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The Effectiveness of Online Supported Learning in High School Students on Invertebrate Topics

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Abstract. This study aims to determine the magnitude of the feasibility of the implementation of learning supported by online learning towards students' outcomes in invertebrate material in grade 10 SMA Negeri 10 Medan TP 2019/2020. The method used in this study is an experimental study using the form of One Group Pretest Post Test that is giving treatment to one group and then observing the results. Treatment (treatment) as an independent variable and the result as a dependent variable. This design is used to examine a group by giving one treatment and measuring it once without the comparison group. The sample used was grade 10 students of SMA Negeri 10 Medan. Data collection techniques using questions and questionnaires. The data analysis technique used is N-Gain Analysis. This research is beneficial for schools and teachers to choose the right learning innovation for biology learning in high school and the implementation of learning supported by e-learning. And as a preliminary data or reference for biology education program students if they want to carry out further research on this matter. The results of the study show that the n-gain calculation test is 0.64, which means that learning outcomes have increased in the medium category. Thus it can be said that learning using e-learning can be said to be effective and helpful in improving student learning outcomes.

1. Introduction

The era of globalization has had quite a broad impact on various aspects of life, including the aspect of education. One of the real challenges is that education should be able to produce human resources who have complete competencies known as 21st-century competencies. It is the main competence that students must have in order to be able to take part in real life. Competence in the 21st century is also known as competence that comes from the positive impact of globalization as an effort to meet the needs of life in various contexts that are more knowledge-based. Efforts to meet the needs of knowledge-based education, knowledge-based economic development, knowledge-based social empowering, and development in knowledge-based industries [1].

Realizing 21st-century competence requires several learning innovations in education, such as the use of information technology. Along with the rapid development of Information Technology (IT), the need for a concept and teaching and learning mechanism in IT-based education is inevitable. The concept which became known as e-learning had an influence on the transformation of conventional education into digital form, both in content and in the system. Currently, the concept of e-learning has been widely accepted by the world community, as evidenced by the widespread implementation of e-learning in educational institutions (schools, training, and universities) and industry [2].



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The success of learning science in Senior High Schools (SMA) is generally measured by students' understanding of the concepts being taught. The retention factor or the stickiness of concepts in memory gets less attention even though it can be used as an indicator of the quality of learning or learning outcomes. To find out the effectiveness of learning outcomes, it should not only be from mastering the concept but further, it needs to be analyzed whether the concepts being taught can be embedded in students' memories or are quickly forgotten because the learning carried out is only a mere memorization transfer [3].

Invertebrate topics are classified as difficult material in learning biology. This is supported by the results of Maharani's research which revealed that the analysis of conceptual mastery in invertebrates was considered difficult at the X grade high school level. Apart from the very broad coverage of the material, it also has several weaknesses, which are considered difficult to understand by students (Maharani, 2015).

Based on the results of observations with teachers at SMA Negeri 10 Medan, it was found that the facts include; (1) the concentration of students towards a lesson is low; (2) Students tend not to remember subject matter in the long term (long-term memory); (3) The learning process is still conventional and the school does not yet have an e-learning-based website; (4) 50% of students' biology learning outcomes are still below the KKM; and (5) conventional learning has not been able to support students learning independently outside the classroom

Based on the problem phenomenon above, this situation indicates that the biology learning method applied in the Teaching and Learning Process (PBM) in the classroom has not been able to encourage students to study outside the classroom. The reasons for students not repeating lessons at home/outside the classroom are because low interest in students, lack of student motivation which indicates an important lesson, the learning has not applied the learning model that is student-centered or still uses the conventional learning model [5]. The purpose of this study was to determine the effectiveness of learning implementation supported by e-learning on learning outcomes in invertebrate material in grade 10 high school.

2. Method

This research was conducted in grade 10 of one of the State Senior High Schools in Medan. The research was conducted from February to April 2020. The population of this study was all 10th-grade students of Mathematics and Natural Sciences which consisted of three classes, namely a class with a total of 103 students. Consisting of 48 men and 55 women. The sampling technique was carried out using purposive sampling which is seen from the number of students per class and the number of students who have smartphones to support learning supported by e-learning.

This type of research is an experimental study with the design of One Group Pretest Post Test, namely giving treatment to one group then observing the results. The research steps consisted of 3 stages, namely the preparation stage, the research implementation stage, and the data analysis. The preparatory stage includes observation at school, developing learning plans, developing research instruments (cognitive tests), developing Student Worksheets, and developing student response questionnaires to e-learning supported learning. The research implementation stage includes a pretest, implementing learning, and holding a posttest. Furthermore, in the third stage, the researcher analyzed the data to conclude the effectiveness of learning based on the improvement of student cognitive learning outcomes.

The instruments used in this study were cognitive tests and student response questionnaires to learning supported by e-learning. Cognitive questions used in this study were 10 multiple choice questions and 4 essay questions that had passed the validity and reliability tests. This problem is done by students through google classroom after learning is complete in one subject. The cognitive domains contained in this research instrument include understanding (C2), application (C3), analysis (C4), evaluation (C5), and creation (C6) of Bloom's taxonomy. The questionnaire used in this study was a semi-open questionnaire containing questions about student responses to e-learning supported learning. The categories of responses given by students to learning are taken from [6] in Table 1.

Table 1. Response Category on the Questionnaire

Respon	Criteria
>85%	Very positive
70% ≤ Respon < 85%	Positive
50% ≤ Respon < 70%	Less positive
Respon < 50%	Not positive

Normalized Gain (g) analysis is used to determine the effectiveness of learning by considering the increase of learning outcomes scores before and after treatment is applied. The formulas that can be used are as follows.

$$\text{Normalized gain} = \frac{[S \text{ post}] - [S \text{ pre}]}{[100\%] - [S \text{ pre}]}$$

Annotation:

S post = Score post-test

S pre = Score pre-test

Interpretation of the normalized gain value obtained uses the criteria of [7], with the classification shown in Table 2.

Table 2. Categorization of N-Gain Value

N-Gain	Category
N-Gain > 0,70	High
0,30 ≤ N-Gain ≤ 0,70	Medium
N-Gain < 0,30	Low

3. Results and Discussion

3.1. Utilization of the E-Learning Portal

The use of e-learning portals in this study is to use the learning house portal and google classroom. With the use of e-learning, in addition to face-to-face learning in the classroom, students can also study independently at home. In this case, the researcher provides freedom for students to access learning materials available on the learning house portal, namely learning resources followed by printed books that have been provided by the school per student then the google classroom portal is used to collect assignments, distribute assignments, and assess assignments. without being bound by the time limit of lessons anytime and anywhere.



Figure 1. Display Learning Resources on the RumahBelajar Platform

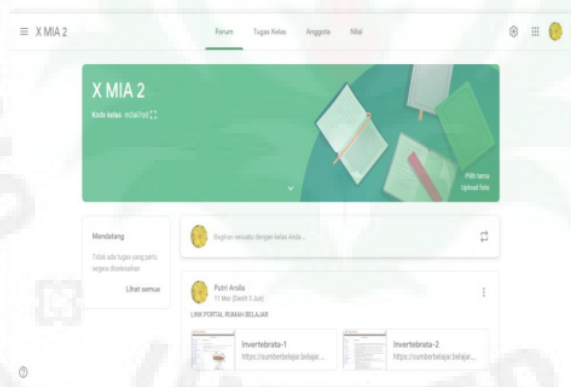


Figure 2. The Classroom Homepage

The learning house portal is a learning resource used by students for supporting material in addition to textbooks that serve as guidance for students in the learning process which can be accessed anytime and anywhere. The learning house portal, which is a learning resource, is a concise material and there is a quiz at the end of the material per section. In addition, this material can be accessed for free without having to register first on the learning house portal. Thus, it is hoped that students can learn independently and with a brief summary can help students understand faster. This research was conducted by combining face-to-face and online learning due to the COVID-19 pandemic which requires students to learn from home.

The role of teachers in face-to-face learning in the classroom can be optimized by using e-learning so that students who do not understand can learn it anywhere and anytime. The google classroom portal is used as a means to discuss, collect assignments, and distribute assignments. After studying the material, students are given LKPD through google classroom to work on in groups and then discuss together or presentations. If students make good use of the two e-learning portals and study independently at home, students can certainly better understand the learning material. This has a positive impact on student learning outcomes. The findings of previous research indicate that there is an effect of e-learning based learning in improving learning outcomes [8-9].



Figure 3. Student Discussion in Meeting Learning 1

3.2. Students Learning outcomes

This research is a type of One Group Pretest-Posttest, which is to determine the implementation of learning supported by e-learning to improve student learning outcomes. The research that has been carried out has obtained student learning outcomes through the use of the Learning House portal and Google Classroom by comparing the pretest and posttest scores. Thus, from student learning outcomes we can find out the magnitude of the feasibility of e-learning learning on student learning outcomes and learning can be said to be effective. The resulting data is presented in table 3 and 4.

Table 3. Descriptive statistics of the data

	N	Minimum	Maximum	Mean	Std. Deviation
pre-test	19	2.50	32.50	11.5789	7.41669
post-test	19	47.50	92.50	71.3158	12.83897

Before starting learning using e-learning, students are given a pretest with the aim of knowing each student's initial abilities and student readiness before learning begins. The results of the research that had been carried out showed that the students' initial average ability or pretest was 76% (0-20 value interval), 12% (21-40 score interval) and 12% (41-60 score interval). This shows that the students' initial ability is low. Then the treatment begins using e-learning supported learning for 3 meetings.

Table 4. Students' Pretest-Posttest Values

Score interval	Frequency	
	Pre-test	Post-test
0-20	19	-
21-40	3	-
41-60	3	6
61-80	-	11
81-100	-	8
total	25	25

After the learning is carried out, then the students are given a posttest which aims to determine the students' final abilities. The results showed that the average posttest score obtained was 71.3, an

increase in the average value of 53.1 from the pretest score was 18.2. From the Student Pretest-Posttest value data in table 3 it can be concluded that there is an increase in student learning outcomes towards e-learning supported learning. Thus, learning supported by e-learning can be said to be effective, seen in Figure 4.

The increase in student learning outcomes can be seen in Figure 1 where The results are still classified as low, but when the posttest was carried out with the learning process supported by e-learning, the highest student learning outcomes were between the 81-100 value interval with 8 students and the lowest at the 41-60 value interval, which was 6 students.

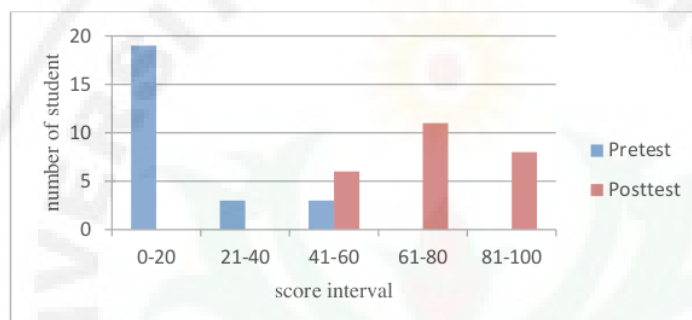


Figure 4. Graphic of Student Learning Outcomes. The students' scores at the pretest were much obtained at the 0-20 value interval.

After the student learning outcomes data are obtained, then the n-gain analysis is calculated to categorize the improvement in student learning outcomes. This analysis was conducted to see the increase in student learning outcomes. The n-gain calculation obtained a value of 0.64 which can be concluded that student learning outcomes have increased in the moderate category. The success of e-learning is supported by maximum interaction between teachers and students, between students and various learning facilities, between students and other students and the existence of active learning patterns in these interactions [10-11].

Table 5. Calculation Results of N-Gain Analysis. Obtained a value of 0.64, then the increase in learning outcomes is in the medium category.

Treatment	Nilai Rata-rata	Nilai N-Gain	Criteria
<i>Pre-test</i>	18,2	0,64	Medium
<i>Post-test</i>	71,3		

The results of a similar study conducted by [12], namely the application of e-learning by utilizing certain portals can develop students' cognitive abilities and skills. Furthermore, the results of research conducted by [13] stated that the application of e-learning based learning is very appropriate as a method to improve student understanding and learning outcomes in mastering subject matter.

According to [14], learning activities using e-learning allow learners to gain knowledge without having to physically attend class. Learning can be anywhere, while the "instructor" and the lessons that are followed are in other places, in other cities, and even in other countries. Interactions can be carried out online and in real-time or off-line or archived. This is one of the advantages that is not found in the face-to-face learning process. In addition, the learning time can be arranged in such a way if the face-to-face learning process cannot be implemented as happened during the COVID-19 pandemic, where all activities cannot be done outside the home. Therefore, e-learning really helps to learn to be more as easy and effective as ever. The advantages that exist in e-learning based learning are the reasons why this learning is appropriate to be applied in the school environment.

3.3. Student Responses to Learning Supported E-Learning

Student response questionnaires are for students to find out students' responses to e-learning supported learning. The results of the student response questionnaire calculation according to the Likert scale can be seen in table 5. The data in the table shows that the student responses to learning biology material invertebrates using e-learning supported learning are categorized as positive (high).

The results of the calculation of the response questionnaire found that; (1) learning biology material for invertebrates is 82%; (2) student acceptance of the ease of e-learning is 82%; (3) the performance of e-learning is 81%; (4) the e-learning expectation is 78%; and (5) the social influence of e-learning is 78% with a total average of 80%. Based on these results, it can be concluded that learning supported by e-learning received a good response from students and that in the COVID-19 pandemic students felt e-learning learning was very effective and very helpful so that the subject matter was not left behind.

Research by [15] reveals that through e-learning, students do not only listen to material descriptions from educators but also actively observe, do, demonstrate, and so on. Teaching materials can be virtualized in various formats so that they are more dynamic and able to motivate students to further the learning process. Thus, e-learning learning supports students to be more active and independent in the learning process.

Table 6. Questionnaire Student Responses to Learning Supported E-Learning

Indicator	Percentage (%)
Learning of Invertebrate topic	82
Student acceptance of the ease of E-Learning	82
E-learning performance	81
Students expectations for E-Learning	78
Social Influence on E-Learning	78
Rata-rata	80

3.4. Research Limitations

It should be realized that there are still some limitations to this research, even though every effort has been made. Some problems experienced by students in carrying out learning such as limited internet networks and student assignments not being sent due to running out of quotas.

4. Conclusion

Implementation of learning supported by e-learning on learning outcomes has increased in the medium category with the calculation of n-gain 0.64. Thus, it can be said that learning using e-learning can be said to be effective and help in improving student learning outcomes.

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