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The Efficiency of Utilizing The Physioex® Application Through E-Learning Among Students in The Field of Health at Universitas Negeri Gorontalo

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ABSTRACT

Introduction: Physiology is a study of the normal functions of the human body. However, the traditional lecture-based approach to teaching this subject has been observed to cause disengagement and boredom among students. Universitas Negeri Gorontalo was exploring the use of PhysioEx®, an interactive e-learning laboratory to studying physiology. This study aims to identify effective teaching methods to enhance student learning outcomes in physiology courses.
Method: A true experimental study was carried out at the Faculty of Medicine in Universitas Negeri Gorontalo in October 2023 with a pretest and posttest group. Each test comprised of nine questions and had a time limit of nine minutes. The study population consisted of 200 Public Health students and 69 medical students from the year 2023. A sample of 161 random individuals was selected for analysisusing the Slovin formula, and the data was analyzed using the T-test analysis.
Results: Based on the statistical analysis of the pretest and posttest scores, it was observed that both the lecture method and the PhysioEx® method resulted in a significant increase in scores ($p<0.05$). However, no substantial difference was observed in the learning outcomes between the two methods ($p > 0.05$).

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Conclusion: The comparative effectiveness of the lecture method and the PhysioEx® method in the instruction of physiology has been analyzed. The findings indicate that both methods are similarly effective when employed in educational contexts pertaining to physiology. The results of this analysis underscore the utility and potential of both pedagogical approaches.

Key words: Learning effectiveness, e-learning, physiology, physioEx®

Introduction

Physiology is the study of how the body works under normal circumstances.[1] Physiology is a very important basic science, by understanding how the body normally works, it will be easier for students to know and understand everything that is abnormal in the body, making it easier for them to learn the pathophysiology of various diseases. [2]

Physiology is semi-abstract but how it works is very real because people do it in everyday life, but in reality most students still have relatively difficulty understanding it. This physiology course requires students' ability to understand, connect and analyze the functions of each body system through metacognitive activities.[3]

Research results have shown that the final semester exam scores for physiology courses are still relatively low. The final semester exam results of Biology Education students at Brawijaya University for human physiology courses are still relatively low with an average score of 66.[4] Only 15% of students from the Nursing Professional Education Study Program Batch 16, Faculty of Medicine and Health Sciences, UIN Alauddin Makassar for the 2019-2020 academic year had good knowledge of physiology, while 45% were in the sufficient group and the other 40% were in the poor group.[5]

Data from the Gorontalo State University Academic System for 2022 has also shown the same thing, where Biomedical Science scores are still relatively low among students from the class of 2022, both in the Department of Public Health and in the Faculty of Medicine. The Department of Public Health with a total of 176 students showed an average score of B and there was only one student who got an almost perfect score (with an A-). The same thing was also found in students from the Faculty of Medicine, namely the physiology score in Biomedik 2 which showed that the average Physiology score of 59 students was 49.4 with the highest score being 72 and the lowest being 28. In Biomedicine 3 it showed the same thing. namely, the average value is 44, with the highest value being 69 and the lowest value being 25.

The low understanding of students in Biomedical Sciences, especially physiology, is

thought to be because human physiology courses are generally synonymous with learning using seminar methods and rote memorization, causing students to become bored quickly.[6] Biomedical Science books, especially physiology books, are usually very thick with a complicated writing style and content, making it difficult for students to understand them.[2]

The importance of physiology has triggered the emergence of several new methods to support students' understanding of biomedical science subjects, especially physiology. In the world of education, the role of technology is a new breakthrough that must be mastered to welcome the era of rapidly increasing globalization. In a study of the use of technology in the world of education in America, Alavi and Gallupe found that the use of technology can improve the quality of learning and teaching, reduce operational costs, and develop new products and service quality.[7] In responding to this, all elements of global governance, including Indonesia, are taking strategic steps in responding to the new era of education in order to guarantee and improve the quality of education, which must even be of higher quality than in previous times.[8] Health and Medical Education must also adapt to current conditions where digital-based technology continues to be developed. One breakthrough in technology-based physiology learning media is through applications *PhysioEx*®. Application *PhysioEx*® created with the hope of changing the method of learning physiology courses from difficult and boring to easy and fun.[9]

PhysioEx® is an application that provides sensation *learning by doing*, which offers laboratory experience *online* and allows students to practice in an environment that focuses on critical thinking and understanding. Through simulations, students can read an overview of the exercise, find the purpose of the laboratory, and undergo an introduction to the laboratory and laboratory equipment before diving into the virtual laboratory itself. Students can also take pre-lab and post-lab quizzes, do an overall review, and create a lab report. *Physioex*® is also an application that can be downloaded and installed on a laptop or computer easily.[9] Students can carry out laboratory and learning activities repeatedly according to their wishes, making it easier for them to learn and re-understand what they still don't understand.

PhysioEx® has the advantage of making it easier for students to carry out experiments that are difficult to carry out in a wet laboratory environment due to time, cost, or safety issues, and carrying out experiments without endangering live animals. In addition, the virtual laboratory presented by *PhysioEx*® Minimize the occurrence of equipment damage in wet laboratories.[9] However, so far there has been information about the effectiveness of learning methods using applications *PhysioEx*® This has not been widely publicized and is

rarely carried out among students, especially health students at Gorontalo State University.

This research aimed to identify effective learning methods for physiology courses at Gorontalo State University. It is hoped that the results of this research can provide a solution to overcome the low grades in human physiology courses, especially at Gorontalo State University.

Methods

This research was carried out at the Faculty of Medicine, Gorontalo State University, in October-November 2023. The type of research used was quantitative with a design.*experiment* with a plan *two groups pretest-posttest design*. The population in this study were students from the Faculty of Medicine and students from the Department of Public Health, first year student, namely class of 2023. There were 200 students from the Department of Public Health, and 69 students from the Faculty of Medicine, so the total population was 269 people. Sampling was carried out using the method *Simple Random Sampling*. Meanwhile, the number of samples was determined using the Slovin formula, and was obtained as many as 161 people.

The research variables consist of the dependent variable, namely the level of student understanding, the independent variable, namely the learning method, and the control variable, namely the duration of the material provided. The level of student understanding is how capable the student is of capturing and understanding the material being taught, and is assessed based on the results *Pretest* and *posttest* using Google forms. The pretest and posttest consist of 9 questions, in accordance with those available in the *PhysioEx*® application. Both groups were given the same questions and had 9 minutes to complete them. The data obtained was then carried out using univariate and bivariate tests *T-Test* with the SPSS application®. Learning methods are provided with two different methods, namely *e-learning* using the application *PhysioEx*® and conventional learning, namely using the lecture method.

Result

Table 1 shows that respondents from the control group (A) have the characteristics of 65 female respondents and 12 male respondents. Meanwhile, respondents from the treatment group (B), namely 16 male respondents and 62 female respondents. Most respondents in both groups were 18 years old.

Table 2 shows the analysis of the value results *pretest* and *posttest* in the control group

(A) and treatment group (B). in the control group (A) there was an increase in the average value before (*pretest*) and after (*posttest*) intervention was carried out on 77 respondents in the control group amounting to 15.0. The standard deviation value of 17.7 is higher than the average difference value. In the treatment group (B), from 78 respondents it was found that the minimum value obtained before the intervention was 0, and after the intervention it was 11.1. Meanwhile, the maximum value before the intervention was 77.8 and after the intervention it rose to 88.9. This shows an increase before and after the intervention in both groups.

Table 1. Characteristics of control and treatment group respondents

Characteristics	Control Group N = 77	%	Treatment Group N = 78	%	p value
Gender					
Male	12	15.6	16	20.5	0.475
Female	65	84.4	62	79.5	
Age (years)					
16	1	1.3	1	1.3	
17	7	9.1	5	6.4	0.777
18	53	68.8	56	71.8	
19	15	19.5	14	17.9	
20	1	1.3	2	2.6	

Chi-square test

Table 2. Analysis of results of *pretest-posttest* control and treatment group

Statistical Value	*Pretest*	*Posttest*
Control Group		
Mean	33.2	48.2
Median	33.3	44.4
Mode	33.3	33.3
Standard Deviation	16.4	17.3
Minimum	0	11.1
Maximum	88.9	100.0
Range	88.9	88.9
Treatment Group		
Mean	33.0	44.1
Median	33.3	44.4
Mode	44.4	55.6
Standard Deviation	16.9	18.3
Minimum	0	11.1
Maximum	77.8	88.9
Range	77.8	77.8

Based on Table 3, a comparison of values is obtained *pretest* and *posttest* control group and treatment group. For the control group (A), the average difference value before and after

intervention in the control group was -15.0, which means that on average there was an increase from *pretest* and *posttest*. Meanwhile, for the significance test value *paired sample t-test* namely 0.000. This shows that there is a significant difference between the average values before and after the intervention in the control group (*p-value*<0.05). In other words, learning using the lecture method influences the grades of UNG Medical and Public Health Students class of 2023.

Table 3. Comparison of values before and after intervention control group and treatment group

Group	*Pretest* (Mean ± SD)	*Postttest* (Mean ± SD)	Difference	*p-value*
Control (N = 77)	33.2 ± 16.4	48.2 ± 17.3	-15.0	0.000
Treatment(N = 78)	33.0 ± 17.0	44.2 ± 18.3	-11.1	0.000
Difference	0.2	4.0		
p-value	0.928	0.160		

The average difference between the treatment group (B) before and after the intervention was -11.1. This value indicates or gives meaning that on average there has been an increase in results *pretest-posttest* by using the test *paired sample t-test* with a significance value of 0.000 (*p-value*<0.05). In other words, learning by method *PhysioEx*® influence on the grades of UNG Medical and Public Health Students class of 2023.

Significance test results *independent sample t-test* shows a value of 0.928 which means that there is no significant difference between the average values *pretest* in the control group with the treatment group before the intervention (*p-value*>0.05). Meanwhile, the value of the significance test results is between values *posttest* control group and treatment group use *independent sample t-test* of 0.1. This shows that there is no significant difference between the average values *posttest* control group (A) with treatment group (B) after the intervention (*p-value*>0,05).

Discussion

Based on value data *pretest* control group, shows that the results *pretest* the control group was still relatively low, namely with a minimum value of 0 and a maximum value of 88.9. Reasons for low grades *pretest* can be caused by the respondent himself. Several factors that can influence include the respondent having never been exposed to physiology material before, the respondent's lack of interest and concentration in completing *pretest*, the respondent's inability to understand the questions, or due to low intellectual abilities. This is in line with research by Widayat, et al., the factor that influences student learning outcomes

is the student's initial abilities. Students who have good initial abilities have the potential to be able to think critically or think higher than those who have a low level of initial abilities, because they already have a good foundation for thinking.[10]

Minimum value of *posttest* in the control group, it was 11.11 and the maximum score reached a perfect score, namely 100. This shows that the lecture method is effective in increasing student understanding. This lecture method is a conventional method, or you could say it is a traditional method that has been used for a long time. Students feel more accustomed to receiving material using the lecture method, resulting in significant improvement.

The effectiveness of using this lecture method is thought to be influenced by the mentor who uses language that is simple and easy for respondents to understand so that it is easy for respondents to understand the material being taught. Sari stated that the lecture method is a method of delivering learning material orally and directly, participants are only required to see, hear and record important information from the teacher which is always considered correct among students and there is a psychological mechanism that allows them to reject and obtain information from the teacher.[4] A comfortable classroom and a learning process that is not too long can cause respondents to remain focused and comfortable in class. This is in line with Fatah et al. which states that the teaching and learning process, the use of simple language, and the atmosphere in learning also influence students' ability to understand the material being taught.[11] The research results have shown that there was a significant increase in learning outcomes before and after the intervention was given to the control group (A). This is in line with Nisa's research, which states that the level of respondents' understanding of learning material is said to increase if the results *posttest* which is greater than the average value*pretest*.[12]

Pretest results in the treatment group (B) was still relatively low with an average score of 33.0. This may be because health students still consider physiology to be a difficult subject to understand. This is in line with Miranto and Wardani who stated that many health students still have difficulty understanding human physiology due to the large amount of material that students have to study and memorize.[2] Other factors are thought to be the cause of the low scores *pretest* is the condition of the samples/respondents taken. The students who were used as respondents were the first year students who were still relatively new students and had never been taught physiology material before. Therefore, value *pretest* Low levels could also be because the sample has never been exposed to physiological material before.

Results of value analysis results *post-test* treatment group after exposure to the application *PhysioEx*® indicates the increased value of the results*pretest* average 33.04 to 44.15. This can provide an illustration of learning physiology using applications *PhysioEx*® can help students improve their understanding of physiology material. Students are presented with applications that require them to learn by doing. Apart from that, the animations displayed by the application *PhysioEx*® It is also clear and detailed, so that students can easily understand the material being taught. This is in line with research conducted by Moya-Salazar, application use *PhysioEx*® effective in learning physiology because this application uses simple language so it is easy to understand and also if students don't understand, they can try experiments or study repeatedly without limit until they understand the material.[9] But the results are value *posttest* shows that there are no samples/respondents who have received a perfect score in this study.

Several things may be the cause of the relatively short learning process, namely 45 minutes per material with a total of 2 (two) materials only 90 minutes. The researcher's assumption is that students still need more time to study. Learning methods use applications *PhysioEx*® which is still relatively new can also be the cause of the low value *posttest* respondents.[13] The assumption that students still consider physiology to be a difficult subject also influences the respondents' test results. This is in line with Tiraini's research, which proves that instilling the suggestion "Mathematics is easy" is effective in improving mathematics exam results.[14] Students who are used to using the lecture method during their learning from kindergarten to high school still need time to adapt to the application first. The optimal time for someone to understand true learning is 5 to 10 hours.[15] Meanwhile, this study only used 90 minutes, so it was still not enough to be able to understand 2 (two) learning materials at once.

Analysis results *pretest* and *posttest* in the treatment group (B) has shown that there is a significant average difference between before and after the intervention (*p-value*<0.05). In other words, learning using the application method *PhysioEx*® influence on the grades of 2023 UNG Faculty of Medicine and Public Health students.

Mark *pretest* control group (A) and treatment group (B) there is no significant difference as indicated by a value of 0.9 (*p-value*). Mark *pretest* which can still be said to be relatively low with an average of 33 also shows that both groups do not have adequate initial knowledge about physiology. In other words, both groups have the same initial knowledge.

Posttest results between the two groups has a relatively different average difference, namely 4.0. The control group (A) had a higher mean value compared to the mean value of

the treatment group (B), but the T-test result showed that the average value *posttest* between the control group (A) and the treatment group (B) there was no significant difference. Research results have shown that the use of applications *PhysioEx*® effective for use in studying physiology as shown by an increase in the average value *posttest*, but based on the criteria for determining learning completeness it is still in the poor category.

The habit of students who are more accustomed to learning using the lecture method, causes students to need time to adjust to new learning methods when changes are made to learning methods. The conventional method or lecture method remains the most effective method because students are often exposed to this method, so they are more accustomed to and more comfortable with the lecture method.[16] According to Fatah et al, social interaction has an effect on increasing students' understanding of the material being taught. An interactive mentor will certainly build greater social interaction compared to learning using applications.[6] This could have an effect on increasing respondents' understanding regarding the physiology material being taught.

The limitation in this research is the application *PhysioEx*® In use, it is only available in one language, namely English, so mentors need more time because they have to explain more than once. Apart from that, there were several respondents who filled in *pretest* and *posttest* more than once, and still need a companion.

Conclusion

Based on the research results, it was concluded that the two methods, both the lecture method and *PhysioEx*® significantly effective in learning physiology, there is no significant difference between the two methods. Suggestions from researchers, applications are expected *PhysioEx*® This can be used as a supporting application in learning physiology and still applies the lecture method, with the hope of increasing students' understanding of physiology.

Conflicts of Interest

Nothing to declare

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Nothing to declare

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