ELEMENTARY SCHOOL MATH GAMES: JOYFULL AND MEANINGFULL LEARNING

Meilani Safitri[1], M.Ridwan Aziz[2]

meilanisafitri05@gmail.com[1], ridwan.aziz@student.uns.ac.id[2]
University of Sjakhyakirti[1], University of Sebelas Maret[2]

Abstract. Online learning is a learning method that uses game applications that have been specifically designed to assist in the learning process. Online technology allows us to continue to interact with students, both one-way and two-way. Game-based learning is a learning method that uses game applications that have been specifically designed to assist in the learning process. Children generally like games, so the use of game-based learning is suitable for the current digital generation. Our game-based learning can provide stimulus to three important parts of learning that are rational, intellectual and psychomotor. We don't need to be afraid if we don't have a background as a game developer or are less technologically literate if we want to implement games that have been specifically designed to assist in the learning process. In learning mathematics in elementary schools, it is necessary to implement games in every meeting as evaluation material. There are several types of games that have been used, as will be explained in this article.

Keywords: elementary school, math, games, learning, joyfull, meaningfull

INTRODUCTION

Most students believe mathematics to be a challenging, if not terrifying, subject. Because, in their perceptions, mathematics is a topic that requires detailed and intricate computations to arrive at a final answer, the impact is one of boredom and laziness in thinking. Furthermore, according to Muliawan (2012: 51), mathematics taught in schools is a pure science based on numbers, symbols, and symbols. So far, mathematics learning has mostly concentrated on the computational side, which is algorithmic. It is not unexpected that, according to many studies, pupils can perform a variety of mathematical calculations but do not demonstrate encouraging outcomes when used in actual life.

However, many schoolchildren in Indonesia do not like mathematics (Sagisolo, 2020). This subject is even a specter that some children fear. It turns out that students dislike mathematics lessons due to various reasons (Pijar, 2021). Here are some examples: (1) Not Having a Strong Foundation, this problem is why many students do not like mathematics. Because they do not master the basics, students become increasingly confused when they move up a class and continue their mathematics lessons at a more difficult level. Why are there students who do not master the basics of mathematics? One reason is that teachers tend to use the majority's ability benchmark in mastering lessons. One or two children who are unable to keep up with the average learning speed of children in a class will usually be left behind. (2) Trauma, students can be traumatized by pressure or failure to meet the expectations of teachers or parents. Traumatic experiences can also be caused by an incident that embarrasses students. (3) Inharmonious Teacher-Student Relationships, many math teachers in schools are labeled killers, rigid, and have difficulty communicating. In conditions where the relationship between teachers and students is not harmonious, the transformation of knowledge becomes more difficult to do. (4) Need to Remember Many Formulas, many students do not like mathematics because they have difficulty memorizing many formulas and equations. (5) Boring Learning Methods, many students have difficulty learning mathematics because they lose motivation. Mathematics is considered boring because students cannot find the relevance between mathematics and real things in everyday life. (6) Teacher Competence, if a teacher does not have

sufficient knowledge of a subject, then he will have difficulty teaching others to understand it. Lack of interest and limitations in communication can also cause students to have difficulty learning mathematics.

For most students, mathematics is a weakness and the most disliked subject to date. How could it not be, mathematics presents many formulas, calculations, and fractions that can drain the brains of students. No wonder many educators are racking their brains to make mathematics a fun subject. So how do you make mathematics fun? Mathematics is indeed a subject that is rarely of interest to students. Many reasons make it very difficult for teachers to bring students to learn mathematics in a fun way. Moreover, in this modern era, when technology is increasingly sophisticated and everything is simple. Students prefer everything practical, easy, and fast. Rarely are there students who want to solve math problems in books or those explained by teachers at school. When students no longer like or are afraid of mathematics, they will tend to be lazy to study it. If this is the case, it means that a way is needed to make mathematics fun (Sagisolo, 2020).

Teachers must be imaginative while offering learning materials so that pupils do not become bored while learning (Kara, et al., 2024: 702). Variations in the usage of learning media that are tailored to the needs of students are essential for ensuring that pupils continue to learn effectively. Providing interludes in the form of games in the middle of studying can also help to maintain a joyful learning environment (Dewantara, et al., 2020: 15).

Using engaging and game-based learning paradigms is crucial for effective mathematics education. As a result, kids believe they are learning rather than not learning. The game-based learning methodology is one such example. According to Azan and Wong (2008), a game-based learning paradigm is one that is appealing and engaging for users, with a clear end objective, such as increasing knowledge and skills. The game-based learning paradigm is a self-contained unit with a clearly defined beginning, game, and end. Students understand that they are participating in a gaming activity that will culminate in a "winning state". In diverse contexts, games can deliver a variety of learning content.

By adopting game-based learning, we can stimulate three crucial aspects of learning: emotional, intellectual, and psychomotor. If we want to integrate game-based learning, we don't need to be concerned because we don't have a background as a game developer or aren't as tech-savvy. There are numerous instructional games available for cellphones, including many web-based applications. We merely need to choose a game that is appropriate for the materials we will give (Bestari, 2023 dan Alotaybi, 2024).

Games in education are both engaging and enjoyable. Students will be more interested in learning if it is packed with games, and learning will become more enjoyable, therefore students' recollection of the material presented is expected to be rather high. We also don't have to worry about pupils not being able to utilize the games we'll be using because each game usually includes instructions, both on cellphones and in web-based applications.

RESEARCH METHOD

This study uses the Systematic Literature Review (SLR) method to identify, evaluate, and synthesize literature relevant to the topic of Elementary School Math Games. SLR is used to provide a structured and comprehensive understanding of existing research. The study was conducted in the following stages: Problem Identification, Establishing criteria for selecting relevant literature, Literature Search Strategy, Literature Selection Process, Data Analysis, and Literature Synthesis (Pan, Ke, Xu, 2022: 10).

Problem Identification; (1) How do math games affect elementary school students' learning? (2) What types of math games are effective in improving numerical skills? (3) What factors need to be

considered in designing math games?. Establishing criteria for selecting relevant literature; (1) Articles published in the last 10 years (2014–2024), (2) Articles available in English or Indonesian, (3) Focus on learning mathematics through games for elementary school students, (4) Articles with limited access without abstracts, (5) Research outside the context of formal education or elementary school children. (Hui & Mahmud, 2023: 3)

Literature Search Strategy, conducting article searches using trusted databases such as: (1) Google Scholar, (2) PubMed, (3) Scopus, (4) ProQuest. Keywords used, for example: "math games for elementary school", "educational games in mathematics", "effectiveness of math games". Literature Selection Process; (1) Selection based on title and abstract to evaluate relevance, (2) Reading the full article to ensure the literature meets the criteria. (Pan, Ke, Xu, 2022: 10)

Data Analysis, data from selected articles are extracted and analyzed for: (1) Research methods used, (2) Main findings, (3) Research gaps. The results are presented in the form of tables and descriptive narratives. Literature Synthesis, conducting a synthesis of findings from various articles to answer research questions. This synthesis will include consistent findings, differences between studies, and opportunities for further research. Tools and Software: (1) Reference Manager: Mandeley or Zotero to manage references, (2) Data Analysis: NVivo (optional) for qualitative analysis of articles, (3) Prisma Template: Used to visualize the literature selection process. . (Hui & Mahmud, 2023: 4)

RESULT AND ANALYSIS

1.1 Interesting Mathematics Teaching Methods

After knowing the various problems that cause students to dislike mathematics, what solutions can teachers offer as learning agents? Most of the reasons are due to a wrong mindset about mathematics, therefore it is better to change students' mindsets from initially considering mathematics as a boring, complicated, and irrelevant subject to a fun and liked subject. To change this mindset, teachers must change their teaching strategies and methods to be more fun (Lestari, Habibi & Bastari, 2024: 21). Well, here are several mathematics teaching methods that can be used:

1.1.1. Discussing or casual chatting

If usually math classes are dominated by explanations about questions and how to solve them, there's nothing wrong with discussing mathematics. Chatting about mathematics can help students learn new knowledge and shape their way of thinking. Involve students in a chat where they can explain how they solve problems. The goal is not to get right or wrong answers but to find out how far students' understanding of mathematics is. If it turns out that the basics of students' understanding of mathematics are not yet strong, that's where the teacher's opportunity to improve.

1.1.2. Connecting Mathematics with Hobbies

Relate mathematics to the world that students live in or their hobbies, such as music, sports, and art.

1.1.3. Personalizing Learning.

Allow students to choose the way they like to learn mathematics and the speed that best suits their abilities. If there is a large gap between a child and the average student in the class, give him different materials and questions. Here is the teacher's opportunity to improve or strengthen a child's mathematical foundations by giving special attention. After his self-confidence rises, and the student begins to master the lesson, the teacher can slowly reduce his attention and raise the level of his lessons.

1.1.4. Using Technology

Use technology to encourage students to be involved in Learning. Technology is the best motivator for many students, especially those born in the era of gadgets and the internet. Try using videos, applications, programs, and websites to practice mathematics.

1.1.5. Playing Educational Games

Various educational math games can be used to stimulate student interest. Starting from paid to free games can be used to stimulate students to love mathematics, especially for those who are fond of video games. Many schools that adopt games in mathematics learning gain various benefits such as students who are interested in educational games are more focused on their learning devices and negative behaviors such as chatting, walking around the classroom and other distracting activities are reduced, because homework is given in the form of educational games, the number of students who do not do their homework is greatly reduced so that students' mathematical abilities develop rapidly.

Mathematics is one of the important subjects. It is no wonder that from elementary school to high school, mathematics always gets a large portion compared to other subjects. Mathematics also provides many benefits for school students. Research conducted by Dr. Taya Evans from Stanford University concluded that studying mathematics is very good for the human brain. The study also stated that people who study mathematics have a greater volume of gray matter, which affects a person's ability to make decisions. Mathematics also helps students to think analytically and hone their reasoning skills. These two skills are very important because they can help students solve problems and find solutions to various problems..

1.2 Games Based Learning (GBL)

The rapid advancement of technology nowadays necessitates that instructors continue to adapt to current creative and new learning trends. This strives to ensure that the teaching and learning process is always relevant to the qualities of the students while remaining successful. The contemporary generation prefers creative, useful, and exciting activities, including studying.

Its applications include project-based learning, field studies and practices, and, of course, game-based learning. Related to Game Based Learning, it can be defined as a learning strategy that employs games to help facilitate the learning process, make learning more engaging, and even boost learning effectiveness.

This is consistent with Maiga's opinion (2009:198), who stated that playing is an important aspect of the learning environment since it improves memorable learning experiences, boosts mood, and makes learning more successful. GBL can be used to a variety of areas, including mathematics, physics, biology, language, and history. There are several varieties of GBL that are often used in teaching and learning today, ranging from traditional (no gadgets) to video game-based, which uses both desktop and mobile devices.

Additionally, research by Papastergiou (2009), Kazigmolu et al. (2012), and several other studies shows that GBL can increase student motivation in learning because a game-based learning environment can inspire students and provide them with great learning opportunities to improve their learning in a fun way (Charles et al., 2012). These factors make GBL itself suitable for application in the learning of the current generation of children. The first is that competition and teamwork can increase student motivation. The second is that the availability of quick feedback allows students to find other options when solving problems.

GBL is considered suitable for application in the learning of the current generation of children due to several factors such as: (1) Competition and team cooperation can increase student motivation, (2) The existence of fast feedback allows students to look for other alternatives in solving problems, (3) Creating a fun and enjoyable learning environment which increases student enthusiasm and motivation.

1.3 Characteristics of Game-Based Learning

1.3.1 Interesting and exciting

GBL is able to make students understand the material and achieve learning objectives in a more interesting and enjoyable way. With GBL, students can also find out the application form of a concept and material.

1.3.2 Based on Experience

Students do not have to be directed and trained in playing games and understanding the contents of the game. Through GBL, students will understand by themselves through a trial and error process, so that when they fail they will try again with different strategies and methods to achieve goals/missions.

1.3.3 Some challenges can be Adjusted

The characteristics of GBL generally have different levels of challenge, ranging from easy to difficult. Generally, games using levels can be found in different types of video games.

Students can adjust the level and level of difficulty according to their understanding and abilities. Start from the easy one and then increase the challenge to a higher level if they have succeeded.

1.3.4 Interactive and Feedback

GBL allows for an interactive process between fellow students and between students and the game interactively. For example, the strategy, decisions, and actions chosen in the game will determine the process and results of the game itself.

Meanwhile, regarding the feedback method, GBL students can reflect and draw conclusions from the results of actions taken in the game. With feedback, students can know the impact of the actions taken and can learn from mistakes/failures.

1.3.5 Social & Cooperation

GBL is expected to build communication and cooperation among students. With intensive collaboration, it is expected to train students' social skills.

1.4 Recommended Platforms for GBL

As an educator, of course, it is necessary to know and increase references regarding various examples of games that can be used to support learning. Here are some recommendations for GBL that are suitable for supporting the teaching and learning process, either as the main tool or as a complement in the teaching and learning process (Madjid: 2020).

1.4.1 Educandy

Educandy is a web-based educational game application that can be used for learning. Educandy has a variety of educational games that can be changed in terms of questions and vocabulary and can be played directly. For example, there is a 'memory' game that functions to test the memory of certain vocabulary, besides that there is a 'Crosswords' game or the general term is crossword puzzles, and many other games. After the teacher creates and changes the questions according to needs, a quiz/game code will come out. Just share the code so that it can be accessed and played by students. In addition to being available on the educandy.com website. This game is also available on the mobile platform.

1.4.2 Wordwall

Is a web application that contains interesting quiz-based educational games. Teachers can create various quiz models according to their creativity. There are various categories of games that can be created with this platform, such as Match up, Random Wheel, Anagram, Wordsearch, true or false, and others. The interesting thing about Wordwall is that we can see and play games that have been created by other members. Because it is community-based, teachers can learn creatively and collaboratively with other members. In addition, Wordwall also supports multiplayer, offline and printable play features. After being completed, teachers can also easily share the games that have been created on various platforms and social media.

1.4.3 Marbel Budaya Nusantara

This game is a work of the nation's children which aims to introduce Nusantara culture. Through this game developed by Educa Studio, children will learn and be introduced to various Nusantara cultures such as traditional musical instruments, regional dances, regional clothing, traditional houses, and regional foods. This game focuses more on simulation, such as when studying Javanese culture, children will play the role of a karawitan player, in another scene children will also be given the task of completing the weaving process such as adjusting the pattern and color of the weaving

as in the example. This game also uses game levels from easy to difficult. Teachers can download this game on the Playstore with the keyword 'Marbel Belajar Budaya Nusantara'. In addition to studying Indonesian culture, Educa Studio also provides other educational games such as Marbel Pramuka, Marbel Belajar Jam & Waktu, and others.

1.4.4 Khan Academy Kids

Is an educational game with an activity game theme and interactive activities. Specifically intended for toddlers, preschoolers, and kindergarteners. This game is made with a simple, interactive, but meaningful game concept by carrying the concept of stories and daily activities. Children can learn language, reading, writing, counting, social-emotional, problem solving, to motor sensor development. This game has various interesting features and content, such as fairy tales (text, images, and audio), interactive videos, counting games, reading, logic, and others. In addition to being able to be played online via a mobile platform, teachers can also set this game mode to be played offline and can even be printed. Teachers can set learning schedules for students, learn more at Khan Academy, and organize distance learning with the available tools effectively. To be able to access this game, you can download it for free on the Playstore and App Store with the keyword 'Khan Academy Kids'.

1.4.5 Baamboozle

Is a web-based educational game application that provides a variety of interactive and interesting games. Just like the wordwall, this platform is community-based so we can see and use games and quizzes that have been created by other members. The advantage of using Baamboozle is that teachers and students do not need to register first to play the available games. Teachers and students can search for various games by searching in the search box using keywords or by scrolling manually. If you want to create your own game, teachers can register first and then start creating according to their creativity. Teachers can create games for one to several teams and set the number and rules of other games. After that, so that it can be accessed by students, please share the game link to the class group.

1.4.6 Quizizz

In using games, quzizz is familiar to students. Since before the pandemic hit, this game has often been used in class as a form of evaluation and is often used for ice breaking to make the learning atmosphere in class fun. Quizizz is a web tool for creating interactive quiz games. It is very easy to use, the interactive quizzes that we create have up to five answer choices including the correct answer. We can also insert images into the quizzes we create.

1.4.7 Kahoot

Kahoot is a game-based learning platform. In Kahoot we can create multiple-choice quizzes which can then be accessed via the web or the Kahoot application on an Android smartphone. The Kahoot game during PJJ learning was given for material evaluation.

The variety of game choices that can be played seems to be a special attraction for students. The most important thing to ensure is that this GBL method must be in accordance with the characteristics of the students, learning objectives and the readiness of the facilities and infrastructure available at school and owned by you and the students. So that when applied this method can be more optimal, effective, and meaningful (Rulyansah, et al., 2022: 418).

1.5 Analysis of Research Related to GBL

From the research results, three main themes emerged: (1) Joyful Learning: Games create a fun learning atmosphere, reducing students' anxiety towards mathematics. (2) Meaningful Learning: Through games, students learn by connecting mathematical concepts to real situations or everyday contexts. (3) Improving Critical Thinking Skills: Challenging games improve students' ability to solve problems and think logically. (Permana, 2022: 433).

The results of the analysis show that the use of games in mathematics learning has a positive impact in the following aspects: (1) Student Motivation: As many as 80% of articles reported an increase in student motivation to learn mathematics through a game-based approach. The learning atmosphere becomes more relaxed and enthusiastic. (2) Conceptual Understanding: As many as 70% of studies

show that students who learn through games have a better understanding of concepts compared to conventional approaches. (3) Strengthening Cooperation: Collaborative games have an impact on students' ability to work together and help each other in solving mathematical problems (Barus, et al., 2022: 60).

The use of games in elementary school mathematics learning has been shown to increase student interest and motivation. Math games not only make the learning process fun but also help students understand mathematical concepts more deeply. Benefits of Games in Mathematics Learning: (1) Increase Interest and Motivation: Math games can change students' perceptions of mathematics from being initially considered difficult to more interesting and fun. This encourages students to be more active in the learning process. (Rodiyah & Siregar, 2024: 60). (2) Facilitate Conceptual Understanding: Through games, students can apply mathematical concepts in more real situations, so that their understanding of the material becomes stronger. (Marhamah, 2018: 406). (3) Improve Critical Thinking Skills: Well-designed games can stimulate students to think critically and creatively in solving math problems. (Abduh, 2023).

Examples of Math Game Implementation: (1) Math City Map (MCM): This application integrates math learning with GPS technology, allowing students to learn math through interactive and fun outdoor activities. (Abduh, 2023). (2) Mathstacko Game: This game combines mathematical concepts with interesting challenges so that students feel challenged and motivated to study harder.

Although the benefits are significant, several obstacles were also found, including: (1) Limited Facilities: In some schools, facilities such as computer devices or digital games are still limited. (2) Inappropriate Game Design: Several studies have shown that poorly designed games can disrupt students' learning focus. (3) Learning Time: Teachers often find it difficult to manage time to align games with curriculum targets (Hamari, Koivisto, & Sarsa: 2016).

Recommendations for Implementing Games in Learning: (1) Selecting the Right Game: Choose a game that is by the material being taught and can achieve the desired learning objectives. (2) Integration with the Curriculum: Make sure the games used are in line with the curriculum and can support the achievement of the established basic competencies. (3) Teacher Training: Teachers need to be given training in designing and implementing math games so that the learning process runs effectively. By implementing games in mathematics learning, it is hoped that students can experience a more enjoyable and meaningful learning experience, thereby improving their understanding and achievement in mathematics subjects.

CONCLUSION

Based on the analysis, the following are recommendations for the implementation of math games: (1) Game Design: Games should be relevant to the curriculum and target specific math skills. (2) Teacher Training: Teachers need to be trained to integrate games effectively into the learning process. (3) Game-Based Evaluation: Evaluation of student learning outcomes can be done through games to create a non-stressful evaluation atmosphere. This study confirms that math games have great potential to create more enjoyable and meaningful learning in elementary schools. However, the success of their implementation is highly dependent on planning and support from the school, teachers, and the availability of facilities.

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