The effectiveness of the use of interactive multimedia on the initial mathematics abilities of low grade students in elementary schools

D Suri$^{1,*}$ and R Rachmadtullah$^2$

$^1$ STKIP PGRI Bandar Lampung, Bandar Lampung, Indonesia
$^2$ Universitas PGRI Adi Buana Surabaya, Surabaya, Indonesia

$^*$reza@unipasby.ac.id

Abstract. This study aims to determine how the effectiveness of the use of interactive multimedia on the initial low-grade mathematics ability in elementary schools. This research method uses a quantitative approach with experimental design, the sample in this study amounted to 40 low-grade students in elementary schools, the results of this study indicate that there is an effective early mathematics ability of low-grade elementary school students, because multimedia has attractiveness such as animated appearances, video appearances, so that students feel happy and interested in learning mathematics. Multimedia plays an important role in student motivation and students easily understand the basic material of elementary school mathematics concepts.

1. Introduction

Understanding the concept of early mathematical abilities is one of the mathematical skills or skills that are expected to be achieved in learning mathematics, these mathematical skills are indicated by showing an understanding of the mathematical concepts that students learn, explaining the relationship between concepts and applying concepts or algorithms in a flexible, accurate, efficient and right in problem solving [1].

Understanding the concept of good initial mathematical abilities in students will support good solving abilities as well. Initial mathematical skills that are accepted and understood by students will lead students to solve problems in a systematic and structured manner [2,3]. Teaching students to solve problems allows students to be more analytical in making decisions in life. In other words, if students are trained to solve problems, these students will be able to make decisions, because these students are skilled at gathering relevant information, analyzing information and reexamining how necessary the results they have obtained [4]. Paying attention to what students will get by learning to solve problems, it is only natural that problem solving is a very important part of learning mathematics [5]. This is because basically one of the goals of learning mathematics for students is that they have the ability or skills to solve mathematical problems or problems, as a means for them to hone careful, logical, critical, analytical, and creative reasoning [6].

The initial ability of mathematics to problems is part of the mathematics curriculum which is very important, because in the learning process and in solving the students it is possible to gain experience using the knowledge and skills they already have to apply them to solving problems that are not routine
in nature. Mathematical problem solving is a process that uses the power and benefits of mathematics in solving problems which is also a method of finding solutions through the stages of problem solving.

However, the fact is that learning mathematics, especially in elementary schools, is still considered difficult to understand learning, this is in line with the PISA data in 2019, namely Mathematics, which is ranked 72 out of 78 countries. While the Science score is ranked 70 out of 78 countries [7]. Furthermore, the results of Monitoring and Evaluation of the Center for the Development and Empowerment of Teachers and Mathematics Education Personnel in 2007 and PPPG Mathematics in previous years showed that more than 50% of elementary school teachers stated that most students had difficulty solving story problems in learning mathematics [8]. Furthermore, research conducted by John gay suggests that mathematics is an essential exact subject, which can be a support for other subjects. Through mathematics lessons students are expected to have the ability and skills in reasoning, critical thinking, and logical thinking [9]. However, in reality the mathematics learning outcomes achieved by primary and secondary school students are still relatively low compared to other subjects. Students still have difficulty mastering mathematics subjects. Based on the results of a survey conducted by the Trend Mathematics and Science Study (TIMSS) in 2011, it was reported that Indonesian students' mastery of mathematics was ranked 38 out of 45 countries evaluated with an average score of 386 from the highest score achieved by the Republic of Korea [10]. Indonesia's score decreased by 11 points from the TIMSS assessment results in 2007. This means that the learning outcomes of Indonesian students have decreased and are still at a low level.

From the above, it is known that the problem of understanding students' concepts and solving math problems is a serious problem to be addressed immediately. This is due to the understanding of the concept of one's initial basic mathematical ability in learning mathematics. If the concept received is correct and well conveyed, students will find it easy to apply to mathematics problems. Therefore, in improving the initial mathematical abilities, this research report explains how the effectiveness of using interactive multimedia applications on the early mathematics abilities of elementary school students. Interactive multimedia itself is a teaching delivery system that presents video, images, text, animation and audio / sound material with computer control to the audience (students) who not only hear and see visual and sound elements, but also provide active responses [11], Multimedia is media that combines two or more media elements consisting of text, graphics, images, photos, audio, video and animation in an integrated manner [12,13].

2. Methods

2.1. Research design
This study aims to determine how the effectiveness of the use of interactive multimedia on the initial mathematics abilities of elementary class students. This research uses quantitative research methods with a pretest and posttest control group design. In this design, there are two groups, namely the experimental group and the control group who are randomly selected, then given a pretest to determine the initial state, is there a difference between the experimental class and the control class [14]. The control class was treated using the lecture method and without giving homework, while the experimental class was treated using the lecture method and giving homework. After finishing the treatment, the two classes were given a posttest which aims to measure the learning achievement of students for the treatment that has been given.

2.2. Participants
Participants in this study amounted to 35 early grade students at the public elementary school of Banda Lampung Indonesia, the sample selection in this study used the simple random sampling technique, namely a sample of two classes from a population consisting of four classes II A, B, C Then each class was written on a small piece of paper and then made a roll and put in a box and drawn. Then one roll of paper is pulled, then another roll of paper is pulled out, without reinserting the first roll of paper. The
class names on the two rolls of paper are members of the sample drawn by lot. From this step, taken as a sample, namely class II B.

2.3. Data analysis
Collecting research data used the test method. Tests are in the form of questions or exercises and other tools to measure skills, intelligence knowledge, abilities or talents possessed by individuals or groups. In this study, the test was conducted to measure the ability of students, so the test used was a form of achievement test (learning outcomes), which is a test used to measure a person's achievement after learning something. Hypothesis testing uses the t-test with the help of the SPSS 24 program, which compares the mean between the pretest and posttest.

3. Results and discussion
The results of the analysis in this study were to determine how the effectiveness of using interactive multimedia on the early mathematics abilities of elementary school students as table 1 follows:

Table 1. The results of the pretest and posttest comparison of the effectiveness of the use of interactive multimedia on the initial mathematics abilities of elementary school students.

|                  | Mean | N  | Std. Deviation | Std. Error Mean |
|------------------|------|----|----------------|-----------------|
| Pretest Group    | 74.00| 30 | 3.500          | 1.014           |
| Postets Group    | 83.20| 30 | 3.269          | 0.972           |

Based on the calculations in the comparison test table pretest and posttest the effectiveness of using interactive multimedia on the initial mathematics ability of elementary school students above shows the average value before using interactive multimedia learning on the initial mathematics ability of elementary school students of 74.00 and after being treated using multimedia learning interactive on the initial mathematics ability of elementary school students increased, namely getting an average score of 86.40 This means that descriptively there is a difference in the average before and after the application of the use of interactive multimedia on the initial mathematics ability of elementary school students. For more details, this can be seen in figure 1 below:

![Figure 1](image-url)  
**Figure 1.** comparison of pretest and posttest the effectiveness of the use of interactive multimedia on the early mathematics abilities of elementary school students.

Based on the research findings, it is known that the use of interactive multimedia to the initial mathematics abilities of elementary school students is effective because this is because interactive multimedia is a combination of text, art, sound, animation, and video delivered via computers or electronic and digital equipment. If you use these multimedia elements together, such as images and animations, complete with sound, video clips, and information in the form of text, it will give clear
meaning to those who need them. Multimedia is used to describe a system consisting of hardware, software, and equipment such as televisions, monitors, optical disks or display systems used for the purpose of presenting videos or presentations [15-17]. Furthermore, multimedia in science includes several aspects that synergize between text, graphics, static images, animation, film, and sound. A number of studies have shown that the use of multimedia in learning supports the effectiveness and efficiency of the learning process [18,19]. This research, among others, was carried out by Multimedia which made students understand the content of the lesson, Multimedia made students remember easily about the content of the lesson, Multimedia delivered the content of the lesson in a sophisticated and impressive manner, Multimedia was able to be a source of knowledge, Multimedia was able to find a relationship between one science and another, Multimedia able to show the world around which is rich with knowledge, Multimedia is rich with various learning activities, Multimedia is able to entertain during the learning process [20,21]. Based on the results of this study, interactive multimedia can be said to be a medium that has enormous potential in helping the learning process, especially the initial math abilities of elementary school students.

4. Conclusion

The use of interactive multimedia for elementary school students' initial mathematical abilities is effective, interactive multimedia Interactive multimedia is multimedia that is equipped with a controller that can be operated by the user, so that users can choose what they want for the process of understanding the concept of elementary school students' initial mathematical abilities. The use of interactive multimedia in learning activities is very important in the learning process of elementary school students' initial mathematics abilities. Application is a tool whose function is to transfer knowledge to students. Interactive multimedia is anything that is used to transmit a message to the recipient, which aims to stimulate thoughts, feelings, attention, and student interests so that the teaching and learning process.

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References

[1] Saraev P, Blyumin S, Galkin A, and Sysoev A 2020 Mathematical Remodeling Concept in Simulation of Complicated Variable Structure Transportation Systems Transp. Res. Procedia 45 475–482
[2] Sulistyaningsih D, Purnomo P, and Aziz A 2018 Development of Learning Design for Mathematics Manipulatives Learning based on E-learning and Character Building Int. Electron. J. Math. Educ. 14(1)
[3] Bahar A K and Maker C J 2020 Culturally Responsive Assessments of Mathematical Skills and Abilities: Development, Field Testing, and Implementation J. Adv. Acad. 31(3) 211–233
[4] Plotnikova N F and Strukov E N 2019 Integration of teamwork and critical thinking skills in the process of teaching students Cypriot J. Educ. Sci. 14(1) 1–10
[5] Chiu T K F and Mok I A C 2017 Learner Expertise and Mathematics Different Order Thinking Skills In Multimedia Learning Comput. Educ., 107 147–164
[6] Kaiser G 2020 Mathematical Modelling and Applications in Education in Encyclopedia of Mathematics Education (Cham: Springer International Publishing) 553–561
[7] OECD 2018 Programme for International Student Assessment [online] retrieved from https://www.oecd.org/pisa/publications/pisa-2018-results.htm.
[8] Raharjo M 2008 Pembelajaran Berkait, Soal Cerita Pengurangan, Penjumlahan dan Pusat, di SD (Yogyakarta: Pengembangan Dan, Pemberdayaan Pendidik Kependidikan, Tenaga Matematika)
[9] Gay J 2020 The new mathematics and an old culture Mind, Cult. Act. 27(2) 113–116
[10] Mullis I V and Martin M O 2019 PIRLS 2021 Assessment Frameworks (Amsterdam: International
Association for the Evaluation of Educational Achievement

[11] Mayer R E and Moreno R 2020 Aids to computer-based multimedia learning Learn. Instr., 12(1) 107–119

[12] Rachmadtullah R, Ms Z, and Sumantri M S 2018 Development of computer-based interactive multimedia: Study on learning in elementary education Int. J. Eng. Technol., 7(4)

[13] Hamidi F, Kharamideh Z M, and Ghorbandordinejad F 2011 Comparison of the training effects of interactive multimedia (CDs) and non-interactive media (films) on increasing learning speed, accuracy and memorization in biological science course Procedia Comput. Sci. 3 144–148

[14] Creswell J W 2008 Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research (New Jersey: Pearson)

[15] Xia C 2018 Multimedia Teaching Platform Construction Based on Flash Interaction Technology for Gymnastics Int. J. Emerg. Technol. Learn., 13(05) 224

[16] Krishna S, Francisco B D, Balas E A, Konig P, Graff G R, and Madsen R W 2003 Internet-Enabled Interactive Multimedia Asthma Education Program: A Randomized Trial Pediatrics 111(3) 503–510

[17] Rachmadtullah R, Zulela M S, and Sumantri M S 2018 Development of computer-based interactive multimedia: Study on learning in elementary education Int. J. Eng. Technol., 7(4)

[18] Lee W W and Owens D L 2004 Multimedia-based instructional design: computer-based training, web-based training, distance broadcast training, performance-based solutions (John Wiley & Sons)

[19] Clark R C and Mayer R E 2016 e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning 3rd Edition (John Wiley & Sons)

[20] Essel H B, Osei-Poku P, Tachie-Menson A, and Opoku-Asare N A 2016 Self-Paced Interactive Multimedia Courseware: A Learning Support Resource for Enhancing Electronic Theses and Dissertations Development J. Educ. Pract., 7(12) 74–84

[21] Alsadhan A O, Alhomod S, and Shafi M M 2014 Multimedia based E-learning: Design and integration of multimedia content in E-learning Int. J. Emerg. Technol. Learn., 9(3) 26–30