

Fun Math Learning For Elementary School Students Through Interactive Puzzle Media

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ABSTRACT

Amid the covid-19 pandemic, teachers and students should undergo an educational transformation which suddenly force them to embrace digital learning to support an online mode of teaching. In mathematic context, teachers can make use of interactive puzzle media as one of the digital tools that may stimulate activeness, mathematical understanding, and fun math learning for students. The purpose of this study is therefore to unearth the students' reception during mathematics instruction using the media. This descriptive qualitative research involved 30 first graders of elementary school in West Java, Indonesia and employed questionnaire, interview, and video-based observation to collect the data. The research findings showcase that learning mathematics using interactive puzzle media is enjoyable for students, and there is a strongly positive response from 80% of them which can be seen from the activeness and enthusiasm demonstrated during the learning process. It further indicates that the application of interactive puzzle media increases students' confidence, fosters learning motivation, develops self-reliant learning, and provides clearer understanding of recognizing the concept of numbers and recognize the concept of numbers and geometric shapes. With these specialties, interactive puzzle would be appropriate instructional media and technology for learning. Interactive puzzle media can be accessed online through <http://bit.ly/MediaPuzzleInteraktif>.

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INTRODUCTION

Digital literacy may be construed as survival skills for the digital age (Eshet-Alkalai, 2004). Other opinions suggest that digital literacy is an understanding, a mindset and a capacity for the proper use of digitals in recognizing, accessing, handling, incorporating, assessing, analyzing, synthesizing digital resources, building new knowledge, creating media expression, and interacting with others in certain life situations (Martin & Madigan, 2007).

Digital literacy plays a pivotal role in 21st Century education as it not only applies technology to the educational process, but also provides benefits for various interests to

commemorate the quality of learning. The learning process which utilizes information and communication technology is a major requirement for developing students' digital literacy (Sujana & Rachmatin, 2019). In today's mathematics learning, digital literacy is essential to teachers and students in the achievement of their learning objectives.

The introduction of mathematics must be made early, since studying mathematics will stimulate the children's thinking abilities to be ready for the next level of mathematical learning (Syafdaningsih & Utami, 2020). Math learning materials for first graders include the introduction of the concept of numbers. Mathematical ability can be seen from the children's ability to recognize the concept of numbers, calculate at a certain limit even understand the simple addition and subtraction (Fitri, Nurhafizah, & Yaswinda, 2020).

However, math is the lesson that students are least interested in. This is in line with the findings of another study that revealed that elementary school students experience errors resolving statistical problems due to a lack of interest in learning (Dewi Nur, Nina Yulian, & Laelasari, 2021). For many students, mathematics is challenging as it is a difficult task which takes a plenty of efforts. Mathematical learning also lacks an attraction because the teachers' instruction still employs traditional approaches and has not used interactive learning media (Satriawan, Sutiawarso, & Rosidin, 2020). As a result roughly 60 percent of children are not capable of correctly mention the number symbols in sequence, of measuring with the number symbols, of matching the number with the number sign and of correctly organizing the number symbols for 1-20 (Devi, 2020). This is compounded by the fact that a lot of students in the field are still not learning the basic mathematical material but are forced to remain on pace following the next lesson.

This situation definitely leads to difficulties for students. For example, in addressing the issues of unstructured numbers, the students face a numerous problems such as difficulty in understanding problems to read comprehension and mathematical sentences; lack of understanding of prerequisite materials needed by students; difficulties in building a settlement strategy; and difficulty in drawing conclusions (Mahmud & Pratiwi, 2019).

In this digital age, an interactive media is required to help teachers teach the material and allow students to easily and pleasantly understand the content. One of the functions of the learning media is as an impulse between students and teachers (Hendra Saputra & Pasha, 2021). This statement confirms the study finding which states that play is a learning activity that is close to the child's life, diverting, without coercion and can cause positive emotions of the child to play a role in math learning activities (Anisa, Ambarwati, & Deasyanti, 2020).

One of the interactive media in games that makes the concept of numeracy easier to grasp and enjoyable for students to learn is interactive puzzle. Puzzle game media can also be used by teachers to introduce the principles of numbers that affect students' math ability (Safitri, Leksana, & Jihansyah, 2020). Puzzles media are a fascinating and delightful platform for games that can enhance children's cognitive (Mahardikha, Asrori, & Yuniarni, 2013). Through this puzzle medium, mathematics learning becomes more pleasant and compelling, can develop good character and can increase the learning outcomes for students. Puzzles are chosen as an appropriate medium for character building inasmuch as puzzles are one of the educational games and believed to be able to build characters in children aged 5-12 years (Akmaluddin & Fajri, 2019).

METHOD

This study employs descriptive qualitative to describe existing situation and activities throughout the research period. The subjects for data collection were up to 30 grade-1 students at a primary school in West Java, Indonesia. The supporting instrument that

researchers use to determine students' responses to the application of interactive puzzle media is a questionnaire developed by Guttman in the form of a 'Yes-No' number conversion. Here is table 1. A review of student responses on the Guttman scale:

Student Response	Score
Yes	1
No	0

The aspects of the question developed on the Guttman scale questionnaire are as follows:

Measured Aspects	Question
Learning Interests	<ol style="list-style-type: none"> 1. Does the medium of interactive puzzles add to the desire to learn mathematics? 2. Does the interactive educational puzzle medium give the spirit of learning mathematics? 3. Does learning mathematics through the medium of interactive puzzles make the heart happy?
Ease of Understanding	<ol style="list-style-type: none"> 4. Is the explanation of mathematical material presented on interactive puzzle media easy to understand? 5. Is learning to know numbers through interactive puzzle media, easy to understand? 6. Is learning to know flat wake through interactive puzzle medium easy to understand?
Media Presentation	<ol style="list-style-type: none"> 7. Is the interactive puzzle medium presented attractively? 8. Is the puzzle displayed in the media various forms? 9. Is interactive puzzle media easy to use?

In addition, researchers also used open interview instruments to teachers about student responses during the teaching-learning process using interactive puzzle media. To support both instruments, researchers used observation sheets to view the mathematical learning process using interactive puzzle media.

To facilitate validation of the data, the triangulation technique was employed. Triangulation in credibility testing is defined as checking data in different ways and times from different sources. Moeleong notes that there are three types of triangulation: triangulation of the source, technique and time. On this basis, this study used various sources and multiple techniques for gathering and handling the data. In terms of the sources, the data came out from teachers and students, while relating to technique they were collected from other different instruments including video and interview.

Therefore, to test the consistency of finding about the response of students and teachers to the application of the media obtained from the questionnaires, the researchers conducted an unstructured interview. To support the results, the researchers afterwards analyzed the puzzle media implementation documented through video to see the activities during the instruction. The researchers also did direct interviews with the classroom teacher in order to gain feedback on the usage of interactive puzzle media.

RESULTS AND DISCUSSION

Based on the results from the processing and analysis of answered questionnaire, teacher interviews as well as the video documentation in interactive puzzle media for the concept of counting, the data of student responses was obtained. The data were compiled on the following aspects mentioned in the questions: 1) learning interests; 2) ease of understanding; and 3) media presentation.

The results of this study provide evidence that, as much as 80 percent of students have responded well to mathematical learning through interactive puzzle media in the total average questionnaire aspects. Particularly, in terms of learning interest the student response is 82%. The response is 78% in terms of ease of understanding. And the student response in the media presentation aspect is 80%. Recapitalization of the student response percentage as a whole is presented in Table 3:

Table 3. Recapitulation of Overall Student Response

Questionnaire Aspects/Indicator	Percentage of Responses Saying 'Yes'	Percentage of Responses Saying 'No'
Learning interests	82%	18%
Ease of understanding	78%	22%
Media presentation	80%	20%
Overall average percentage	80%	20%

Interactive puzzle media referred to in this study is multimedia learning designed using power point application. This interactive puzzle medium is presented by containing various multimedia elements such as text, images, sounds, animation and interactivity that help children to actively construct their own knowledge, and their understanding (Putra & Ishartiwi, 2015). The puzzle shapes used in the media are jigsaw puzzles, word crafting puzzles, guess number puzzles, and unpacking puzzles. Here are the pictures of various puzzles:



Figure 1. Word Building Puzzle

Figure 1. is word building puzzle that is presented on interactive puzzle media. This puzzle presents a flat wake shape in which there are letters that must be arranged by the student according to the question, so that students will find a 'word' that contains the word number.



Figure 2. Guess the Numbers Puzzle

Figure 2. It's a puzzle of guessing numbers which is also presented on interactive puzzle media. This puzzle presents images and numbers, which must be placed according to the direction of the arrows on the display.



Figure 3. Jigsaw Puzzle

Figure 3. is a jigsaw puzzle, which pairs the presented image with the number to be selected, or vice versa.



Figure 4. Contraction Puzzle

Figure 4. is one example of contractions puzzles. This puzzle displays parts of the image that need to be organized in order to transform into a frame. Once the images are composed, the questions presented must be answered based on the images formed.

Besides the questionnaire that provides a well response from students to mathematical learning via the media, the learning process of mathematics can also be found through video analysis. It revealed that math learning activities are very fun for students. They are very enthusiastic about taking part in math classes, and all students are actively involved in classroom discussions. When students were asked to alternately appear in front of the class to answer the quiz presented in the puzzle media, they pointed their fingers to be welcome to answer the question given.

Mathematics learning exercises undertaken in interactive puzzles have an effect on both the affective and cognitive dimensions of students. In the emotional aspect, positive roles among the students are revealed, for example high trust, mutual respect between friends and high motivation to learn mathematics. The mathematical understanding of students, particularly on numbers, is excellent on the cognitive aspect.

The results of this study show that students are very enthusiastic and satisfied with their learning in mathematics through interactive puzzle media. This attitude can be seen from the positive response given to each aspect of the questionnaire.

The utilization of interactive puzzle as one of the multimedia promoting the movement of digital literacy has strong consequences for the abilities of students to understand the basic concepts of numbers. This is consistent with the findings that computer-based learning systems result in substantial changes in student learning improvements (Inventado, Scupelli, Heffernan, & Heffernan, 2017). To a greater extent, using highly involved interactive technology will enhance mathematics for children (Miller, 2018). The use of educational playing media like interactive puzzles makes mathematics learning engaging and fun as well as facilitates children's understanding of math concepts. Students must also acquire cognitive mathematical skills as a basis for learning (Watanabe, 2019).

Not only that, the improvement of affective aspects also has implications for students, in which strong characters are awakened in students starting from an early age. Self-reliance, confidence, and mutual respect are established, and this is the fundamental basis for building a strong student character. If this continues to evolve, there will come the next generation who master knowledge not only because of its cognitive skills, but also because of the strong character of the generation that gives rise to a superior generation.

Other reports also show that the increase in student activity has reached 83.48% and that 67.5% was part in the excellent criteria (Cahyadi & Hernita, 2016). Media puzzles as a fun educational game can also boost the imagination of children, teach them how to solve their problem, develop their cognitive skills, train them to collaborate, build self-reliance and explore skills of concentration and their abilities [17–20]. The development of children's emotions and fine motor skills are a key factor in fostering their confidence in both school setting and homes (Abristiana, Kristanti, & Aisyatul W., 2020).

The Crossword media provides primary-school students with an innovative learning atmosphere. This medium encourages a more meaningful, creative learning environment (Suciningrum, Slamet, & Hartono, 2020). Further studies also indicate that learning mathematics, accompanied by games, can stimulate students' interest in learning. The results of previous studies corroborate the current research findings (Chang, Hwang, Fang, & Lu, 2017).

The students' learning experiences of mathematics are so enjoyable that they can learn to play on numerical material through interactive puzzle media which are designed according to the age of the student. In addition to interesting and enjoyable, puzzles play practices are also associated with character education values that are trustworthy, tolerant, disciplined, independent, friendly or communicative, curious and responsible (Aisyah & Yultas, 2019).

While the findings of this study have a positive influence on students, the implementation of this puzzle media still poses many challenges, so the government projects for teachers and students to develop digital literacy skills cannot be carried out in the best possible way. There are many factors affecting the use of interactive puzzle media in mathematic learning in schools: (1) limited capacity of teachers to design interactive, multimedia-based learning; (2) limited time availability by teachers for the development of interactive, multimedia learning that represent students' characteristics and development; 3) limited teacher capacity to use digital media in the process of learning; 4) Limited access to digital media relevant to the teaching/learning materials; 5) Limited interactive learning media with game nuances that can offer strong student character; 6) Limited access to educational media which are intended to establish local culture.

CONCLUSION

This study applies digital literacy in elementary school students' mathematical learning by incorporating interactive puzzles as the media in acquiring the concept of numbers. The findings showed that 80 percent of students have positive responses during the instructions of math material number. It can be seen from the activities performed by the students who seemed highly motivated and confident to understand the materials and address the questions posed during their mathematic class. This is one of the characters developed from the use of interactive puzzle media. In addition to the affective attitudes resulting from the introduction of the media, cognitive aspects evolve even further. The students' comprehension of the conceptual material of number is improved; they can comprehend the concept of numbers so easily that learning objectives can be achieved well. Overall, the results of the study indicate that interactive puzzle-based mathematical learning can enhance motivation, develop self-reliance, and boost the students' mathematical understanding.

In response to the teachers' feedback, numerous changes to the media puzzle were further refined. Due to time constraints and the energy, the interactive puzzle media evaluated in this report only covers the concept of numbers, the operation of addition with a limit of 20 outcomes, and quiz presented on each number material. Future research, therefore, should further develop more compelling interactive puzzle media, by integrating video content, songs, stories, and also expanding the scope of the material such as flat wake, space building, number patterns, addition and subtraction operations, and so on that are tailored to the region's local cultural contexts. Apart from developing digital literacy skills, interactive puzzle media are also expected to enhance awareness of local culture among students.

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Pembelajaran Matematika Menyenangkan Bagi Siswa Sekolah Dasar Melalui Media Puzzle Interaktif

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Abstrak

Di tengah pandemi covid-19, guru dan siswa harus menjalani transformasi pendidikan yang tiba-tiba memaksa mereka untuk merangkul pembelajaran digital untuk mendukung mode pengajaran online. Dalam konteks matematika, guru dapat memanfaatkan media puzzle interaktif sebagai salah satu perangkat digital yang dapat merangsang keaktifan, pemahaman matematika, dan pembelajaran matematika yang menyenangkan bagi siswa. Oleh karena itu, tujuan dari penelitian ini adalah untuk mengungkap penerimaan siswa selama pembelajaran matematika menggunakan media. Penelitian kualitatif deskriptif ini melibatkan 30 siswa kelas satu sekolah dasar di Jawa Barat, Indonesia dan menggunakan kuesioner, wawancara, dan observasi berbasis video untuk mengumpulkan data. Hasil penelitian menunjukkan bahwa pembelajaran matematika menggunakan media puzzle interaktif menyenangkan bagi siswa, dan terdapat respon yang sangat positif dari 80% siswa yang terlihat dari keaktifan dan semangat yang ditunjukkan selama proses pembelajaran. Lebih lanjut menunjukkan bahwa penerapan media interaktif puzzle meningkatkan rasa percaya diri siswa, menumbuhkan motivasi belajar, mengembangkan kemandirian belajar, dan memberikan pemahaman yang lebih jelas mengenal konsep bilangan dan bangun datar. Dengan kekhususan tersebut, puzzle interaktif akan menjadi media dan teknologi pembelajaran yang tepat untuk pembelajaran.

Keywords: Belajar Matematika; Media Puzzle Interaktif; Siswa Sekolah Dasar.
