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Mia Nurkanti, Riandi and Desy Putri Angraeni



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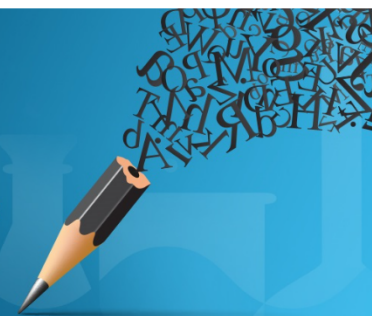


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The Improvement of Student's Learning Outcome on Human Respiratory System Using Visual Interactive Multimedia

Mia Nurkanti^{1, a)}, Riandi^{2, b)} and Desy Putri Angraeni^{2, c)}

¹*Universitas Pasundan, Jalan Tamansari No. 6-8 Bandung, Jawa Barat, Indonesia*

²*Universitas Pendidikan Indonesia Jalan Dr. Setiabudhi No. 229 Bandung, Jawa Barat, Indonesia*

^{a)}Corresponding author: mia.nurkanti@unpas.ac.id

^{b)}rian@upi.edu

^{c)}putridp46@gmail.com

Abstract. This research aimed at identifying the improvement of students' learning outcomes in three aspects, namely cognitive, effective, and psychomotor using visual interactive multimedia. The research was conducted in a private school in Bandung using an experimental method with pre-experimental design and one-group pretest-posttest design. The research subject consists of 20 high school students who were selected using purposive sampling. The instruments used were multiple choice questions to measure the learning outcomes in the cognitive aspect. Meanwhile, the instrument used to measure the learning outcomes in the affective and psychomotor aspects was an observation in which the suitability had been tested for the sample. On the cognitive aspect, the average score was 29.36 in the pre-test, 82.17 in the post-test, and 0.74 in the N-Gain test, which belonged to the high category. From these findings, it can be concluded that the use of visual interactive multimedia can improve students' learning outcomes on the human respiratory system topic.

INTRODUCTION

Biology is a subject that requires students to have adequate comprehension of the concepts and the abstractions on the subject. The difficult concepts and students' abstractions in describing the complicated and relatively complex materials often hinder the learning process. These problems have been accommodated by the government by constantly improving the curriculum. Fundamentally, the curriculum addresses the issue by simplifying the process of comprehending the concepts and abstractions. The 21st-century learning is an initial concept that can help teachers in overcoming learning problems.

The 21st-century learning that puts forward the scientific approach is a derivative of the curriculum that the government had developed. Scientific learning puts its emphasis on the learning approach consisting of observing, questioning, trying, reasoning, and communicating. A learning process with the scientific approach is a learning process carried out using scientific methods the likes of those used by scientists; it requires necessary skills including observing, questioning, gathering information from various sources, analyzing or processing information, and communicating to others [1].

To achieve good learning outcomes, teachers can manage the learning process using systematic and well-constructed lesson plan [2]. For instance, teachers can apply a scientific approach that allows students to be more active in the learning process. A scientific approach is a pedagogical approach that can be used in the learning process in the classroom [3].

Essentially, a learning process with the scientific approach is relatively difficult and requires learning media that can support the learning process, especially in biology subject. The right media can make the learning process in the classroom to be more innovative and interesting, thus making it easier for students to comprehend materials and concepts with complicated abstractions that need visualization [4]. In today's global era, teachers are expected to

educate and to provide students with the necessary skills and abilities to learn biology. These include innovative thinking, critical thinking, communication, collaboration, technological literacy, and leadership in biology learning processes [5]. It is important for biology teachers to have a thorough understanding about these learning demands in developing innovative learning so that the input obtained by the students is able to equip them in facing the challenges of the 21st century.

The majority of teachers nowadays are aware of the importance of technology in innovative learning while some teachers do not yet have the same awareness and are also reluctant to utilize technology in the learning process. Furthermore, teachers ideally have to start changing the thinking paradigm in the learning process; from deductive learning, which emphasizes giving materials or lectures, to a student-centered learning process [6].

One way to utilize technology in the learning process is by using visual interactive multimedia. Interactive media are a set of media with a control device that can be operated for specific processes [7]. In addition, visual media comprise of several groups, such as illustrations, photographs, diagrams, and mind maps that visualize concepts and materials with graphic representations. Therefore, it can be concluded that visual interactive multimedia are media that can be used to help students comprehend learning materials that include illustrations, diagrams, and charts [8].

In biology, the human respiratory system is one of the topics that many students are interested in. However, this topic also has quite many abstractions that might make it difficult for students to comprehend. Based on an interview conducted in a private school in Bandung City, many students found it difficult to comprehend the human respiratory system; only five out of 20 students (23%) were able to pass the minimum standard in the score criteria set by the school.

All things considered, a learning process was conducted using visual interactive multimedia on the topic of the human respiratory system to identify how the visual interactive multimedia improve the students' comprehension on the material in terms of their cognitive, affective, and psychomotor aspects.

EXPERIMENTAL DETAILS

This research was conducted using an experimental method with pre-experimental design [9]. This kind of method still has an external variable that affects the formation of the dependent variable. Therefore, the results of the experiment on the dependent variable are not merely affected by the independent variables. In addition, this condition can take place due to the absence of a control variable and the fact that the samples are selected at random [10].

The research was also conducted using a one-group pretest-posttest design. During the pre-test, one group was observed to identify the initial comprehension of the students on the respiratory system material. Afterwards, the treatment was given by the information obtained from the pre-test. Upon the completion of treatment, a post-test was conducted to which the results were compared with the pre-test results.

TABLE 1. Research Design

Group	Pre-Test	Treatment	Post-Test
A	01	X	02

Research Subject

The subjects of this research were the students in a Math and Science class in a private school in Bandung City, who were chosen to be in the experiment class. The samples were selected using purposive sampling due to several considerations of past researchers. Meanwhile, the research object was the improvement of the students' learning outcomes after using visual interactive multimedia in learning the human respiratory system in academic year 2017/2018.

Statistical Analysis

There were three instruments used to identify the improvement of the students' learning outcomes. For the cognitive aspect, the instrument used was a selected-response assessment (multiple choice) given in pre-test and post-test; for the affective aspect, the instrument used was a behavioural assessment; and for the psychomotor aspect, the instrument used was a performance assessment. The data obtained were analyzed using the Statistical Package for Social Science (SPSS) 24 for Windows.

RESULT AND DISCUSSION

The primary data of this research were obtained from a pre-test and a post-test for the cognitive aspect, a behavioural assessment for the affective aspect, and a performance assessment for the psychomotor aspect, which were all collected from the students' learning outcomes after using visual interactive multimedia in learning the human respiratory system.

The results of the analysis indicated that the students' learning outcomes in the cognitive aspect were unsatisfactory before the treatment; the average pre-test score from 20 students in the class was 29.36, with the lowest score of 15 and the highest score of 50. The scores were inadequate to pass the minimum standard in the score criteria, and this condition served as the basis of the treatment given in the learning process. After the treatment, the students' learning outcomes were significantly improved. This can be seen from the post-test scores; the average post-test score from the 20 students was 82.17, with the lowest score of 65 and the highest score of 95. Table 2 below shows the students' learning outcomes before and after the treatment.

TABLE 2. Students' Learning Outcomes Before and After Treatment

Score	Research Result Data	
	Pre-Test	Post-Test
N	21	21
\bar{X}	29.36	82.17
Max	50	95
Min	15	65

The pre-test and post-test scores that had been obtained were normally distributed because the $X^2_{Observe}$ was bigger than the X^2_{Table} . The following table further shows the normality test results based on the pre-test and post-test scores.

TABLE 3. Pre-Test and Post-Test Scores Normality Test Results

Result Data	N	\bar{X}	$X^2_{Observe}$	X^2_{Table}	Conclusion
Pre-Test	21	29.36	1.87	9.21	Normal Distribution
Post-Test	21	82.17	5.79	9.21	Normal Distribution

Based on the table above, the $X^2_{Observe}$ score from the pre-test and post-test was smaller than the X^2_{Table} score > 9.21 . Since the $X^2_{Observe}$ score was 1.87 on the pre-test and 5.79 on the post-test, it can be stated that the data were normally distributed. Furthermore, based on a homogeneity test to the pre-test and post-test scores of a population with the same variance, it was found that the homogeneity was > 2.12 with an $F_{Observe}$ of 1.002. Hence, it can be concluded that the population had the same variance or was homogeneous.

The results of the normality and homogeneity tests were used to test the hypothesis using the one-sample t-test. From the one-sample t-test, it was identified that the significance value (sig. 2 tailed) was $16.67 > 2.70$, which means that H_0 was rejected and H_2 was accepted. Other data that could strengthen the hypothesis testing result were the average N-gain index obtained, which was 0.74, which showed a high-level of learning outcomes. Therefore, according to the results of several aforementioned tests, it can be concluded that the learning outcomes on the human respiratory system topic using visual interactive multimedia were significantly and noticeably different in the cognitive aspect.

The average score of 82.17 on the cognitive aspect was in accordance with the hypothesis of "visual interactive multimedia can improve students' learning outcomes on human respiratory system topic" because the average score of the students had passed the minimum standard in the score criteria. One of the factors that caused the difference between the learning outcomes achieved in conventional learning and one equipped with visual interactive multimedia was the lack of teacher's ability to explore and use the information technology facilities available at the school or the ones they owned. The frequent use of the lecture method by teachers was also one of the factors that cause the learning material to be difficult to understand, monotonous, and not interesting for students. In addition, teachers also had not used learning media optimally due to the lack of media knowledge and limited learning resources [11]. By the previous teacher, this can also affect the student's learning outcomes. By using this interactive multimedia learning media here students have an important role in the learning because they are required to be active in existing learning activities.

According to] states that interactive multimedia is a multimedia display designed so that it looks to fulfil the function of informing the message and has interactivity with its users. This understanding refers to the ability of interactive multimedia to communicate with its users. The interface is designed so that users can get interactive information.

The success of the use of visual interactive multimedia in the human respiratory system topic is supported by [13], who states that the use of audiovisual technology was able to improve students' learning outcomes by up to 50% compared to not using audiovisual learning media. The use of visual interactive multimedia in learning was also able to increase students' retention and memory because the use of more senses and the availability of pictures during the learning process could add to the learning experience of students [14]. Visual interactive multimedia was able to cause distinct phenomena and processes clearly because they were able to simulate complex contents and materials and also to present various levels of abstractions [8].

Based on the results of data analysis, the use of interactive visual multimedia was able to improve the students' learning outcomes as a whole, especially in terms of the cognitive aspect. This was supported by the results from the questionnaire, which indicated that the students felt that visual interactive multimedia was excellent to be used in biology subject.

SUMMARY

Based on the data obtained, it can be concluded that visual interactive multimedia were able to improve students' learning outcomes in human respiratory system material. It was proved by the average value of N-Gain obtained, namely 0.74 (moderate) on the cognitive aspect and 82.17 (good) on the affective aspect. Therefore, interactive visual multimedia can be used by teachers to improve student learning outcomes effectively.

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