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The Effect of Interactive Multimedia-Based Learning on Students' Mathematical Problem Solving Ability

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Abstract: This research was motivated by the low mathematical problem solving ability of students, and the online learning system during the covid-19 pandemic. This research aims to improve students' mathematical problem solving ability through interactive multimedia-based teaching material as a support for online learning. This research type is a quantitative research (quasi-experimental) which was carried out at Universitas Islam Riau (UIR) and Universitas Pasir Pangaraian (UPP). The research subjects were students of mathematics education who took Structure Algebra course at UIR (experimental class) students of mathematics education and UPP (control class) in the 2021/2022 academic year. The data collection technique used is a mathematical problem solving ability test and the test result data is processed by statistical test. Normality test using Kolmogorov-Smirnov and homogeneity test using Levene and also t test. Based on the result of the t-test, a significance value of $0,025 < 0,05$ was obtained. This means that there is an increase in the mathematical problem solving ability of student who receive from using interactive multimedia-based teaching material.

Keywords: Problem Solving; Teaching Material; Interactive Multimedia; Online Learning

1. Introduction

Media is an important component of a learning system. The media acts as an intermediary or tool to convey and deliver teaching messages (Nurrita, 2018). Learning media is a tool used to convey information in the teaching and learning process so that it can stimulate students to learn. So it can be concluded that the purpose of using media in learning is to achieve an effective and efficient teaching and learning process (Indah & Safaruddin, 2022; Istiqlal, 2017).

Multimedia is a medium that involves various types of media and equipment covered in a learning process. Multimedia learning involves the senses of sight and hearing through text media, silent visuals, moving visuals, and audio as well as computer based interactive media and communication and information technology (Damopolii, et al., 2020; Kurniawati & Nita, 2018; Suandi, 2021). Interactive multimedia has high effectiveness and is well used as a support for learning and lectures (Sair, et al., 2019). Interactive multimedia is several media that are combined in the form of images, text, audio or animations that are interactive with the aim of providing information (Zamzam, 2021).

Efficiency and effectiveness in learning can be obtained from the use and utilization of learning media (Lutfi, et al., 2021). Some studies say that the use of interactive media is considered effective to help the learning process become more enjoyable, as a support for information that has a wide scope. (Hidayati, 2017; Noormiyanto, 2020; Suandi & Ultimate, 2019).

Interactive multimedia based teaching materials can be a reference that can make students more active in the learning process in the classroom, by solving problems independently (Wahyuni & Yolanda, 2021). Thus, interactive multimedia based teaching materials can be used as a substitute for lecturers in the learning process. Students can understand the material and solve problems that can indirectly train mathematical problem solving ability.

Problem solving ability is one of a basic ability in the learning process (Hidayat & Sariningsih, 2018). Mathematical problem solving is an effort in solving problems, especially in mathematics learning, which emphasizes the use of methods, procedures, strategies that are proven systematically (Rahmatiya & Miatun, 2020). Mathematical problem solving must not be separated from mathematics learning because it is an integral part and learning mathematics itself (Oktaviana & Susiaty, 2020). Mathematical problem solving can help learners think critically, creatively, and develop other mathematical ability (Parulian et al., 2019).

Problem solving ability is an ability that is the target of mathematics learning, which is very useful for students in their lives. In problem centered learning, students learn about problem solving ability through problem solving (Andriani, 2017). Learning with problem solving must be designed to stimulate students to think and encourage students to use their ability (Sahrudin, 2016). The process of solving problems is required to think and work hard to accept all challenges in order to be able to solve the problems faced (Rambe & Afri, 2020).

Problem solving ability is a complex cognitive activity, as a process to overcome the problems encountered and to solve them a strategy is needed (Harahap & Surya, 2017; Sahrudin, 2016; Sulistiyowati, et al., 2021). Strategies that can be used are by applying 4 phases of solving problem solving problems, namely; understand the problem, plan the solution, solve the problem according to plan, and recheck all the steps that have been done (Fatimah, 2020; Yuwono, et al., 2018).

The ability to solve mathematical problems can be seen from the fulfillment of the indicators of mathematical problem solving ability. The indicators of mathematical problem solving ability are; identifying the known elements, questioned, and the adequacy of the necessary elements; formulating mathematical problems or drawing up mathematical models; implementing strategies for solving everyday problems; explain or interpret the results according to the initial problem; using mathematics meaningfully (Hendriana, 2018). It would be nice, the indicators of mathematical problem solving ability are contained in an interactive multimedia based teaching material so that learning becomes more effective and efficient.

Interactive multimedia based teaching materials can improve mathematical problem solving ability (Fadlilah, et al., 2021; Sulistiyowati, et al., 2021). Multimedia in learning aims as a means of introducing knowledge, skills, information, and can stimulate students' interest in learning so that learning becomes more effective (Asmara, 2016; Buchori, 2019).

Research related to the importance of mathematical problem solving ability has been carried out by Oktaviana & Susiaty (2020). Meanwhile, research on interactive multimedia based teaching materials can make learning more effective and efficient has been carried out by (Fadlilah, et al., 2021; Sulistiyowati, et al., 2021). Meanwhile, this study relates learning that using interactive multimedia based teaching materials can improve students' mathematical problem solving ability. Interactive multimedia based teaching materials are packaged in the form of materials, practice questions that are in accordance with indicators of students'

mathematical problem solving ability. This study aims to improve mathematical problem solving ability through interactive multimedia based teaching materials to support online learning.

2. Method

The research method used in this research is experimental. This research involved 2 classes, namely the experimental class and the control class. The experimental class is a class that obtains learning using interactive multimedia based teaching materials, while the control class is a class that obtains learning using Student Worksheet (SW) teaching materials. Each teaching material used aims to provide effective learning so that students have good mathematical problem solving ability.

The Student Worksheets used in the control class is also arranged according to the stages that must be achieved in computational thinking ability. The difference between the two learnings is that the experimental class uses interactive multimedia which is structured by taking into account the stages of computational thinking, while the control class uses Student Worksheets which have the same content and exercises, but the stages in the SW also refer to aspects of computational thinking that must be achieved student. The SW is also structured as attractively as possible by considering the problems that have been experienced by students.

There are several reasons why researchers conduct research at UIR and UPP, including: (1) Both groups have homogeneous variances; (2) In order to obtain better generalization results; (3) UIR and UPP have established collaborations (partners) in the field of research (4) Lecturers who support algebraic structure courses at UIR and UPP conduct intense communication on problems in algebraic structure lectures and some of the same problems are found, including low thinking ability student computing.

This study used a quasi experimental nonequivalent control group design, because students who were respondents would use existing classes and were not randomly selected. In addition, the study looked at the singular influence of learning.

The subjects in this study were students of the Mathematics Education Study Program at UIR and UPP who took the Algebraic Structure Course for the 2021/2022 academic year, totaling 32 students. The relevant research data will be collected through tests. The tests given are in the form of questions regarding mathematical problem solving ability. The test has been validated in advance by experts. Furthermore, data analysis used 3 tests, namely the normality test, homogeneity test, and t test.

3. Results

Mathematical problem solving is an effort in solving problems, especially in mathematics learning, which emphasizes the use of systematically proven methods, procedures, strategies that can help think critically, creatively, and develop other mathematical ability (Parulian, et al., 2019; Rahmatiya & Miatun, 2020).

With this mathematical problem solving, it can stimulate students to think and encourage students to use their ability (Sahrudin, 2016). Mathematical problem solving is centered on a problem, where students learn about problem-solving skills through solving a problem (Andriani, 2017). The following are the results of data processing of students' mathematical problem solving ability:

Table 1. Normality Test

Class	p-value
Experiment	0,705
Control	0,833

From Table 1, the p-value in the experimental class is $0.705 > 0.05$ and the p-value in the control class is $0.833 > 0.05$. So that it can be concluded that the mathematical problem solving ability of experimental class students and control class students is normally distributed at the level of significance $\alpha = 0.05$. Furthermore, the results of the homogeneity test are obtained as follows:

Table 2. Homogeneity Test

Levene Statistic	df	p-value
2.045	30	0,759

From Table 2 obtained the p-value is $0.759 > 0.05$ That is, both learning groups have homogeneous variances. Furthermore, the results of the T- Test are obtained as follows:

Table 3. t Test

t	p-value
Learning	0,025

From Table 3, the p-value is $0.025 < 0.05$ That is, the improvement of mathematical problem solving ability of students who obtain interactive multimedia based teaching materials is better than students who obtain conventional learning as a whole.

The results showed an increase in the mathematical problem solving ability of students who were taught through interactive multimedia based teaching materials. Media is an important component of a learning system. The media acts as an intermediary or tool to convey and deliver teaching messages (Nurrita, 2018). Learning media is a tool used to convey information in the teaching and learning process so that it can stimulate students to learn. So it can be concluded that the purpose of utilizing media in learning is to achieve an effective and efficient teaching and learning process (Indah & Safaruddin, 2022). Interactive multimedia has high effectiveness and is well used as a support for learning and lectures (Sair et al., 2019). The following is some documentation of the implementation of learning using interactive multimedia based teaching materials:



Picture 1. The Learning Process of Experimental Class

The picture above was taken during the ongoing learning process using interactive multimedia based teaching materials. During the learning process, students are active and participate in answering practice

questions given by the lecturer. They also offered to answer the questions in turn. They answer the practice questions in turn. The picture above is one display of interactive multimedia based teaching materials. The media contains: (1) prerequisite materials that aim to stimulate students' initial ability; (2) The core material aimed at inculcating the concepts that must be learned; (3) Practice questions that aim to apply the concept ability they learned that day. Some of the buttons in the display above function to: (1) Back button to the previous material, this is intended so that students who forget the concepts they are learning can immediately open the material quickly; (2) The home button, which functions to determine what meeting materials they will study, this makes it easier for students who have high ability to learn faster than students who have medium and low ability, thereby minimizing the boredom they experience ; (3) The practice button, the button is directly connected to Quizizz, this is done so that students can do exercises such as playing games, so that their boredom and boredom disappear and are replaced with curiosity and enthusiasm to complete the practice questions so that they reach the finish point .

From the results of the postes obtained, students who learn using interactive multimedia-based teaching materials are able to meet the stages: 1) Understand the problem, that is, students have the ability to understand the problems contained in the questions; 2) Plan for completion, that is, students have the ability to make plans that will be used in answering questions; 3) Solve problems according to plan, that is, students have the ability to use the plans that have been made in solving the problem; 4) Check again, that is, students have the ability to see and check again for the answers to the questions.

4. Conclusion

Based on the results of the research and discussion above, the following conclusions can be drawn: There is an increase in the mathematical problem solving ability of students who use interactive multimedia based teaching materials compared to students who use conventional learning methods as a whole. Furthermore, it is necessary to see the influence of interactive multimedia based teaching materials on mathematical problem solving ability based on Initial Mathematical Ability (IMA). In other aspects, it is realized that students' mathematical ability can also distinguish the students' mathematical problem solving ability themselves.

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