

Research Article

Learning Using Edmodo Based On The Science, Technology, Engineering, Art and Mathematics (STEAM) Method

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ORCIDMeti Maspupah: <https://orcid.org/0000-0002-3335-7204>**Abstract.**

This research was motivated by technological developments in the world of education, particularly the increasingly rapid e-learning as one of the media supporting learning. The STEAM approach to learning can improve critical thinking, creative and collaboration skills with good communication. This is very necessary to face the challenges of the Industrial Revolution 4.0. Therefore, this study aimed to assess student response to the learning of the immune system using Edmodo based on the STEAM approach. The study used the Pre Experiment Method with a one-group pretest post-test research design. Data was collected through observations and tests. The instruments used were observation sheets, creative thinking ability tests, validation sheets and questionnaires. This study discovered an increase in students' creative thinking skills with pretest results of 80.00 and posttest of 97.14. The results of hypothesis testing showed that $Asymp\ Sig. < Sig. 0.05$ was $0.002 < 0.05$, as such, H_0 was rejected, and H_1 was accepted, showing a significant increase between the pretest and post-test. In addition, the average value of n-gain was 0.71 in the high category. Student responses to the media and learning approaches were positive, with a percentage of 86.97% in the very good category.

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1. INTRODUCTION

The development of science in the 21st century demands that the educational curriculum adapt to the situation, conditions and challenges of globalization. Education today must keep up with the times, one of which is the use of technology in learning so that students can have analytical thinking skills, communicate, collaborate, discuss and develop their creativity to face various problems in the era of globalization. Therefore, a good classroom learning process is needed which can adapt to the needs of students and the facts of the existing situation [1].

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Currently, learning has been developed that can equip students with the skills needed in the 21st century, namely STEAM (Science, Technology, Engineering, Art, and Mathematics). STEAM involves a creative thinking process and integrates several learning methods in the discovery and investigation process. Various kinds of innovations have been carried out in learning by utilizing ICT, one of which is mobile learning or e-learning. E-learning is a learning design to facilitate students in gaining knowledge or skills that can be done anywhere, anytime and by anyone using electronic media [2, 3]. This e-learning system utilizes the mobility of handheld/mobile devices, such as mobile phones and PDAs, to provide a learning function that can be done anywhere and anytime [4, 5].

One of the e-learning media is Edmodo. Edmodo learning media is a social media-based learning platform for teachers, students and schools. Edmodo media has many displays (features) that can be used for the implementation of learning. The features or displays in Edmodo include class groups, libraries, notes, assignments, announcements (alerts) and so on [6]. Edmodo media can be accessed by students and teachers anywhere and anytime. Just like other social networks, Edmodo accounts can be obtained free of charge (free), made for school-based learning use. The Learning Management System (LMS) feature on Edmodo can support e-learning such as assignments, quizzes and assessments. Edmodo access is also faster, its use is easier because it is equipped with features with various supporting functions, thus making Edmodo able to compete with other Learning Management Systems such as Moodle [7]. According to Yulistiana, biology is a science that deals with the study of abstract forms and structures and their relationship with deep understanding. Therefore, to study biological material, media is needed that can visualize concepts and support the transfer of knowledge properly [8].

Based on a preliminary study at Madrasah Aliyah Negeri 4 Garut, data obtained from the KKM (Minimum Completeness Criteria) for biology class XI MIPA is 75. The average grade XI MIPA is 65. With a passing percentage of 60%, it means that there are 40 % who have not met the KKM. From the results of the preliminary study, namely interviews with biology subject teachers at MAN 4 Garut, it was found that learning activities in the classroom tend to be passive or teacher-centered, and the learning media used are less varied. During online learning, it appears that biology learning does not involve students' creative abilities, so that students only know the theoretical concepts of biological material. Therefore, schools need to strive so that educators and students can understand and be able to complete the tasks given so that they are able to compete for higher education levels and in the world of work. To support this, it is necessary to have interesting learning media so that students can learn actively and

can absorb the knowledge taught by the teacher both during school hours and outside school hours [9].

STEAM (science, technology, engineering, art, and mathematics) education has been implemented to enhance scientific literacy to use the integrated knowledge in the newly revised Korean science education curriculum. Recently STEAM approach has emerged to develop human resource with creativity in mind and see and understand human society in the future. STEAM approach is defined as education approach in which the students understanding and interest in related subjects such as science, technology, engineering, etc., foster of conversions of thinking and problem solving based on science and technology [10]. Hence, the purpose of National Curriculum 2013 of Indonesia and STEAM has the similarity which is to make the student be creative and implement the knowledge in daily life.

STEAM is a learning approach that makes students think critically, creatively and have broader thinking skills. The STEAM approach has the aim of training students to be able to adapt to the demands of an unexpected era and is expected to foster problem solving skills in students. To implement a comprehensive approach, it is required to have two main components: 1) Concepts, namely approaches based on teaching models of student character and thinking activities, 2) Principles, which are fundamentals or basic rules that identify teachers' beliefs and abilities in mastering the pedagogy used in the teaching and learning process. STEAM was developed into a learning competency called hybrid ability or 4C (Communication, Collaboration, Creativity and Critical Thinking), namely Communication, Collaboration, Creativity, and Critical Thinking [11].

According to the results of research conducted by Wandari, the results of the implementation of the STEAM approach before the test or pre-test showed an average value of 43.35 from 27 children and after the test or post-test showed the number 87.42. This shows that the ability to understand a concept with the Cognitive Domain. Students' creativity in new things got 76%, at a resolution of 78%, while in elaboration and synthesis it was 69%. It can be concluded that the results of children's creativity abilities can be categorized as good [12].

This adaptation is carried out in the learning environment at Madrasah Aliyah Negeri (MAN) with the STEAM approach which has an acronym as well as being a reference in applying this approach to the learning process, where in Science, students will be given a material regarding scientific disciplines according to the existing subjects. , where the material will be studied by students empirically, the learning process in class uses the help of an LMS which is in accordance with the second acronym after Sciene, namely Technology with its application utilizing tools used to support the learning process

taking place such as Edmodo media, which supports students to do learning based on Student Worksheet, in accordance with the next aspect, namely Engineering, Art, and Mathematics where students must meet the demands of predetermined competencies where these demands students must have creative abilities by developing or making things that exceed their standard competence. In the engineering process, students perform logical analysis of a phenomenon or understand technology about immunology. Then finally from STEAM, namely Art and Mathematics, which analyzes and develops ideas related to immunity in the form of mind mapping.

The STEAM approach will be packaged with Edmodo as a supporter of the learning process in the classroom. Through the help of Edmodo as a learning medium using the STEAM approach, high school students can improve the ability to think critically, creatively, be able to collaborate with good communication and have broader thinking skills in accordance with hybrid abilities learning competencies and can also facilitate educators and students in teaching and learning process. With notes that students can be monitored their progress by educators and parents/guardians of students [9]. Thus, this study aims to develop Edmodo learning media based on the Science, Technology, Engineering, Art and Mathematical (STEAM) approach to the immune system. This research will analyze two variables they are students' concept mastery and student responses towards STEAM approach-Based Learning.

2. RESEARCH METHOD

The research method used in this study is quantitative research with methods including filling out questionnaires carried out on students at Madrasah Aliyah Negeri (MAN 4 Garut) for sampling before treatment and taking Pre-Test and Post-Test samples after testing the students. By using Pre Experiment with Single Group Design with Pre test - Treatment - Post Test so as to form a research pattern as follows:

TABLE 1: Research design one-group pretest-posttest.

Pretest	Treatment	Posttest
O ₁	X	O ₂

Information:

O₁ : The Experimental Group will do a Pre-test to get data before treatment.

X : Treatment is carried out with the development of learning media .

O₂ :The Experimental Group will do a Post-test to get the data after the treatment

This means that the research will use 1 experimental group which will later be used as a control group as well as an experimental group [13]. The research sample consisted of one class, namely class XI MIPA 1 and MAN 4 Garut. The population in this studied class XI even semestered 2020/2021 academic year which consists of three classes and a total of 82 people. While the sample was taken based on purposive sampling because it was determined based on certain criteria by the Biology subject teacher. The research sample was students of class XI MIPA 1 with 38 students.

Data collection techniques used are observation and questionnaires. The instruments used are response questionnaires to determine student responses related to Edmodo media and observation sheets to observe the teaching and learning process. The research design Pre test - Treatment - Post Test was also used to test students' knowledge abilities both before and after the treatment was carried out. The data taken in the form of LMS Edmodo feasibility assessment data by expert lecturers and teachers. Where the pre-test and post-test scores will be tested using the normality test to test the feasibility of the questions.

The instruments used in the form of lesson plans, student worksheet, materials, and instrument questions will be tested for feasibility using a Likert scale. The results of student work were analyzed using the analysis of the normality test, namely the Liliefors (L) test. The results of the feasibility analysis of research instruments that have been validated get the average results very feasible. instrument questions get 92.5%, learning media made to support learning 87.5%, and student instruments to learning get 92.5%.

Before going through the data processing, the researchers conducted a normality test using the Liliefors Test method. The Liliefors test is a statistical test used to determine the distribution or distribution of data, or the data comes from a normally distributed population or vice versa. According to Hadi, in testing the hypothesis the Liliefors test is used to test whether there is a difference in the frequency of one or more samples[13]. In this hypothesis test, the students' pretest and posttest data were tested for normality and homogeneity with the results being normally distributed and having a homogeneous variance, then parametric statistical tests were carried out with the paired t-test type. The resulting score is obtained from the N-gain value shown in formula [14].

$$N - Gain = \frac{skor\ posttest - skor\ pretest}{skor\ maks - skor\ pretest} \times 100\% \quad (1)$$

Change does not stop at the ability of knowledge. After experiencing the treatment, the results of the student's skill assessment were calculated using an assessment rubric based on the posttest result observation assessment. What students do can meet the skills acquisition indicators. The instrument used in addition to quizzes is a student

assessment rubric sheet that assesses the results of each student's skills based on student worksheets. All tests will be calculated using the help of the IBM SPSS statistics 25 application, to find out the results of the research both before and after treatment [15].

Questionnaire to accommodate student responses to STEAM-based edmodo learning media. The questionnaire used is a questionnaire with a Likert scale. Answers students who have been graded will be added up then averaged using the formula:

$$X = \frac{1}{N}(2)$$

Information:

X = Average score

n = Total number of students

Furthermore, student answers from each category are then calculated by using the formula:

$$P = \frac{jR}{jS}(3)$$

Learning activities using Edmodo media are carried out in cycles with the first stage, namely the introduction, where the researcher enters the class by simulating the method of using Edmodo first. The core activity was carried out in 2 meetings, and the closing activity was distributing questionnaires to students. Learning activities using Edmodo based on the STEM approach still pay attention to the learning steps from the initial activities.

The second stage, students are given the opportunity to fill out the Pre-Test which is carried out for 45 minutes. The third stage, followed by online learning started as a treatment. Online learning through Edmodo for approximately 30 minutes as an implementation of the STEAM approach. The teaching and learning process follows the Learning Toolkit Plan (RPP), 30 minutes later students are required to actively provide brief analysis and evaluation on a teaching material in the form of interactive multimedia videos that researchers have prepared as a stimulus for students to think analytically and creatively according to the Student Worksheet. The fourth stage, students are given assignments and posttests according to a predetermined deadline. The assignments made for students are in accordance with the Basic Competition of the material being studied [16].

3. RESULTS AND DISCUSSION

This research was carried out in stages through the research subjects of class XI MIPA 1 students with 38 students. The research instrument is in the form of pre-test and post-test questions. Student response questionnaire to Edmodo media based on STEAM approach. These learning tools and learning media have gone through the validation stage by Biology Education Lecturers and Biology Teachers from MAN 4 Garut. The level of significance used in this study is = 0.05. The results of the calculation of the normality test are presented in Ttable 2 as follows.

TABLE 2: Tests of normality class pretest using edmodo.

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
Data	.132	32	.170	.955	32	.205
Lilliefors Significance Correction						

Table 2 shows that Asymp Sig. > Sig. 0.05 in the experimental class H₀ was accepted. This means that with a significance level (α of 5% in that class, it comes from a normally distributed population. Meanwhile, the results of the posttest normality test calculations can be seen in Table 3 as follows:

TABLE 3: Tests of normality class posttest using edmodo.

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
data	.115	32	.200*	.952	32	.168
*. This is a lower bound of the true significance.						
Lilliefors Significance Correction						

Table 3 shows that Asymp Sig. > Sig. 0.05 in the experimental class H₀ was accepted. This means that with a significance level (α) of 5%, the class comes from a normally distributed population.

3.1. Analysis of Improved Learning Outcomes

3.1.1. Normality Test

Normality test is a test method to assess and test the distribution of data that has been obtained in a group with normal or abnormal distribution. Normality test must be done because this is a requirement to do the Paired Sample T-Test. From the data that has been obtained where the results on the pre-test value are 0.170 > 0.05 while the test

results on the post-test value are $0.20 > 0.05$. This means that the Pre-test and Post-test scores are normally distributed [14].

3.1.2. Homogeneity Test

Homogeneity test is a test conducted to ensure that the groups being compared are groups that have homogeneous variance. Testing the homogeneity of variance for the two groups of pretest and posttest data was carried out using Fisher's exact test [14]. Based on the results of the normality test of the pretest and posttest data above, the data obtained were normally distributed, so a homogeneity test could be performed to determine whether the data had homogeneous variance or not. The results of the homogeneity test in general on the pretest and posttest data can be seen in table 4 as follows:

TABLE 4: Results of homogeneity test of pretest and posttest data.

		Levene Statistic	df1	df2	Sig.
Result	Based on Mean	1.437	4	14	.273
	Based on Median	1.374	4	14	.293
	Based on Median and with adjusted df	1.374	4	10.844	.306
	Based on trimmed mean	1.447	4	14	.270

Table 4 shows that the pretest and posttest data were obtained by Asymp Sig. $> \text{Sig. } 0.05$ is $0.273 > 0.05$ then H_0 is accepted. That is, with a significance level (α) of 5%, the pretest and posttest data in the experimental class both have homogeneous variances.

3.1.3. Hypothesis Testing

Hypothesis testing is one of the methods of testing the hypothesis where the data used is not independent which is characterized by the existence of a value relationship in each of the same samples (pairs). This hypothesis test compares the average of two variables for a single sample group [14]. The results of hypothesis testing in general on the pretest and posttest data can be seen in Table 5 as follows.

Table 5 shows that, the results of hypothesis testing for pretest and posttest data in the experimental class, indicating that Asymp Sig. $< \text{Sig. } 0.05$ is $0.002 < 0.05$, then H_0 is rejected and H_1 is accepted. That is, with a significance level (α) of 5%, the pretest and posttest data have a significant difference. This means that there are differences

TABLE 5: Results of pretest and posttest hypothesis testing.

		Paired Samples Test					t	df	Sig. (2-tailed)
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretest - Posttest	-26.76500	9.11956	1.61213	-30.05295	-23.47705	-16.602	31	.002

in creative thinking skills before and after using STEAM-based Edmodo media in the learning process.

3.1.4. Student Skills Assessment Rubric Test

The increase in students' creative thinking skills can be seen from the results of the pretest and posttest in Table 6 as follows:

TABLE 6: Results of students' ability to use edmodo.

Test	Minimal score	Maksimal score	Average	Criteria
Pretest	42.86	77.14	60	Enough
Posttest	80.00	97.14	88.57	Very good

Table 6, the average pretest is 60 with a minimum score of 42.86 and a maximum score of 80 and an average posttest of 88.57 with a minimum score of 80 and a maximum posttest score of 97.14. This shows that there is a significant increase in the results of the pretest with a higher posttest. Furthermore, the n-gain test was conducted to measure how much students' understanding of the learning that had been carried out was carried out. The n-gain score is obtained from the posttest results minus the pretest score, then divided by the maximum score or ideal score minus the pretest score. The n-gain gain is 0.71 in the high category.

3.1.5. Response Analysis Students on Class Experiments

The results of student responses to learning biology using STEAM-based Edmodo media showed a positive response, so that it could increase students' creative thinking skills by 86.97% with a very good category. Edmodo on the STEAM approach gave a positive response, both in terms of completeness of the display (features), increasing enthusiasm for learning, access with parents, helping absorb material and so on [16].

Edmodo media can access sources of teaching materials such as videos, images, or other collaborations that can be obtained virtually and help the teacher and parent assessment process for the ongoing learning process in the classroom. This is in line with Widiyanto's research on Edmodo based on the Science, Technology, Engineering, Art and Mathematic (STEAM) approach that can improve the pedagogic and professional competence of teachers in terms of teaching skills, and professional competence of teachers, especially in mastering the concept of learning materials in order to accelerate the era of teaching and learning digitalization in education [17].

In addition, learning using Edmodo media based on the STEAM approach can foster a positive attitude, because it can foster a spirit of learning and interaction between students and can improve students' ability to access other electronic media [18]. This is in line with research conducted by Apriliana, that students consider the STEAM approach in project-based learning to be interesting, exciting, and fun [19]. The STEAM approach in learning can develop students soft skills, namely collaboration, critical thinking, environmental care, responsibility, adaptability, creative thinking, leadership, and honesty.

4. CONCLUSION

Based on the results of research and discussion regarding the development of STEM-based Edmodo media and student responses in using STEM-based Edmodo media on immune system material, the following conclusions can be drawn; first, results of students' ability to use edmodo in learning obtained an average pretest of 60 and posttest of 88.57 with an n-gain value of 0.71 in the high category. Secondly, student responses to learning biology using Edmodo media based on the STEM approach showed a positive response, so that it could increase students' creative thinking skills by 86.97% with a very good category.

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