Discovery Learning Assisted by Animation Audio Visual Media Optimizes Problem Solving Ability and Students' Independent Attitude

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A R T I C L E   I N F O

A B S T R A K

Kegiatan pembelajaran yang monotun membuat siswa mudah bosan dan tidak tertarik dalam pembelajaran. Proses pembelajaran yang seperti itu tidak dapat melatih siswa untuk berpikir kritis dan tidak dapat dicerna secara maksimal oleh siswa. Tujuan penelitian ini yaitu yaitu menganalisis model pembelajaran discovery berbantuan media audi visual animasi mengoptimalkan kemampuan memecahan masalah dan sikap kemandirian siswa. Jenis penelitian ini adalah penelitian kuantitatif. Penelitian ini menggunakan pendekatan kuantitatif dengan metode eksperimen. Populasi pada penelitian ini adalah seluruh siswa kelas III di SDN Cengklik Surakarta yang berjumlah 64 siswa. Teknik pengumpulan data yang diperoleh melalui dua metode yaitu metode tes dan non tes. Teknik analisis data yang digunakan yaitu analisis deskriptif kualitatif, kuantitatif dan statistic inferensial. Hasil penelitian yaitu menunjukkan bahwa menggunakan model pembelajaran Discovery berbantuan media audio visual animasi berpengaruh pada kemampuan siswa dalam memecahkan masalah pembelajaran dan menumbuhka sikap kemandirian siswa. Disimpulkan bahwa model pembelajaran Discovery berbantuan media audio visual animasi dapat meningkatkan kemampuan siswa dalam memecahkan masalah pembelajaran dan menumbuhka sikap kemandirian siswa.

A B S T R A C T

Monotone learning activities make students easily bored and not interested in learning. Such a learning process cannot train students to think critically and cannot be digested optimally by students. This study aims to analyze the discovery learning model assisted by audio-visual animation media to optimize problem-solving abilities and student independence attitudes. This type of research is quantitative research. This study uses a quantitative approach with experimental methods. The population in this study were all third-grade students at SDN Cengklik Surakarta, amounting to 64 students. Data collection techniques were obtained through the test and the non-test. The data analysis technique is descriptive qualitative, quantitative, and statistical inferential analysis. The results showed that using the Discovery learning model assisted by audio-visual animation media affected students' ability to solve learning problems and fostered student independence. It was concluded that the Discovery learning model assisted by audio-visual animation media could improve students' ability to solve learning problems and foster student independence.

1. INTRODUCTION

Learning is the transfer of knowledge carried out to educate the new generation. Learning is a process that connects students and educators along with teaching resources in a predetermined place(Selvaraj et al., 2021; Wahidin, 2021). Development in the learning process is needed to keep up with the times. One of the learning that requires concepts to think systematically is learning mathematics. Mathematics learning functions to shape students so they can think logically, mathematically and critically(Hidayat et al., 2020; Ibrahim et al., 2020; Nurmanita et al., 2019). Mathematics is a knowledge that is structured in detail on the nature and theory of learning that is made deductively based on elements that are not defined, axioms, and theories that have been proven and true is a science that contains patterns and ideas(Arifah et al., 2019; Laurens et al., 2018; Nurmanita et al., 2019). Mathematics

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is also art and beauty in which there is harmony and harmony in the way of thinking. Learning mathematics in elementary schools is useful for developing attitudes in students' creative and independent thinking(Brinus et al., 2019; Nugraheni, 2017; Rahmah, 2018b).

One of the basic abilities that students must have is the ability to solve problems during learning, not only teaching students to be able to solve problems in learning. This can teach students to understand the concept of a problem that occurs in everyday life when solving problems(Fonda & Sumargiyani, 2018; Hadar & Tirosh, 2019; Widodo & Wardani, 2020). Learning must pay attention to the five thinking skills, namely: connection, reasoning, communication, problem-solving, and representation. Students will benefit when they can master the ability to solve problems because in everyday life we will be faced with a problem(Kurniawan et al., 2020; Santagata et al., 2021). However, some teachers prefer to use the old learning model, where students only become recipients of learning the information without seeking and processing information independently(Nasution & Mujib, 2022; Widiasih, 2019). Honing the ability to solve problems takes a long time because it changes the habits of students and teachers that have been done so far. So far, teachers and students carry out conventional learning that does not involve student activity during the learning process(Arianti et al., 2019; Nurgiansah & Pringgowijoyo, 2020). Therefore, it is necessary to change the learning process so that it can implement a learning system that can meet students' needs to solve problems

The learning process at SDN Cengklik Surakarta uses a contextual learning model. In the learning process, students do observe and understand what is explained by the teacher. This makes students easily bored and uninterested in learning. Such a learning process cannot train students to think critically and cannot be digested optimally by students. Students' ability to solve problems is also still low because of the unsuitability of learning models in Math Multiplication material. This can be deduced from the low learning outcomes of students in doing multiplication and tend not to understand the purpose of a problem. Multiplication material is certainly more difficult and mostly makes students confused. However, many students still have difficulty with stacking multiplication as given by the teacher.

The results of interviews with third-grade teachers at SDN Cengklik Surakarta that students are often lazy when learning mathematics and many students are slow in understanding multiplication. Based on the results of daily test learning when students are given multiplication questions with a multilevel level of difficulty, from 10 Questions the average student is only able to answer correctly 4 to 5 questions. The initial ability of third-grade students in SDN Cengklik Surakarta in Learning Math Multiplication material is low because the percentage of incomplete as much as 56% of the total number of students. The initial percentage of students ' independence is also quite low because as many as 65% of the total number of third-grade students still depend on others when doing the teaching and learning process.

In addition, it was also found that the attitude of independence of students at SDN Cengklik Surakarta was classified as low. Students still depend on teachers and friends when they want to find answers or solutions to problems in learning materials. The results of observations on students when carrying out the learning process and found results that students when appointed to work on multiplication problems tend not to be able to understand the meaning of the questions. Students still need help such as step-by-step guidance when working on questions. Students cannot work independently and are embarrassed to ask their friends. Therefore, besides helping children to improve learning outcomes, teachers must also be able to foster an attitude of independence in students. Independent attitude in solving a problem is very important for the learning process and everyday life.

The solution to making it easier for teachers to conceptualize mathematics learning activities requires an appropriate model or framework. Interesting learning models and the characteristics of students will make students active in learning(Call et al., 2016; Lestari et al., 2018). The learning model that supports mathematics learning activities, especially in the multiplication material, is Discovery Learning. The *Discovery learning* model is a learning model or process that can invite and encourage students to ask questions according to the teaching material and then students can conclude the learning concept that has been carried out(Setiyowati, 2019; Widiatmika et al., 2017). The *Discovery* learning model positions students as discoverers of solutions to problems that are presented independently or in groups*. Discovery learning* is learning in which the delivery of learning material is incomplete because the learning process it invites students to be active in searching for and discovering a learning concept for themselves by seeking information from various learning sources(Bahari et al., 2018; Edeltrudis, 2018; Erniati et al., 2022). The characteristics of the *discovery* learning model are learning to become a student centre; inviting students to explore information from various learning sources and being able to solve a problem that has been identified; and requires students to be able to connect an old and new learning principle so that it becomes a coherent principle and can be used for all parties(Kristin, 2019; Setiyowati, 2019; Widiatmika et al., 2017).

Learning mathematics with the *discovery* learning model familiarizes students with meaningful learning(Bahari et al., 2018; Mayar et al., 2022). Meaningful learning is an activity that links the learning process with the latest information on relevant concepts that students have learned and remembered(Edeltrudis, 2018; Rahmah, 2018a). With the learning stages that have been conveyed, the application of the *discovery* learning model can support mathematical multiplication material in elementary schools. Discovery learning requires teachers to be more creative in creating situations that make students learn actively and discover their knowledge(Erniati et al., 2022; Putra & Sujana, 2020). In addition to determining the appropriate learning model, the use of learning media is also equally important in maximizing the ability to solve problems independently. The use of media in the teaching and learning process can make students active and hone critical thinking skills(Hendi et al., 2020; Huda & Abduh, 2019). Learning media is developed so that students can understand abstract learning material.

Previous research findings also state that instructional media can make it easier for students to understand abstract material(Anggraini et al., 2018; Shophia & Mulyaningrum, 2017). Other research findings also state that animated media will make it easier for students to learn(Ayuningsih, 2017; Walangadi & Pratama, 2020). The use of the *Discovery* learning model with media can improve student learning outcomes(Lestari et al., 2018; Nugrahaeni et al., 2017). Previous research did not use animation media which helps students to practice their ability to solve problems independently. In addition, the research conducted only discussed student learning outcomes and did not develop attitudes that students had to grow from an early age. In contrast to this study, the research was conducted using animated audio-visual media in learning. In addition, research not only optimizes students' ability to solve problems but also develops students' self-reliance. Recognizing that mathematics learning is something that students must master, the purpose of this research is to analyze the Discovery Learning Model assisted by audio-visual animation media to optimize problem-solving skills and students' independence.

2. METHOD

This type of research is quantitative research, namely research that states data in detail and has a collection pattern in the form of numbers. This research used quantitative research so that it can conduct detailed research and obtain valid data. The research was conducted at SDN Cengklik Surakarta. This research approach is quasi-experimental. The implementation of this research is divided into three stages, namely preparation, implementation, and reporting. The preparatory stage consists of designing learning tools to be used in research, consulting on learning tools that have been designed, testing research learning tools, and analyzing and improving research tools that have been carried out. The implementation stage, researching what has been planned. The research was conducted in three meetings, the first meeting was giving *pre-test* questions to experimental and control class students. The second meeting provided stimulation to experimental class students in the form of videos on understanding the multiplication concept presented in animated form. The third meeting was held to give post-test questions to the experimental and control classes. At the reporting stage, the researcher processes the data by the established hypothesis and then the results of the data processing were delivered by the actual results. The third meeting was held to give *post-test* questions to the experimental and control classes. At the reporting stage, the researcher processes the data by the established hypothesis and then the results of the data processing are delivered by the actual results. The third meeting was held to give post-test questions to the experimental and control classes. At the reporting stage, the researcher processes the data by the established hypothesis and then the results of the data processing were delivered by the actual results.

The population in this study were all third-grade students at SDN Cengklik Surakarta, totalling 64 students. The selection of the sample in this study was not carried out randomly but was chosen directly by the researcher. In the research design, classes IIIA and IIIB are divided into two classes: experimental class and control class. In this study, there were two variables, namely the dependent and independent variables. The ability to solve problems and the attitude of independence of students as the dependent or dependent variable. Meanwhile, the *Discovery* learning model was assisted by animation audio visual media as an independent variable or free variable.

Data collection techniques were obtained through two methods, namely test and non-test methods. The data collection method in this study was carried out in 4 stages, namely: 1) Observation, perception of the implementation carried out by third-grade students at SDN Cengklik Surakarta. 2) Test, which consists of story questions to hone students' skills in solving multiplication problems. At this stage, students are given 2 parts, namely the *pre-test* and the *post-test*. 3) Questionnaire, this stage is to determine the level of student independence. 4) Documentation, this stage was in the form of names and a list of student grades and photographs while conducting research. The test method was carried out to

determine the ability of students to solve problems and non-test methods through observation, questionnaires and documentation.

The data analysis techniques used were qualitative descriptive analysis, quantitative and inferential statistics. This study used an experimental research design by testing the comparison of two samples through a t-test. Experimental techniques were directed at looking at causal relationships by controlling for at least one factor in (at least one) exploratory encounter and comparing results and a benchmark group facing no controls . Control implies methodically changing the properties (values) of autonomous factors. Once controlled, the autonomous variable is usually called "Garapan" treatment (Ade et al., 2018).

3. RESULT AND DISCUSSION

Result

Data for calculating students' ability to solve mathematical multiplication material in the learning process for 64 students in grades IIIA and IIIB at SDN Cengklik Surakarta were taken from pre-test questions. A descriptive analysis is done to assess a student's self-reliance attitude on the learning process. Therefore, the following are the results of statistical calculations. The results of the calculations are shown for the statement that this study has fulfilled the prerequisites for normality if sig>α then the data is normally distributed. The normality test results are presented in Table 1.

Table 1. Normality test

Variables	Kolmogorov-SmirnovB			Shapiro-Wilk		
	Statistics	df	Sig.	Statistics	df	Sig.
Experimental attitude	0.124	32	0.200	0.948	32	0.128
control attitude	0.140	32	0.115	0.905	32	0.008
Ability to solve pre-experimental problems	0.140	32	0.115	0.905	32	0.008
Ability to solve post-experimental problems	0.147	32	0.078	0.960	32	0.267
Ability to solve pre-control problems	0.140	32	0.115	0.905	32	0.008
Ability to solve post-control problems	0.120	32	0.200*	0.927	32	0.033

Based on Table 1 which contains the results of the normality statistical test in the control class using conventional learning without media and the experimental class using Discovery learner has a Sig value. So it can be concluded that the control and experimental classes are normally distributed. a>0,05 Student Descriptive Analysis Test on Students' Ability to Solve Problems is presented in Table 2.

Table 2. Student Descriptive Analysis Test on Students' Ability to Solve Problems

Statistics	Control Class		Experiment class	
Description	Pre-test	Post-test	Pre-test	Post-test
subject	32	32	32	32
Lowest value	50	65	65	71
The highest score	70	79	79	85
Average	59,59	69,28	69,28	78,38
Standard deviation	4,898	3,603	3,603	2,938

Based on the data presented in Table 2, shows that there are differences in the values of the control and experimental classes. In the control class, the lowest score is 50 and in the experimental class the lowest score is 65, this shows that the student's ability to solve problems in the experimental class is better than in the control class. The use of the *Discovery* model can make students active in learning and train students in solving problems in the form of stories in daily life. Based on the results of the homogeneity analysis, it was found that the sig. is 0.216 with the criteria $a > 0,05$ which means that the class results are homogeneous. The percentage of students' ability to solve problems is presented in Figure 1.
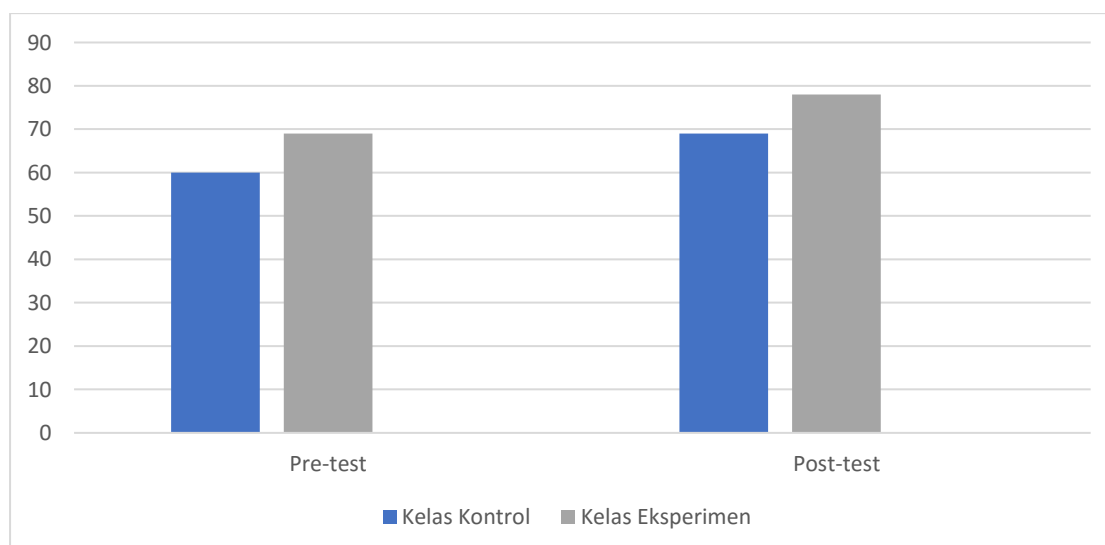
Figure 1. Percentage of Students' Ability to Solve Problems

Based on the data presented in table 4 and diagram 1, it shows that the use of the *Discovery* learning media model with the help of animation audio visual media can increase students' independence. This is evidenced by the results of the pre-test and post-test scores, namely the highest score at the pre-test stage was 79 and the highest score at the post-test was 93. The use of *Discovery* learning with the help of animation audio visual media makes students have passion about solving a problem because students are asked to find their answers to these problems. So that the teacher only becomes a facilitator in a lesson. The results of the statistical analysis showed that the student's learning outcomes in the experimental class that used the *Discovery* learning model and animation audio visual media were higher than the control class that used conventional learning models without media. This shows that the use of the *Discovery* learning model with audio visual media can improve student learning outcomes.

Discussion

Based on the results of data analysis, it was found that the *Discovery* learning model with animation audio visual media can be applied to learning. This is because, first, the *Discovery* learning model with animation audio visual media can improve student learning outcomes. From the results of the research that has been done, there are two important indicators, the first is using animation audio visual media to understand the problem-solving story problems presented. The use of video will make it easier for students to understand the learning material(Ayuningsih, 2017; Ulusoy & Çakiroğlu, 2018). This is what makes students understand the concept of calculating multiplication through animation audio visual media. At the time of research in the experimental class using *Discovery* learning, students carried out controlled learning in a certain syntax. The syntaxes that have been explained in the introduction are that *Discovery* learning has six learning syntaxes(Call et al., 2016; Lestari et al., 2018; Widiatmika et al., 2017).

The first, *stimulation*, in this syntax students, is given questions and statements about the concept of multiplying integers in the form of stories, so that students experience confusion and have the willingness to investigate the problem(Putra & Sujana, 2020; Winoto & Prasetyo, 2020). The second, *Problem Statement*, at this stage the teacher allowed students to identify as many problems as possible and related them to the learning material being investigated and determine hypotheses or temporary answers. The third, *Data Collection*, allowing students to find information from various types of sources, one of which is using audio-visual animation media played by researchers. The fourth, *Data Processing*, students process data that has been previously obtained through animated audio-visual media. The fifth, *Verification*, at this stage students, prove that the hypothesis made is correct and can be connected with the evidence that has been found. The sixth, *Generalization*, students are assisted by teachers to conclude and make valid student findings into learning principles that are used by all parties(Bahari et al., 2018; Edeltrudis, 2018; Erniati et al., 2022).

The second, animation audio visual media attract students' attention when studying. Animation audio visual media is a learning video, which means media that can be seen using the sense of sight, can be heard using the sense of hearing(Muslina et al., 2018; Walangadi & Pratama, 2020; Widjayanti et al., 2019). As a learning medium, animation audio visual media video is effectively used for mass learning processes, individuals or groups(Risata & Maulana, 2016; Yuniarni et al., 2020).To strengthen students'

understanding of the concept of mathematical multiplication, animation audio visual media is made as much as possible to communicate with students, so that students can actively follow it coherently until it is finished. The advantages of animation audio visual media include making learning interesting and varied, stimulating imagination and critically understanding learning material(Maryanti & Kurniawan, 2018; Yuliani, 2017). In addition, this media is also able to concretize something abstract so that students quickly remember and understand learning material(Lukman et al., 2019; Novita & Putra, 2017). This media also makes learning active and effective to improve learning outcomes. Weaknesses of animation audio visual media, that it requires space and time, and requires costs and time to make.

The third, *Discovery*-based learning with animation audio visual media increases student independence. Children's learning interest is directly proportional to their ability to solve learning problems. If the child's learning interest in learning increases, the child's ability to solve problems and students independence will also increase (Nurlia et al., 2017; Rohmah et al., 2020). This was supported by discussion activities. Through discussion activities, students are trained to develop ideas and ideas in answering questions posed by their friends temannya (Ahmad & Tambak, 2017; Fatmawati, 2019; Rochimatun, 2016). With this, judging from the explanation that has been conveyed, experimentally and hypothetically it shows that there is a positive effect in using the Discovery learning model with animation audio visual media on learning mathematics on multiplication of integers. This can encourage teachers to carry out learning with innovative learning models and media that make students active(Anis, 2017; Sutisna, 2016; Windiani et al., 2017). Thus, it can be proven that the use of animation audio visual media in conveying the concept of multiplication increases students' independence in learning. At the time of carrying out the research students were given story questions and presented with an animation audio visual media video. It was seen that initially, students experienced confusion, but gradually students were able to follow the media provided and were able to listen to the end. After using animation audio visual media students have new experiences in learning mathematical multiplication and students are independently able to solve problems that have been given by the teacher.

4. CONCLUSION

Discovery learning helps students to find answers independently with various sources of information. The used of animation audio visual media attracts students to listen and follow the lesson until the end. Collaborative use of learning models and animation audio visual media based on research that has been conducted in class III students at SDN Cengklik Surakarta for the 2022/2023 school year has a positive influence.

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