Analysis of Collaboration Skills and Physics Learning Outcomes Using Gamification-Assisted Murder Cooperative Learning Model

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ABSTRACT

Learning is a series of processes to encourage students and organize students to have learning goals. The low collaboration skills and student learning outcomes are caused by the teacher-centered learning process and the lack of application of technology in the learning process. This research aims to find out; (1) the significant influence of the gamification-assisted MURDER cooperative learning model on students' collaboration skills; and (2) the significant influence of the gamification-assisted MURDER cooperative learning model on student learning outcomes. The type of research used is a true experiment with a post-test only control group design. The population in this research is students of class XI science of SMA Negeri 4 Jember odd semester for the 2024/2025 school year. The sample was determined by the purposive sampling area method so that class XI Science 1 was obtained as the experimental class and XI Science 2 as the control class. The data collection techniques used include tests, interviews, documentation, and observation. The data analysis used was a homogeneity test, a normality test, and a hypothesis test. The results of the analysis of collaboration skills and student physics learning outcomes showed that there was a significant influence on the use of the gamification-assisted MURDER cooperative learning model.

Keywords : MURDER Cooperative Learning; Gamification; Collaboration Skills; Learning Outcomes.

I. INTRODUCTION

Physics education is a learning process that focuses and covers the understanding of basic concepts and physical sciences. Education is defined as a form of organized efforts to create a learning environment for students to develop their potential [1]. Physics learning is defined as a learning process that contains elements of interest and involves science information. Physics subjects are related to human activities in the form of knowledge, ideas, and structured concepts regarding natural environmental phenomena [2]. Learning that prioritizes the science process must of course use a suitable learning model. The advancement of science and technology in the era of globalization is inevitable [3]. A learning model that has a large scale and is recognized as one of the efficient approaches in developing collaboration skills and improving learning outcomes, one of which is cooperative [4]. Cooperative learning can encourage positive interactions, increase mutual respect, and strengthen social relationships among students [5]. MURDER is an acronym for *Mood, Understand, Recall, Detect, Elaborate,* and *Review* [6]. Learning at school, especially in physical subjects, usually seems boring and also many students are often bored in the learning process due to a lack of motivation from teachers.

In the context of physics, a fluid can be interpreted as a substance that can flow and change shape. Flow behavior can be understood through two approaches: static fluids (hydrostatics) which study the state at rest and dynamic fluids (hydrodynamics) which study fluid movements and flows [7]. Hydrostatic pressure is a compressive force that acts on a liquid that is in a stationary state. In Pascal's law, a change in pressure at one point in a liquid will cause the same change in pressure at all other points. Archimedes' law is a law of physics that states that an object immersed in a liquid will experience an upward force equal to the weight of the liquid being moved [8]. In the field of physics, especially static fluid material, many students still experience obstacles in understanding physics material [9]. Physics learning outcomes at the school level are often low due to the

nature of physics materials that require an in-depth understanding of concepts and complex mathematical applications [10] . Lastly, the teacher must create a positive atmosphere during the learning process. In the world of education, it is necessary to implement digital technology that has the potential to overcome low student interest and student learning outcomes [1]. In the 21st century there are skills that are a subject that needs attention. In this century, skills are not developed through learning, but through technology-based learning, meaning that 21st century skills must develop along with the development of digital technology. [11].

Physics learning can improve the 4C skills (Communication, Collaboration, Critical Thinking, Creativity) these 4C skills are practiced during the learning process. In order for learning to be carried out as expected, it is necessary to have learning media [12]. Gamification in learning can incentivize students to achieve learning objectives through a reward system that includes games [13]. Gamification is a combination of several game elements and includes game concepts in a non-game perspective, making it interesting and making lessons more effective, as well as improving the quality of learning [14]. Gamification is used to make activities and processes in learning more engaging, interactive, and enjoyable. There are several gamification platforms such as, *Educaplay, Kahoot,* and *PhET Simulations.* Gamification can help improve the implementation of learning and also enhance students' collaboration skills and learning outcomes through the platforms within it.

One of the skills that is important and expected is collaboration skills, because basically education is required to play an active role in improving the quality and quantity of knowledge along with the times [15]. Collaboration skills are a process of learning together that combines differing opinions and thoughts through discussion. Collaboration enhances cooperation skills, goal setting, and problem-solving [16]. Students' ability to work in teams can also be assessed through tasks such as setting goals, making plans, and trying strategies. Learning outcomes are influenced by several factors, generally, such as physical, psychological, and fatigue factors that significantly impact learning outcomes [17]. The interaction between individuals with family, school, and society forms external factors that influence educational development.

II. METHOD

The type of research used is *True Experiment*, which is research conducted by providing This research was carried out at SMA Negeri 4 Jember in the odd semester of the 2024/2025 school year. The research design uses *a post-test only control group design*. The sample was determined using *the purposive sampling area* method [19]. The research design uses *a post-test only control group design* The data analysis used was a homogeneity test, a normality test, and a hypothesis test using the help of the SPSS 23 program. The homogeneity test was used to find out whether the data used came from the same variation population or not. The homogeneity test uses mid-semester test scores in physics subjects. The normality test is used to find out whether the distributed data is normal or not. Hypothesis test using *Independent Sample T-test* if the data is normally distributed and using *the Mann Whitney U Test* if the data is not normally distributed.

Statistical hypothesis is the purpose of the research. In this research, there are two, namely, the first is Ho: There is no significant influence of the use of gamification-assisted MURDER cooperative learning model on collaboration skills. Ha: There is a significant influence of the use of the gamification-assisted MURDER

Cooperative learning model on physics learning outcomes in high school students of Static Fluids. The second hypothesis is Ho: There is no significant influence of the use of the gamification-assisted MURDER cooperative learning model on student learning outcomes, Ha: There is an effect of the use of the gamification-assisted MURDER cooperative learning model on student learning.

III. RESULTS AND DISCUSSION

The analysis process begins with a homogeneity test to ensure the uniformity of data variance and meet statistical assumptions. The homogeneity test of physics mid-semester test score data was carried out using *One-Way Anova* statistical analysis. The data homogeneity analysis showed a significance value of 0.000, so the sample selection was carried out using *the purposive sampling area* method [20]. Based on the data acquisition, there are two classes that have almost the same average, namely, class XI MIPA 1 as an experimental class and class XI MIPA 2 as a control class. The research was conducted using three gamification platforms including kahoot, eduacplay, and PhET simulation. The use of gamification media aims to improve collaboration skills and student learning outcomes. The following is an explanation of each gamification platform in the research.

1) Educaplay

Educaplay is defined as a learning platform that allows its users to create different types of educational games and interactive exercises. The platform is used to enhance a fun and engaging learning experience, as well as using a variety of game formats such as, puzzles, quizzes, crosswords, and jumping frogs [21]. Eduaplay is placed at the moment before the student receives the learning process and is used as a prefix or used when starting a triggering question. The educaplay application can be seen in the following Figure 1.

Fig. 1. Educaplay

2) Kahoot

Kahoot is defined as a gamification platform in which it is designed for social learning, with learners gathering in their respective groups [13]. In kahoot, each element of the game has its own points that can make students think in detail and have a sense of competition in the group. Kahoot is used when the learning process is completed, namely at the evaluation stage. The kahoot application can be seen in Figure 2.

Fig. 2. Kahoot

3) PhET Simulation

Phet simulation is an interactive simulation used for learning and teaching in the field of science. The simulation phet in this study is used as a medium to carry out static fluid practicular activities and can also help students understand abstract concepts that are difficult to understand orally, and can make group learning activities more interesting, imaginative, and challenging [22] . Simulated phet is used when students do group activities and work on the LKPD hydrostatic pressure, pascal law, and archimedes law. The application of the simulated phet can be seen in Figure 3.

Fig.3. Phet Simulation

a.   Collaboration Skills Analysis

The collection of student collaboration skills data was carried out through systematic observation of observation sheets developed based on collaboration skill indicators, and filled in by trained observers in the experimental and control classes. There are five indicators of student collaboration skills, each of which is scored on a scale of 1-4 by calculating the score which is then divided by the maximum score and multiplied by 100. Briefly, the results of the observation sheet of student collaboration skills can be seen in the following Table 1.

Table.1. Observation Results of Collaboration Skills

	Experimental Classes	Control Classes
Number of Students	36	36
Number of Students	100	100
Lowest Rate	57	45
Average	70	63

Observation data of students' collaboration skills were analyzed using the *One-Sample Kolmogorov-Smirnov Test* normality test with SPSS 23. The normality test is used to find out whether the data to be used is normally distributed or not. The results of the *One-Sample Kolmogorov-Smirnov Test* normality test can be seen in Table 2 below.

Table.2. Results of analysis of normality test of student collaboration skills data
One-Sample Kolmogorov-Smirnov Test

		Experiment	Control
N		36	36
Normal Parameters[a,b]	Mean	81.39	71.39
	Std. Deviation	10.929	14.373
Most Extreme Differences	Absolute	.157	.144
	Positive	.157	.144
	Negative	-.118	-.099
Test Statistic		.157	.144
Asymp. Sig. (2-tailed)		.025[c]	.057[c]

Based on the output of the normality test, namely *the Test Statistic* and *Asymp. Sig. (2-tailed) values.* Based on the *One-Sample Kolmogorov-Smirnov Test* test in the experimental class, the *Test Statistic* value was obtained of 0.157 and Asymp. Sig. (2-tailed) 0.025, while in the control class the *Test Statistic value* was obtained of 0.144 and *Asymp. Sig. (2-tailed)* 0.057. The following is the basis for determining whether or not distributed data is normal.

a.   If the distributed data is normal if the value of Sig. (*2-tailed*) $\geq$ 0.05, then the test used next should use a parametric statistical test.
b.   If the data is not normally distributed if the *value of Sig. (2-tailed)* < 0.05, then the next test used must use a non-parametric statistical test

The value of Sig. (2-tailed) of the collaboration skills data of students in the experimental class was 0.025 and the value of Sig. (2-tailed) of the control class was 0.057. The Sig. (2-tailed) value of the experimental class is smaller than 0.05 or can be written 0.025 < 0.05. This means that the collaboration skills data of experimental

class students are not distributed normally. The value of Sig. (*2-tailed*) of the control class is greater than 0.05 or can be written as $0.057 \geq 0.05$. This means that the data on critical thinking skills of the control class is normally distributed. Furthermore, a non-parametric statistical test was carried out, namely the Mann-Whitney U-Test. The results of the analysis of *the Mann Whitney U-Test* can be seen in Table 3 below.

Table.3 . Results of the analysis data on student collaboration skills.
Test Statistics[a]

	Value
Mann-Whitney U	361.000
Wilcoxon W	1027.000
Z	-3.255
Asymp. Sig. (2-tailed)	.001
a. Grouping Variable: Kelas	

Hipotesis :

1) Ho : There is no effect of the gamification-assisted MURDER cooperative learning model on students' collaboration skills
2) Ha : There is an influence of the gamification-assisted MURDER cooperative learning model on students' collaboration skills

Based on the results of *the Mann-Whitney U-Test* in Table 3, the sig value (p-value) of student collaboration skills data can be seen in the Sig. (2-tailed) column, which is 0.001. The value of Sig. (2-tailed) is 0.001 which means it is less than 0.05 and can be written $0.001 \leq 0.05$ which means that Ho is rejected and Ha is accepted. Therefore, it can be concluded that there is a significant influence of the gamification-assisted MURDER cooperative learning model on students' collaboration skills. From the results obtained, there is a significant influence of the use of gamification-assisted MURDER cooperative learning model on collaboration skills. This is in line with the research of [10] which states that learning using a cooperative model can increase student activity during the learning process. In line with the research of [24] which states that using a cooperative learning model can help improve students' collaborative attitudes and student activeness during the learning process.

b. Analysis of student physics learning outcomes

The second data is in the form of student physics learning outcomes obtained from the posttest of the experimental class and the control class. The posttest was carried out after the learning process using the cooperative learning model of MURDER in the experimental class and learning as usual carried out by the teacher in the control class. Posttest questions are arranged based on the cognitive realm, namely applying, analyzing, and evaluating. In summary, the results of the posttest on physics learning outcomes can be seen in the following Table 4.

Table. 4. Descriptive Analysis of Physics Learning Outcomes

Descriptive Statistics					
	N	Mean	Std. Deviation	Minimum	Maximum
Experiment	36	80.69	18.596	38	100
Control	36	70.25	19.048	30	90

Based on table 4, the physics learning results of the experimental class obtained the highest score of 100 and the lowest score of 38. Meanwhile, in the control class, the highest score is 90 and the lowest is 30. The experimental class had a higher average score than the control class. In the experimental class, the average score was 80.69 and in the control class it was 70.25. Furthermore, the posttest data of student learning outcomes was tested with a normality test using the One Sample Kolmogorov Smirnov Test using SPSS 23. The normality test is used to find out whether the data used is normally distributed or not. The results of the normality test can be seen in the following table 5.

Table.5. One Sample Kolmogorov Smirnov normality test

One-Sample Kolmogorov-Smirnov Test

		Experiment	Control
N		36	36
Normal Parameters[a,b]	Mean	80.69	70.25
	Std. Deviation	18.596	19.048
Most Extreme Differences	Absolute	.161	.154
	Positive	.150	.150
	Negative	-.161	-.154
Test Statistic		.161	.154
Asymp. Sig. (2-tailed)		.020[c]	.030[c]
a. Test distribution is Normal.			
b. Calculated from data.			
c. Lilliefors Significance Correction.			

There are two results that must be seen in the normality test, namely *the Test Statistic* and *Asymp. Sig. (2-tailed) values.* Based on the results of *the One-Sample Kolmogorov Smirnov Test* in the experimental class of *the Test Statistical* section of 0.161 and *Asymp. Sig. (2-tailed)* of 0.020. In the control class, the Test Statistic *section* was 0.154 and *the Asymp. Sig. (2-tailed)* was 0.030. The following is the basis for determining whether or not distributed data is normal.

a. If the distributed data is normal if the value of Sig. (2-tailed) ≥ 0.05, then the test used next should use a parametric statistical tes

b. If the data is not normally distributed if the value of Sig. (2-tailed*)* < 0.05, then the test used next must use a non-parametric statistical test

The Sig. (2-tailed) value of the SPSS 23 output can be seen in the One *Sample Kolmogorov-Smirnov* Test table. The value of Sig. (2-tailed) physics learning outcomes of students in the experimental class was 0.020 and the value of Sig. (2-tailed) in the control class was 0.030. The Sig. (2-tailed) value of the experimental class is less than 0.05 or can be written as 0.020 < 0.05. This means that the physics learning outcome data of experimental class students is not normally distributed. The value of Sig. (2-tailed) of the control class is less than 0.05 or can be written as 0.030< 0.05. This means that the physics learning outcome data of the control class students is not normally distributed. Based on these results, the analysis of T test data could not be carried out, so it was continued with the Mann Whitney U Test. The results of the Mann Whitney U Test can be seen in the following Table 6.

Table 6. Mann *Whitney U Test Results*

Test Statistics[a]

	Value
Mann-Whitney U	425.000
Wilcoxon W	1091.000
Z	-2.519
Asymp. Sig. (2-tailed)	.012
a. Grouping Variable: Kelas	

Based on the results of the *Mann Whithney U Test*, a Sig. (2-tailed) value of 0.012 was obtained, which is smaller than 0.05 which means 0.012 ≤ 0.05. Based on the decision-making guidelines, it can be concluded that the null hypothesis (Ho) is rejected and the alternative hypothesis (Ha) is accepted, meaning that there is a significant influence of the gamification-assisted MURDER cooperative learning model on the learning outcomes of students on the subject of static fluids. Thus, there is an influence of the gamification-assisted MURDER cooperative learning model on the learning outcomes of students on the subject of static fluids in the experimental class and in the control class without using models and media. The average learning outcome of the experimental class was 81.69 and the control class was 71.25, which shows that there is a significant influence of the gamification-assisted MURDER cooperative learning model on learning outcomes.

The results of the data in the research that has been carried out are in accordance with the research of which states that learning using the MURDER cooperative learning model can improve student learning outcomes, which is characterized by an increase in student cognitive learning outcomes in classes that use the MURDER cooperative learning model [25]. [26] in their research results also stated that the MURDER cooperative learning model had a significant impact on physics learning outcomes, in addition to research from

[27] also stated that the learning model assisted by gamification media can have an effect on the student learning process.

IV. CONCLUSION

Based on the description of the analysis of collaboration skills and learning outcomes, it was concluded that the gamification-assisted cooperative learning model was significant to students' collaboration ability and success in physics. The use of the MURDER cooperative learning model with the help of gamification obtained a positive response from students, this was characterized by enthusiastic students during the learning process. Based on the results of the research, the following conclusions were obtained.

a. There was a significant influence of the use of gamification-assisted MURDER cooperative learning model on the collaboration skills of high school students on static fluid subjects.

b. There is a significant influence of the use of the gamification-assisted MURDER cooperative learning model on the learning outcomes of high school students on the subject of static fluids.

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