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IMPLEMENTATION OF SETS-BASED IOT INTEGRATED GAMIFICATION ON PHYSICS MATERIALS TO IMPROVE STUDENT LEARNING OUTCOMES

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Abstract: *This study aims to improve student learning outcomes using the concept of SETS-based IoT integrated gamification in physics materials. The method in this study is Pre-experimental one group pretest-posttest which is used to measure student learning outcomes before treatment and after treatment. The subjects of this study were class VIII students of Junior High School AR RISALAH Sumenep Regency. The results showed that the implementation of SETS-based IoT integrated gamification in learning can improve student learning outcomes. This can be seen from the average posttest value which is higher than the average pretest value, which is a difference of 26.67. Based on the analysis of paired t-test data using SPSS 20, it shows that the significance value obtained is the sig pretest value. 0.130 while the posttest value is sig. 0.200. P-value (sig. (2-tailed)) obtained a value of 0.000 which means less than 0.05. So that way it can be concluded that H_0 is rejected, while H_1 is accepted, namely there are differences in learning outcomes before and after treatment by implementing SETS-based IoT integrated gamification on physics materials.*

Keyword: *Gamification; Learning Outcomes; IoT; SETS*

INTRODUCTION

The era of society 5.0 is an era that makes the educational paradigm change towards digitalization with the increasingly rapid consumerization of technology (Nastiti & Abdu, 2020). Education in the era of society 5.0 requires innovative and constructive learning in leading broad thinking to solve problems that are not only centered on physical space but also using virtual space (Wang *et al*, 2022). System in education have important tasks that need to be carried out in order to be able to adapt to technology whose development is quite significant (Díaz *et al*., 2020). Learning methods that only rely on textbooks can be strengthened by using technology and utilizing the internet as digital student teaching materials (Hemmati, 2022). However, students cannot take advantage of digitalization of technology on their own without a teacher who can provide constructive learning directions to students, so that through education they can create a digitalization generation that is not technologically stuttering (Rahayu, 2021).

Learning Natural Sciences (IPA), one of which is physics lessons, especially on simple planes is often considered a difficult subject (Ustari, 2021). This is supported by a statement from Choirunnisa (2021) which states that the thing that makes simple plane material difficult because of the many types of simple planes that make students often have difficulty and are confused between one type and another, this causes the results of learning students are low. Problems experienced by students require teacher involvement to be more innovative, so that student achievement in understanding lessons can be more optimal (Susilo & Sarkowi, 2018). Implementation of learning with games is one way that can improve student learning outcomes which, when viewed from a psychosocial perspective, shows that students at the junior secondary level prefer to play (Bodnar *et al*, 2016). This is also supported by a statement from Pratama et al (2020) which states that learning using games will attract students more in learning.

Learning that applies the concept of gamification is a form of teacher's creative breakthrough to create fun learning (Alsawaier, 2018). This is supported by a statement from Hidayatulloh (2020) that on every plot game there is Theory revealed learning by implied nor written. Therefore, learning in the era of society 5.0 requires wrapped material in game so you can make feeling student be happy and students who think that study that difficult Becomes more easy and fun (Kapp, 2012). It also requires inspiring learning by utilizing digital technology.

The use of IoT (Internet Of Things) also has an important role in the era of society 5.0 by connecting networks and other sites on platforms that exist on the internet (Roblek *et a*l, 2020). This can make learning effective and responsive. Gamification is a form of using technology and digitalization by prioritizing student understanding and maximum learning outcomes (Toriz, 2019). Gamification

is packaged into an interesting form, focusing on learning and games using the help of the internet so that it can be played in groups (Leaning, 2015). One of the advantages of learning that uses the concept of gamification is that students can compete in games but still prioritize positive things that are constructive in learning (Mulyani, 2021). Moreover it can create a mindset, cooperation, criticality, and a high social sense in each student. In addition to games in learning, quizizz games can also be a teacher's choice to make it easier for students to remember the material being studied and summarized in the form of quizzes and then included in the quizizz game (Pitoyo & Asib, 2019).

Not miss from the era of society 5.0 gamification could applied use approach SETS (Science, Environment, Technology, and Society*)* based learning by prioritizing real facts. It is supported by the research of Aisyah et al (2021) which states that the SETS-based approach can be seen around the environment by each student so that it can be easier to remember and learn. Not only that, technology and the social role of society are tools to facilitate learning to develop (siegle & Mitchell, 2021). The material that is packaged by looking at the environment around students aims to facilitate natural memory caused by real knowledge and experience from students (Tahya *et al,* 2022). The use of technology in the form of gamification and social use to foster students' self-confidence so that they are motivated in learning is expected to improve student learning outcomes (Chans & Castro, 2021). Therefore this study aims to improve student learning outcomes using the SETS-based IoT integrated gamification concept on simple aircraft physics material.

METHOD

The method in this research is pre-experimental one group pretest-posttest . The pre-experimental one group pretest-posttest method only uses one class as an experimental class without a control class to measure student learning outcomes before and after treatment. The research design was one group pretest-posttest, namely this research was carried out in one group with the research subject being class VIII students of AR RISALAH Junior High School, Sumenep Regency. The group to be studied is given treatment by implementing the concept of IoT integrated gamification based on SETS in learning. One group pretest-posttest research design can be seen in the following figure:

Pretest **Treatment** ***Posttest***

O_1 ..... X----- O_2

Figure 1 . One group pretest-posttest research design

Information :

O_1 = Value before being given treatment (Pretest)

X = Giving Treatment

O_2 = Value after being given treatment (Posttest)

Students are first given a test (Pretest) in the form of multiple choice questions and descriptions to determine the level of student ability before being given treatment. After

students are given treatment, students are given a test (Posttest), it aims to determine student learning outcomes after being given treatment. The instruments used in this research are tests and questionnaires. Tests are questions that are used to measure the knowledge and abilities of individuals or groups (Murni & Harimurti, 2016). The test instrument used is in the form of test questions consisting of multiple choice questions and description questions. The second instrument is a questionnaire. Questionnaires are several statements that are used to find out statements from respondents on each indicator of the variable to be studied (Murni & Harimurti, 2016). The questionnaire used is using a Likert scale type to measure the data instrument to be collected. The total score of the questionnaire uses 2 types, namely supporting and not supporting the application of the SET S-based IoT integrated gamification concept to simple aircraft physics material.

The Likert scale used contains five alternative responses from the facilitators in this study in each type, namely SA (strongly agree), A (Agree), DB (Doubtful), DS (Disagree) and SDS (Strongly disagree). For the questionnaire score in the supportive type, namely a score of 5 starting from SA (strongly agree) while the SDS score (strongly disagree) gets a score of 1. SDS score (strongly disagree) gets a score of 5 which can be seen in table 1 below:

Table 1 . Questionnaire Score

Type/Response	**SA**	**A**	**DB**	**DS**	**SDS**
Support	5	4	3	2	1
Does not support	1	2	3	4	5

Instrument validation is carried out to find out whether the instrument is feasible or not. Some of the instruments validated are the SETS-based IoT integrated gamification learning implementation plan that will be implemented and the item questions that will be used in the *pretest* and *posttest* . The formula for calculating the validation percentage is:

Validation percentage = $\frac{Total\ Score}{Score\ Criterion}$ x 100%.....(1)

Criterion score = Highest score for each item $\times \sum responden \times \sum validator$

While the percentage of assessment criteria from validation can be seen in the table below:

Table 2 . Percentage of Validation Assessment

Average Score	Criteria
0% - 20%	Invalid
21% - 40%	Invalid
41% - 60	Valid Enough
61% - 80%	Valid
81% - 100%	Very Valid

The results of the percentages will be said to be valid if the average percentage is 61% -80%, and will be very valid if it reaches 81% - 100% so that the instrument can be used in research.

RESULT

Testing student learning outcomes from the pretest and posttest scores, namely the initial test using the normality test from Kolmogorof Smirnov to find out the resulting data is homogeneous or not homogeneous. If the significance is

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greater than 0.05, it indicates that the data is normally distributed, which means it is homogeneous, while if the significance is less than 0.05, it indicates that the data is not normally distributed, which means that it is not homogeneous. Data from the results of the *pretest* and posttest normality tests can be seen in table 3 below:

Table 3 . Normality test

	Kolmogorov-Smirnov [a]		
	Statistics	df	Sig.
Physics Pretest	,215	12	,130
Physics Posttest	,184	12	,200 *

Data Source: SPSS 20 output processed in 2021

Based on the data from the table above, it shows that the pretest value of sig. 0.130 while the posttest value is sig. 0.200, so that the data from student learning outcomes are normally distributed or homogeneous because of the significance of the pretest and posttest scores smaller than 0.05. If the resulting data is homogeneous, the next step is to analyze paired t-test data to determine the accepted research hypothesis, which is between H_0 (there is no difference in learning outcomes before and after treatment by implementing SETS-based IoT integrated gamification on physics material). Or H_1 (there are differences in learning outcomes before and after treatment by implementing SETS-based IoT integrated gamification on physics material).

Pretest and posttest average values are produced. The average pretest value can be seen in Figure 2 histogram below:

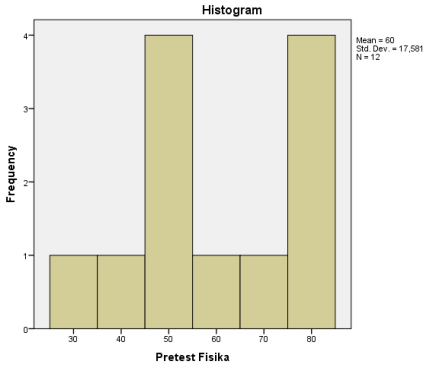

Figure 2 . Histogram of pretest mean scores

Figure 2 above shows the results of the analysis of the average pretest score for class VIII Junior High School AR RISALAH which consists of 12 students as the subject of the study. The results of the analysis of the image above obtained student learning outcomes with an average value of 60. Details of the lowest student test scores are 30 with the number of one student, one student also gets a value of 40, 60 and 70, but there are four students who get the value of 50, while the other four students got the highest score of 80. Meanwhile, the average posttest score can be seen in Figure 3 histogram below:

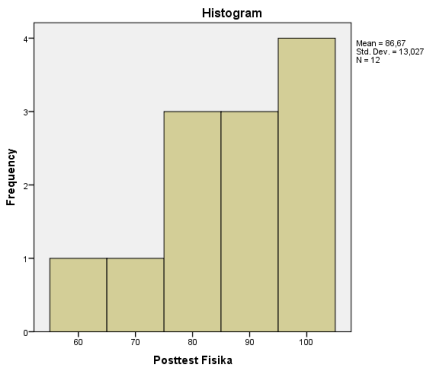

Figure 3 . Posttest mean score histogram

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Posttest mean scores for class VIII Junior High School AR RISALAH which consists of 12 students as the subject of the study. The results of the analysis of the image above obtained student learning outcomes with an average value of 86.67. The details of the lowest student test scores are 60 with a total of one student, one student also gets a score of 70, but there are students who get a score of 80 and 90 with three students each, while the other four students get the highest score. high with a value of 100. Therefore, the posttest average value is higher than the pretest average value.

After seeing the posttest average value and the average pretest value, a paired t-test was carried out to determine the hypothesis of the accepted research so that it would determine whether there was an increase in student learning outcomes after treatment by implementing SETS-based IoT integrated gamification on simple aircraft physics material. Paired t-sample test can be seen in table 4 below:

Table 4 . Paired samples test

		Paired Differences					t	df	Sig. (2-tailed)
		mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Physics Pretest - Physics Posttest	-26,667	6,513	1,880	-30,805	-22,528	-14,182	11	,000

Based on table 4 above, the difference in the average value of the posttest is higher than the average value of the pretest with a difference of 26.667. While the p - *value* (sig. (2-tailed)) obtained a value of 0.000, which means it is smaller than 0.05. So it can be concluded that H_0 is rejected , while H_1 is accepted , that is, there are differences in learning outcomes before and after treatment by implementing SETS-based IoT integrated gamification on physics material.

DISCUSSION

Based on the results of this study, it shows that one of the learning models that are in accordance with current developments is IoT integrated gamification, it is in accordance with the characteristics of students who really like to play *games* so that it will foster students' enthusiasm to learn and become initial capital for students to pay attention to lessons (Nurhayati, 2020). Physics lessons that require high concentration, attention and motivation to learn are very compatible with the concept of gamification which makes learning

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inspiring for students to improve student learning outcomes. The SETS (Science, Environment, Technology, and Society) learning approach combined with IoT integrated gamification makes constructive and innovative learning for students in studying physics subjects, business materials and simple machines.

Student learning outcomes can be analyzed using test scores given before treatment (pretest) and after treatment (posttest). This is because the test is an instrument that was created as a measuring tool in viewing student learning outcomes (Agustin et al., 2018) . Student learning outcomes experience changes when compared between before implementing learning strategies and after learning on physics material. The difference in score results between the pretest and posttest is caused by the influence of the implementation of SETS-based IoT integrated gamification on physics material.

Based on the results of the study, it shows that SETS-based IoT integrated gamification can make students think actively in investigating and analyzing problems in the surrounding environment through games in learning (Indri, 2021) . This affects student learning outcomes, so as to improve learning outcomes. The learning process can have a good impact if the teacher involves students in active and fun activities to discover a concept that is being studied (Ekantini, 2020) . Therefore, students can understand the material studied well, because students will be happy if the strategies and learning models used are based on games that are integrated with the internet. In addition, learning based on students' daily lives can create an increase in students' cognitive skills which makes it easier for students to understand what is learned.

Students' active attitude is related to Jean Piaget's learning theory. Hasanuddin (2017) states that according to Piaget students are not passive agents in their genetic development, but there are adaptations to their environment so that they can bring up three processes of cognitive development in learning. The effect of implementing SETS-based IoT integrated gamification on physics material can improve student learning outcomes. But there are those who still get scores below the minimum completeness criteria. This is because the implementation of SETS-based IoT integrated gamification is carried out in groups, the teacher cannot ensure that all students play an active role in the same portion so that some students do not play an active role. Therefore, the effect of learning activities is less than optimal for all students.

The influence of the implementation of SETS-based IoT integrated gamification based on the value of student learning outcomes is very significant. This is because the physics material which was initially considered difficult by students, but carried out with fun learning can be a special attraction for students especially integrated with IoT which makes a creative breakthrough for teachers. The feelings of students will

feel happy with what is learned, and also learning that emphasizes real facts can be directly seen in the environment around students, so that the material is easy to remember and understand. Therefore, the implementation of SETS-based IoT integrated gamification in physics material has a very good effect on student learning outcomes.

CONLUSIONS

Based on testing the learning outcomes of 12 respondents of class VIII Junior High School AR RISALAH after treatment by implementing the concept of IoT integrated gamification based on SETS in the simple airplane chapter physics material, the learning outcomes before treatment were more improved. This can be seen from the posttest average value which is higher than the pretest average value , with a difference of 26.667. The average value of the *pretest* is 60 while the average value of the *posttest* is 86.67. While the p-value (sig. (2-tailed)) obtained a value of 0.000, which means it is smaller than 0.05. It can be concluded that the implementation of SETS-based IoT integrated gamification on physics material can improve student learning outcome

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