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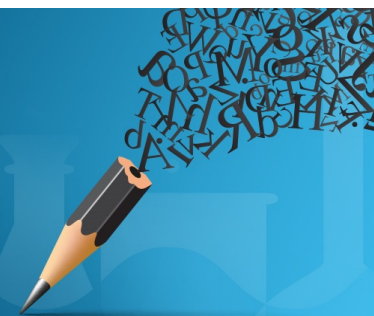


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Use of Video Modeling Examples to Improve Understanding of the Concept of Recombinant DNA Technology for Biology Teacher Candidates

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Abstract. Biotechnology is an essential subjects matter in Biology Education. The material is deep discussed about the application of Biology in daily life and the phenomenon of problems in society such as DNA testing, GMO food, health biotechnology and others. As a provision for science for prospective Biology Teachers, Biotechnology is still considered difficult to understand for students of the subject because it seems abstract, not real and imaginative. One of the elusive material is Recombinant DNA Technology. This study aims to determine the effect of using Video Modeling Examples on the mastery of the concept of recombinant DNA technology in the Biotechnology Course. The method used in this study was quasi-experimental with the design of the pre-test posttest with as many as 50 prospective teacher students. The process of conducting the research was carried out in the first way the students were given pre-tests by answering several questions regarding recombinant DNA technology; then students looked at recombinant DNA technology videos through the explanation of a model in the video. After that, the students answer the post-test. The results obtained showed that the use of video modelling examples could significantly improve the mastery of the concept of recombinant DNA technology for prospective Biology teacher students.

INTRODUCTION

Use of video modelling examples to enhance understanding of the concept of recombinant DNA technology in Biotechnology courses for prospective Biology teacher students. Biotechnology is one of the important subjects taught in the Biology Education Study program because in the Biotechnology material a lot is discussed about the application of Biology in daily life and the phenomenon of problems in society such as DNA testing, GMO food, health biotechnology and others. As a provision for science for prospective Biology teachers, Biotechnology is still considered difficult to understand for students of the subject. This is because biotechnology teaches many things that seem abstract, not real and imaginative. One of the abstract material is Recombinant DNA Technology.

The research result of Purwianingsih *et al.* [1] showed that teachers generally did not understand in depth the knowledge bases needed to explain biotechnology material. In the connection on finding appropriate learning methods, it also tricky to obtain adequate sources of teaching materials, especially teaching materials that are up to date, and constraints English language skills, as a provision for learning the sources of Biotechnology teaching materials. This is a challenge for teachers to make the subject interesting and easy to understand. The teacher's inaccuracy in choosing and packaging the subject matter can cause difficulties and cause cognitive load for learners known as extrinsic cognitive load. For this reason, it is necessary to think seriously about pedagogical norms in the form of strategies that include methods, techniques, and media that will be used in learning. This pedagogical norm will lead to the selection of teaching materials and methods for the benefit of learning. One learning approach that can accommodate the

difficulties of learning material content but can reduce students' cognitive burdens is Examples Based Learning (EBL). Video modelling examples is one of the lessons included in Examples Based

Learning of Kant [2] suggest that sample-based learning provides step-by-step solutions carried out by experts before solving problems. Learning examples in solving problems can help students build problem-solving schemes and can overcome their cognitive burdens. Modelling examples is a display or display that is guided by someone or an animation agent who in detail presents procedures for solving certain problems through personally, film, as a screenshot or animation [3]. Furthermore, learning by observing others directly ("modelling"), the shows used in this study were video broadcasts.

The goal of this study to determine the effect of using Video Modeling Examples on the mastery of the concept of recombinant DNA technology in the Biotechnology Course. The method used in this study was a quasi-experimental design with a pre-test and test post. The results of this study indicate that the use of video modelling examples can improve the mastery of the concept of recombinant DNA technology for Biology teacher prospective students in Biotechnology courses.

Recombinant DNA technology is one of the materials taught in Biotechnology subjects. In recombinant DNA technology studied the stages in making recombinant DNA, what tools and materials needed in recombinant technology such as plasmids, endonuclease restriction enzymes, ligase enzymes, primers, desired DNA, and propagation in host cells. Also, it also studied the application, benefits and uses as well as the disadvantages and advantages of Recombinant DNA.

EXPERIMENTAL DETAILS

This research was conducted in one of the Biology Education Study Programs in Bandung, Indonesia, where Biology teacher candidates educated. A total of 50 students in semester VI (the average age of 21 years old students) who take Biotechnology courses were involved in this study. The method used in this study was a quasi-experimental design with a pre-test and test post [4-5]. Broadly speaking, the process of conducting research was carried out through several steps, namely: students were given a pretest, they had to answer a number of questions related to Recombinant DNA Technology material, then students were given the opportunity to search for and download videos about Recombinant DNA technology from Chanel Youtube where the video must guide him whether it's a guide to the human model or an animation agent. After that, they answered several questions in the post-test.

The pre-test and post-test data obtained were then examined and analyzed using SPSS. The first step of the data obtained was tested for normality. Tests were carried out using the Shapiro-Wilk test on SPSS 17.0 for Windows [6].

RESULT AND DISCUSSION

The results of the T / t-test analysis were conducted to evaluate whether there was an increase in the ability of students after treatment with learning using example modelling videos. The statistical results showed that there was a significant increase in scores from the pretest (M = 26.74, SD = 14.45) to the post-test (M = 65.86, SD = 9.575), $t = 19,034$, $p < 0.001$. the Chi-square statistic shows that this increase has a very large effect size (0.88.)

TABLE 1. Paired Samples Test

	Mean	Std. Deviation	Paired Differences		t	df	Sig. (2-tailed)	
			Std. Error Mean	95% Confidence Interval of the Difference				
				Lower				Upper
Pair 1	PRE_TEST - POST_TEST	-39.120	14.533	2.055	-43.250 -34.990	-19.034	49	.000

The results of the data analysis showed that the use of video modelling examples could significantly improve the mastery of the concept of recombinant DNA technology for Biology teacher candidates. This is in line with several studies that have been conducted, including among them. [7] using worked examples as an additional for conventional problem-solving in algebra class. [8] suggests they are best used in the sequence of examples for models of problems to promote understanding in skill acquisition, "encourage, and help the training system used to facilitate learners. Chan [2] suggests an effective example including, in stages, for example, three stages and between these stages, there are clear links and relationships so that students do not connect themselves. [9] also revealed that many examples were

developed in medical learning. Other studies revealed that learning with video modelling examples can improve students' scientific reasoning abilities when given before inquiry assignments [2]. Research of [10] also reveals that video modelling examples effectively enhance learning how to solve electrical circuit problems and use more mature models. Effective compared to the Peer model. Research of [11] also revealed that worked examples and modelling examples effectively improved learning, close transfer, reduced cognitive burden and increased competence. [3] in learning electrical circuits revealed that Learning that uses many worked examples is more effective and efficient than learning that only relies on problem-solving.

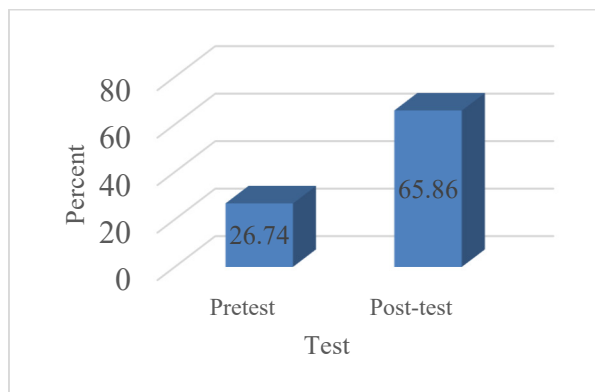


FIGURE 1. The comparison between pretest and post-test

From the results of data analysis, the average pre-test value was 26.74, while the post-test average value was 65.86. The N value of gain is 0.88. Include in a high category. The N-Gain index criteria can be seen in Table 2.

TABLE 2. INDEX Criteria N-Gains

G	Information
$g > 0,7$	High
$0,3 < g < 0,7$	Middle
$g < 0,3$	Low

SUMMARY

Biotechnology is still considered difficult to understand for students of the subject. This is because biotechnology teaches many things that seem abstract, not real and imaginative. One of the elusive material is Recombinant DNA Technology. One learning approach that can accommodate the difficulties of learning material content but can reduce students' cognitive burdens is Examples Based Learning (EBL). Video modelling examples are one of the lessons included in example-based learning (Examples Based Learning. In this study the results of statistical analysis show that there is a significant increase in scores from the pretest ($M = 26.74$, $SD = 14.45$) to the post-test ($M = 65.86$, $SD = 9.575$), $t = 19.034$, $p < 0.001$ The chi-square statistic shows that this increase has a very large effect size (0.88). The results show that the use of video modelling examples can improve mastery of the concept of DNA Technology Recombinant Biology teacher prospective students Significantly.

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