis, sharp critical thinking, and astuteness in seeing patterns that may be hidden in each equation. The Expert Level not only tests a person's mathematical

knowledge, but also measures a person's ability to think analytically, logically and creatively in facing high mathematical challenges. This makes the Expert level a significant step in developing advanced math skills and increasing mental toughness in solving complex problems.

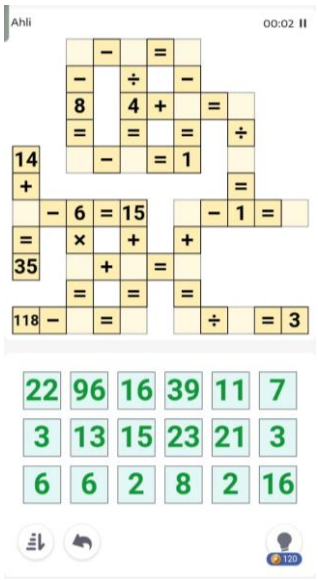

Figure 4. Expert game levels.

Based on the explanation above, Cross Math is a game that is suitable for various levels of mathematical ability because it presents various levels of difficulty, from Easy to Expert. This feature makes it an interesting and rewarding game for players in developing their math skills while having fun. The varying levels of difficulty allow players to choose challenges according to their abilities, so they can continue to develop their math skills at an appropriate pace. Apart from that, this game also encourages players to think creatively, reason critically, use strategies, and increase their accuracy in solving mathematical problems, which are very valuable skills in everyday life and in an academic environment. Thus, Cross Math is not only fun but also provides significant benefits in critical reasoning, problem solving abilities, improving understanding and mathematical skills of players.

THE EFFECT OF CROSS MATH GAMES ON CRITICAL REASONING ABILITY

The influence of the Cross Math game on critical mathematical reasoning abilities in elementary schools (SD) can improve problem solving abilities, because Cross Math challenges students to solve various mathematical problems that require the use of problem solving strategies. So students must identify patterns, apply mathematical operations, and test various possibilities to reach the correct solution. It helps develop students' analytical skills and critical reasoning abilities. Apart from that, this game is able to develop logical thinking skills, because Cross Math requires students to think logically and systematically. They must understand the relationship between numbers and mathematical operations, as well as how each step in the game affects the final outcome. The Cross Marh game can also increase concentration and focus, because this game requires full attention from students to complete each level or challenge. They have to focus on small details and maintain concentration to ensure that all their steps are correct. To Strengthen Understanding of Mathematical Concepts Cross Math can also be used, so that students repeatedly practice basic mathematical concepts in an interesting context. This strengthens their understanding of addition, subtraction, multiplication, and division, as well as other math concepts.

CONCLUSION

Game Based Learning is a learning method that combines education with games to increase students' interest and enthusiasm in learning. The Cross Math game is a learning medium that provides significant benefits in critical reasoning, problem solving abilities, improving students' understanding and mathematical skills. The Cross Math game has a positive influence on critical mathematical reasoning abilities in elementary schools (SD) by improving various important skills. This game challenges students to solve complex math problems, which develops their problem-solving abilities and analytical skills. Apart from that, this game also helps students think logically and systematically by understanding the relationship between numbers and mathematical operations. Cross Math improves students' concentration and focus as it requires full attention to complete each

challenge. Lastly, this game strengthens understanding of basic mathematical concepts through repeated practice in an engaging context. Researchers realize that this research is still far from perfect. The researcher hopes that further research will be able to develop the research so that it becomes an even better article.

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