

## The Effect of Web-based Educational Games Toward Student Learning Outcomes on The Topic of The Immune System

Dwi Ratna Julianti<sup>1\*</sup>, R. Ading Pramadi<sup>1</sup>, Meti Maspupah<sup>1</sup>, Muhammad Muttaqin<sup>1</sup>, Epa Paujiah<sup>1</sup>

<sup>1</sup> Program Studi Pendidikan Biologi, Fakultas Tarbiyah dan Keguruan, UIN Sunan Gunung Djati, Bandung

E-mail: [dwiratnajulianti@gmail.com](mailto:dwiratnajulianti@gmail.com)

### Abstract

The purpose of this study was to analyze the effect of using web-based educational games on student learning outcomes on the immune system topic. This study uses Quasi Experiment method with a non-equivalent control group design. Data analysis technique using normality test, homogeneity test, and hypothesis testing in the form of t-test. The results showed that web-based educational games affected student learning outcomes in immune system topics at SMAN 3 Purwakarta. This finding is proved by the acquisition of the results of the t-test with a significance level of 5%, the value of t-count > t-table = 2.43 > 2.01. The score of learning outcomes on immune system topic in the experimental class is greater than that of the control class, namely the experimental class gets an average score of 78 while the control class gets an average score of 69.4. Therefore, it can be concluded that the use of web-based educational games has a positive effect on improving student learning outcomes on immune system topic.

**Keywords:** Natural science module, STEM, Liquid Pressure.

### INTRODUCTION

Education is a process of planned activities between individuals and teachers which aims to acquire knowledge that will be used as a provision in the future. This learning process can be done directly or indirectly between individuals and groups, intentionally or unintentionally and without being limited by space (Neolaka, 2017: 12).

Educators or teachers have an important role in supporting the learning process. Teachers are required to be able to make learning interesting. This will make the atmosphere of education and learning more enjoyable and will motivate students to learn. This means that teachers

must be able to define methods, learning resources, and media to support learning (Switri, 2019: 1). Because of this role, the teacher must be able to adjust the class situation if the learning process goes well and is not monotonous and will affect student learning outcomes. This is because learning outcomes reflect the learning process.

The learning process at SMAN 3 Purwakarta is carried out with the national curriculum so that in practice students need to be more active in the learning process. This learning process is assumed based on the results of preliminary research that was carried out on January 21, 2021. However, due to the

implementation of distance learning in the Covid-19 pandemic situation, teachers had difficulty in providing learning materials due to limited time, media, and materials that need to be delivered. As a result, the material is not understood by students and student learning outcomes are low. This is evidenced by the results of daily tests. Of the 25 students in the class, only 7 to 10 students reached the Minimum Completeness Criteria with a score of 75.

Based on the results of the interview above, the learning process needs to be improved to make it more active and fun. These improvements can be achieved by maximizing the use of learning media based on the related problems which are expected to improve student learning outcomes.

Furthermore, one of the alternative media that can be used to overcome this problem is web-based educational game media. Learning media in the form of games or games can stimulate children's interest to be able to receive learning materials better (Widoretno et al., 2021). Thus, by enhancing students' interest in learning can improve student learning outcomes.

Based on the description above, it is necessary to conduct a study and analysis regarding the use of web-based educational game learning media to optimize the education and learning process of Biology, especially on the topic of the immune system. Therefore, the purpose of this study was to analyze the impact of the use of web-based educational games toward student learning outcomes in the topic of

the immune system.

## METHOD

This research is an experimental study with a quasi-experimental research design, and pre-test post-test control group type in which used two classes, namely the experimental class and the control class.

The type of data used is quantitative which is obtained from the acquisition of student learning outcomes in the implementation of the pre-test and post-test. The source of the data used is the results of the pre-test and post-test scores of students' learning outcomes.

The population in the study was class XI students in the even semester of SMAN 3 Purwakarta during the academic year of 2020/2021. Meanwhile, the research sample was determined using purposive sampling which resulted two classes, namely class XI MIPA 2 as the control class and XI MIPA 5 as the experimental class. The determination of the two classes was based on the average student's prior ability which was relatively the same. In addition, the number of students in each class is 25 people with a randomly selected sample. The analysis technique used in this study is a prerequisite test in the form of a normality test using the Kolmogorov-Smirnov test and a homogeneity test using the F-test followed by a different sample t-test (T-Test independent sample).

To know the increase in student learning outcomes, it is completed by using the N-gain value obtained from the pre-test and post-test scores. According to Sugiyono (2015:72), the calculation of the N-gain value follows the Meltzer formula

as follows:

$$g = \frac{(\langle Sf \rangle - \langle Si \rangle)}{(S_{\max} - \langle Si \rangle)}$$

Note:

- $\langle g \rangle$  = N-gain
- $\langle Si \rangle$  = Score of Pretest
- $\langle Sf \rangle$  = Score of Posttest
- $S_{\max}$  = Maximum Score

## RESULT AND DISCUSSION

The average score for pre-test and post-test in the experimental class and control class can be seen in the following table:

**Table 1.** Average Pre-Test and Post-Test Scores for Experiment Class and Control Class

Group	Average		N-Gain
	Pretest	Posttest	
Experiment	58.8	78	0.48
Control	58.6	69.4	0.32

Based on table 1, the post-test average score of the experimental class was higher than that of the control class, with the experimental class scoring 78 and the control class 69.4.

The learning outcomes using web-based educational games on immune system materials showed an increase in student learning outcomes in the experimental class with an average post-test score of 78 and for the control class, with a post-test average score of 69.4. In addition to the post-test average score, the increase in learning outcomes was strengthened by the acquisition of N-Gain scores in both classes. The N-Gain score for the experimental class was 0.48 while the N-Gain value for the control class was 0.32. Based on these data, there is a difference between the experimental class and the control class of 0.16.

**Table 2.** Normality Test for Experiment Class and Control Class

Class	Test	Significance	Criteria
Experiment	Pretest	0.200	Normal
	Posttest	0.200	Normal
Control	Pretest	0.200	Normal
	Posttest	0.200	Normal

Table 2 above shows that the pre-test and post-test scores in the experimental class and control class are normally distributed with a significance level of  $0.200 > 0.05$ .

**Table 3.** Test of Homogeneity of Experiment Class and Control Class

Statistics	Experiment	Control
Variance	334.3	568.9
F-Account	0.59	1.11
F-Table	1.98	
Conclusion	Homogeneous	Homogeneous

Table 3 above shows the results of the homogeneity test using the F-test in the experimental class and control class, it can be concluded that the experimental class and control class are homogeneous groups because of the value of F-count  $<$  F-table with a significance level of 5%.

**Table 4.** T-test of Experimental Class and Control Class

Class	Analysis Result		Conclusion
	T-Count	T-Table	
Experiment	2.43	2.01	There is a significance difference
Control			

Based on table 4, the value of t-count  $>$  t-table with a value of  $2.43 > 2.01$ , a significance level of 5%. All in all, it can be concluded that  $H_0$  is rejected, which means that there is a difference between student

learning outcomes using web-based educational games and student learning outcomes on immune system topic.

Based on the data above, it can be concluded that there were differences in learning outcomes in the experimental class and the control class. The experimental class got a higher score than the control class. Furthermore, the class that implement the educational game during the learning process had a higher average score than class that did not use educational games (Selvi, 2018: 2022).

The difference in learning outcomes achieved between the experimental class and the control class was caused by several factors, i.e. external factors, and internal factors. External factors are caused by the web-based educational game contains of text, animation, sound, and images. So that it makes students feel interested when learning takes place. In line with Wijayanto's opinion (2017: 347), educational game content contains several elements that can be used to stimulate student learning, such as graphics, sound, text, animation, and video. These elements are communicated so that students remain interested in learning.

In addition, the learning topics are simpler when delivered during learning, so students can quickly understand the concept. Under Trisianti's statement (2012: 138), complex and difficult learning topics can be simplified with the use of educational game media, thus causing students to understand the material more quickly. Rahayu et al. (2021) also proves that learning topics that are made simpler

and packaged in attractive media can improve student learning outcomes.

In addition to external factors, there are internal factors that cause student learning outcomes in the experimental class to be better than in the control class. The internal factor that causes the experimental class learning outcomes to be better than the control class is student motivation. The students in the experimental class felt more motivated when learning by using web-based educational games during learning, which made the learning process in experimental class more active and fun. Following Rohwati's statement (2012: 80), learning by using educational games in the experimental class is also caused by the changes in students' learning motivation. Students become more active in discussing and asking more questions during the learning process because students feel that the learning process is more interesting.

In addition, the learning process using web-based educational games has several advantages and disadvantages. The advantages of using educational game media during learning process, i.e. learning process are more interesting and fun, affected students to be motivated in the learning process because it can reduce student boredom during learning and can help students understanding the learning concept quickly. Besides, the weakness in learning process by using web-based educational games, is since the use of web-based educational games can only be accessed online, the use of the internet is required in every learning apart from that the internet condition is sometimes

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unstable in every place.

## CONCLUSION

Based on the research findings, it can be concluded that there is an effect of using web-based educational games toward student learning outcomes on immune system topic. This result is indicated by the calculation of the hypothesis test using the t-test, where the value of t-count > t-table is  $2.43 > 2.01$ . Therefore, it can be concluded that  $H_0$  is rejected and  $H_1$  is accepted, which means that the use of web-based educational games affects in enhancing students' learning outcomes in the immune system topic.

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## BRIEF PROFILE

Dwi Ratna Julianti was born in Purwakarta on July 27th, 1999. Student of Biology Education Department, Sunan Gunung Djati State Islamic University, Bandung.