The Effectiveness of the Discovery Learning Model Assisted by Video Games to Improve Student Learning Outcomes on the Concept of Momentum and Impulse in High School

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ABSTRACT

This study aims to determine the effectiveness of the discovery learning model with the help of video games on student learning outcomes on the concept of momentum and impulse in high school. This research is using an experimental method. The research design used was a pretest-posttest control group design. In this study there was an experimental group and a control group. Data collection using essay test and multiple choice tests. Data analysis using the mean difference analysis and N-Gain. The results showed that the t-value on the multiple-choice test was 2.183 and on the essay test was 2.811, which was greater than t-table 2.037. Referring to the rule of testing the hypothesis that if $t_{count} > t_{table}$, then H_0 is rejected, H1 is accepted, which means there is a significant influence. So it can be concluded that learning using the discovery learning model with the help of video games has a significant effect on student learning outcomes on the concept of momentum and impulse in high school. Through the n-gain test on the multiple choice test it can be seen that the N-gain value for the experimental class is 0.713 and the control class is 0.582. While on the essay test for the experimental class 0.777 and 0.667 for the control class. So it can be concluded that the increase in student learning outcomes using the discovery learning model with the help of video games is higher than the use of the discovery learning model on the concept of momentum and impulse in high school.

Introduction

Activities during the implementation of teaching and learning are the main points of the formal and informal education process. In learning activities, there is interaction between learning components. The learning component is a collection of various interconnected items in the learning process such as humans (teachers and students), materials (teaching materials) facilities and equipment (classes, laboratories, projectors), procedures (methods, models and approaches) that influence each other to achieve goals in a planned learning (Suhendi Syam et.al, 2022).

The learning that is applied demands an output in the form of achieving predetermined goals by looking at learning outcomes. Strategies or methods in carrying outlearning are certainly needed to achieve the expected results. For this reason, teacher innovation is needed in responding to these challenges. Through innovation teachers can modify models or methods tailored to the needs of students.

One of the innovations isthrough the implementation of the discovery learning learning model. This learning model can also be integrated with the use of learning

media that are more attractive to students. One of the popular media at this time for students isvideo. The use of video for various purposes has become a trend in today's life. Through the innovative application of discovery learning with the help of media, it is hoped that it can improve student learning outcomes.

Learning outcomes are defined as the competencies that students acquire when they have completed the learning process, both in terms of knowledge, attitudes, and skills (Kunandar, 2013). In another opinion put forward by Cintia et al., (2018) states that learning outcomes are a new ability acquired by students when completing teaching and learning activities in accordance with predetermined objectives. So the learning outcomes are a new competence that is obtained by students after participating in learning activities.

One of the proposals that can be used as a solution is to maximize the involvement of facilities and infrastructure in teaching and learning. Accuracy in the selection of media and learning models is possible to stimulate theactiveness of students during the learning process. So that the target to achieve learning goals becomes easier.

The learning model is a form of conceptual framework that describes and shows the steps that are arranged in a structured manner inorganizing teaching and learning experiences for the purpose of being achieved, and is useful as a reference in the plan to carry out student learning activities (Fathurrohman, 2012). According to Hosnan (2014) the discovery learning model emphasizes the importance of a structured understanding or important thinking of a science through active involvement by students. In another opinion, Roestiyah, (2012) explained that discovery learning is a teaching technique that requiresthe involvement of students in the process of mental activities such as from trying themselves, reading, even seminars and discussions so that children can learn independently. The stages of learning activities of the discovery learning model are providing stimuli, questioning /identifying problems, searching and collecting data, processing data, proving or verifying, and generalizing or giving conclusions (Ilahi, 2012).

Learning media is defined as everything that can be utilized including tools, surrounding areas and all activities with the aim of increasing understanding, changing attitudes or having a new impact on skills for people who function them (Sanjaya, 2012). The current era of digitalization development strongly supports guru to choose and design suitable media to use in helping to transfer knowledge to students. One

of the media that can be selected and functioned is video (audio-visual).

Video is a technology that can transfer information by displaying sound and moving images. With its advantages that can display objects, events, and sounds, it can be used as an alternative to the selection of learning media. According to Anggraeni in (Zakirman & Hidayati, 2017) it is statedthat audio-visual presentations will make visualization more attractive.

The video used is to show games related to physics learning materials. Momentum and impulse teaching materials are classified as one of the materials that are often found in their application to everyday life. The closest example is in the game. So that the video shown contains games related to momentum and impulse material. The game is generally the one that occurs in colliding or colliding in the process. The games in question include: billiards, stone throwing or marbles, caste balls, medium marbles balls, and tennis balls to play girls "ponti" (in Gorontalo).

Physics learning generally studies natural phenomena. All concepts of physics should be shown through the process of these phenomena directly. Presenting phenomena through video is an effort to present related phenomena directly while also introducing physical games to students. Students are currently more familiar with digital game activities through Android smartphones.

The concepts presented in the game are of course related to the phenomena being taught, in this study are the concepts of momentum and impulse. The concepts of momentum and impulse are more widely recognized by students through mathematical equations through memorizing formulas. Meanwhile for the memorization itself, the longer it takes, the greater the chance of being forgotten. In contrast to the concept that is understood through the learning process associated with the phenomenon that is in accordance with what is being studied.

Method

This research is using experimental method. The purpose of the experimental method is to conduct research on causal relationships by manipulating a variable in one, two or more experimental groups. Furthermore, the results will be compared with the control group which was not given manipulation (Payadnya, 2018). This research was conducted at SMA Negeri 1 Bungku Utara, Central Sulawesi

Province, during the even semester of the 2021/2022 academic year.

In this study the determination of sampling using the Cluster Random Sampling technique. This method is applied by taking random samples from the population regardless of level and the population is considered homogeneous or the same (Sugiyono, 2015). The sample in this study was class X IPA 1 as the experimental class, while class X IPA 2 served as a comparison or control class.

This study used pretest-posttest control group design. In this study, one class or group was given X treatment (experiment), then the other without treatment (control). An overview of the design used can be seen through the following Table 1.

Table 1
Research Design

Class	Pretest	Treatment	Posttest
Experiment	M_1	X_1	M_2
Control	M_3	X_2	M_4

Information:
M1 : Pretest results of the experimental group
M2 : Posttest results of the experimental group
M3 : Comparison /control group pretest results
M4 :Posttest results of the comparison/control group

X1 : Treatment in the experimental group, namely learning activities using the discovery learning model with the help of video games
X2 : Treatment in the comparison group/co-ordination, namely learning using the discovery learning model.

Data collection techniques use written tests. The form of the test used multiple choice and the essay of which amounts to 13 items. The test is given before the pretest and after the posttest. This research focuses on the learning outcomes of students in the cognitive realm by paying attention to 6 aspects that are the object of research, namely C1 (remembering), C2 (understanding), C3 (applying), C4 (analyzingis), C5 (evaluating), and C6 (creating).

The instruments used are lesson plans, teaching materials, student worksheets, learning achievement tests, and videos. Before being used, this instrument has been validated for its feasibility by experts in their fields who are lecturers in the physics department, State University of Gorontalo.

Data analysis in this study utilizes several tests, including the prerequisite test (normality and homogeneity), hypothesis test (t), and n-gain test. The

application of this hypothesis test is to determine the mean difference between the two sample groups.

Results and Discussion

After carrying out a series of learning activities, learning results were obtained for the experimental group and comparison group shown in Table 2. Based on the data of Table 2, it is known that the pretest and posttest values in each class are clearly different. To find out the differences in learning outcomes after the application of the discovery learning model with the help of video games, the average difference hypothesis test is used. The average difference hypothesis test is carried out with the data must first be normally distributed and homogeneous.

Table 2
Average Pretest-Posttest Scores Multiple Choice tests (MCT) and Essey Test (ET)

No.	Class	Average Pre-test Value		Average Post-test Value	
		MCT	ET	MCT	ET
1	Experiment	28,8	19,6	79,4	81,37
2	Control	30	17,16	71,18	72,55

The results of the data normality test with the help of the Microsoft Excel application, for multiple choice tests obtained the result L count = 0.18629 < α= 0.05 in the experimental group and L count = 0.19423 < α= 0.05 in the control group. As for the essay test, the results of L count = 0.14971 < α= 0.05 in the experimental class and L count = 0.17482 < α= 0.05 in the control class. For the value of L the table of significance level α= 0.05 i.e. 0.206. In accordancewith the normality test rules, if $L_{calculates} < L_{of the table}$ then H_0 is accepted or the data is normally distributed.

On the homogeneity test, the calculated F_{value} = 1.45522 < F_{table} = 2.33348. While the data analysis on the essay test obtained the calculated F_{value} = 1.48485 < F_{table} = 2.33348. Based on the homogeneity test test criteria, if $F_{counts} < F_{table}$, then H_0 is accepted or homogeneous population.

The hypothesis test (t) used is the Independent t test (independent sample t test). Calculation analysis on an independent t test using an average value after carrying out learning (posttest). The results of the t test analysis are shown in Table 3.

Based on Table 3 it can be seen that both on the form of multiple choice tests and the essay test of the value

of $t_{count} > t_{table}$, then H_0 is rejected and H_1 is accepted. This provides information that there is a clear or significant difference between learning outcomes in the experiment and the control class.

Table 3
Hypotesis Test Result

Test Form	t count	t table	Status
Multiple choice test	2,183	2,037	H_0 is rejected, H_1 is accepted
essay test	2,811	2,037	H_0 is rejected, H_1 is accepted

For improvement in learning outcomes can be known through the results of the n-gain test. The interpretation of the N-Gain test through multiple choice tests can be seen in the following Figure 1.
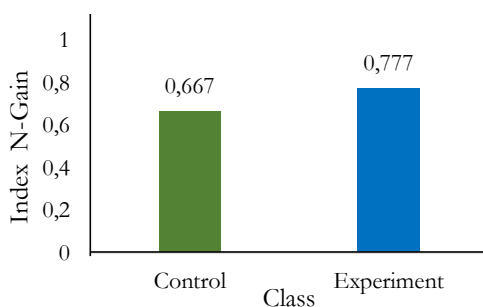
Figure 1
Improved Learning Outcomes (Multiple Choice Test)
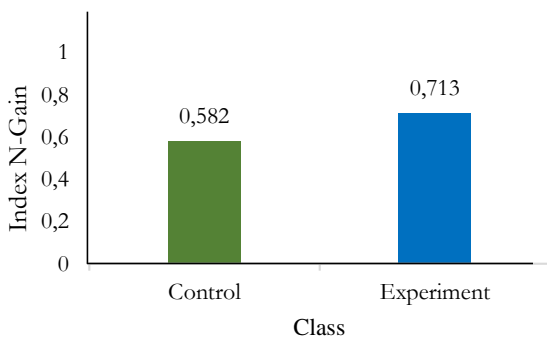
Based on figure 1, it can be seen that the control class N-Gain index is 0.582, then based on the N-Gain criteria index, it means that it is on the medium criteria. As for the experimental class, it is worth 0.713, then it can be said to be on the high criteria. Then for the improvement of learning outcomes measured on the essay test can be seen in the following figure 2.

Figure 2
Improved Learning Outcomes (Essay test)

In figure 2, it can be seen that the n-gain index in the control class is 0.667, then based on the index of the N-Gain criterion, it can be interpreted to be on the medium criterion. While in the control class the n-gain index is worth 0.777 which means it shows a high criterion..

Based on the data analysis that has been previously presented, there are significant differences in learning outcomes between the application of the discovery learning model with the help of video games and the application of the discovery learning model . This is because the delivery of learning materials with the help of videos makes it easier for students to understand them. This result is supported by Daryanto's statement, (2011) that students are able to remember and absorb material better, because the memory and absorption of students will increase significantly if the process of originating the initial source of information is more through the sensory devices of hearing and sight, in this case it means the use of video media. In another opinion also expressed oleh Khairani et al. , (2019) in his research that the appearance of learning video media that contains audio and visual content contains material messages, so as to help students in terms of understanding the content of the lessons delivered.

Video media is very muchused as an alternative in helping to convey the concept of learning. Several reasons that can be considered for using video as a learning medium include (1) the video used in learning can be reopened when students forget the learning material, (2) assisting the teacher in delivering the learning material (3) the use of learning time in class becomes more efficient, (4) video media does not need to be printed, (5) The video size can be changed or adjusted to the needs. In addition to these reasons, there are still many advantages of videos that can be explored so that they provide optimal benefits for students and teachers. Learning videos can also be used as an alternative if one day learning is again carried out online or virtually. The content of the learning video itself is the core of making videos, so that it can be used as a learning medium.

Physics learning materials can be related to events or events that exist in everyday life, for example in games. Games have their own ability to involve learners in the active learning process. One way that can be used is to make games a learning media or provide understanding of students in school, especially in physics lessons. In this study, it was seen that when games are used as learning media in the form of videos, it can affect student learning outcomes. These results are proven through data analysis that has been carried out through statistical tests.

In addition to media selection, another factor that can affect learning outcomes is the use of the right model. Educators or teachers usually only use ateacher-centered learning model, so students tend to become inactive. This situation can trigger the saturation felt by children or learners, thus impacting learning outcomes. The use of the discovery learning model in this research is in the process of requiring students to play an active role in the learning process. Although both classes use the same model, at the stimulus stage, the control class presents video games so that students are more interested and seem more passionate about learning. So that in the learning results, it shows that there is a significant difference. So, when .model discovery learning is combined with the help of game video media, it can have a limited effecton learning outcomes.

These results are in accordance with research conducted by Damayanti et al. , (2022) that teaching and learning activities using the discovery learning model show an improvement in student learning outcomes. In the research conducted by (Romlah & Andi, 2021) it was also found that there was a significant influence on the use of discovery learning models with the help of learning videos on the use of discovery learning models.

Conclusions

The conclusion of this study is that the learning of the discovery learning model with the help of video games is effective in improving the learning outcomes of the concepts of momentum and impulse, it is shown that the value of t count on the multiple choice test is 2.183 and on the uraian test 2.811 is greater than t table 2.037. Referencing the rules of the t test (hypothesis), then, H_1 is accepted and H_0 is rejected which indicates a significant or significant difference between the learning outcomes of the experimental and control classes. Other results that support this through the n-gain test on the multiple choice test obtained an n-gain score of the experimental class of 0.713 while the control class of 0.582. In the breakdown test, the n-gain score of the experimental group was 0.777 and the control group was 0.667.

The advantages of learnersn discovery learning models with the help of video using video games that emphasize physical play mostly use small balls to teach the concepts of impulse and momentum. For further research, you can use games in a real way or use other video games that can motivate learners in learning..

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