The utilization of video animation media for improving students’ understanding of biotechnology subject on lipase enzyme production through genetic engineering technique

B R N Furqan1*, I S Yamin2, E N Qomaliyah3

1Departemen Pengajaran Kimia, Institut Teknologi Bandung, Jl. Ganesha No.10, Lb. Siliwangi, Kecamatan Coblong, Kota Bandung, 40132, Indonesia
2Departemen Epidemiologi, Universitas Indonesia, Jl. Margonda Raya, PondokCina, Kecamatan Beji, Depok, 16424, Indonesia
3Departemen Biokimia, Institut Pertanian Bogor, Jl. Tanjung, Kampus IPB Dramaga, Bogor, 16680, Indonesia

*Corresponding author: refika.nf007@gmail.com

Abstract. Abstract. The introduction of Biotechnology subject started in SMP (9) and deepen in SMA (12). One of the topics on modern biotechnology products is Genetic Engineering technique to produce lipase enzymes. SMA student knowledge on this topics are still limited since the source of information used by teacher on learning process is generally based on the textbook and delivered through lecturing method. The use of learning media with virtual-technology based is expected to provide an illustration of information that make easier and more attractive to understand. In this study, two mediums were evaluated, including textual and video animation media. To test the superiority of video animation media, the test is carried out to SMA students in Lombok, by using same questions about student understanding level between video animation and textual media. The evaluation shows that video animation improve the average outcomes, informative, attractive, and easy to understand. This feasibility tests carried out by Biology teachers and student’s responses. Therefore, video animation media can be used as Biotechnology learning media.

1. Introduction

The introduction of Biotechnology material is studied in 9th-grade junior high school and its deepening in 12th-grade high school [1][2]. The chapter of biotechnology that quite difficult to deliver is Genetic Engineering techniques (recombinant techniques) [3], one of the topics is how to produce lipase enzymes. The knowledge of high school students about this topic was low because the source of information used by the teacher to explain generally only comes from the textbook and is delivered by the lecture method [4].

The subject matter conducted by following conditions and current technological developments are digital teaching materials because nowadays many studies produce the effectiveness of digital material than textbooks in the learning process [5][6]. One type of digital material is animated videos. The existence of learning media based on visual technology is expected to help in describing information so that the learning process is easier to understand and more interesting [7][8].
Preliminary analysis of learning materials is needed in the Lombok island area (based on surveys of several schools) shows that: a) although not all schools have adequate learning facilities, almost all of students have gadgets and internet data, b) student have difficulties in learning through text, therefore student need a visualization to enhance understanding the concept recombinant technique.

Therefore the animated videos and its validation as teaching materials related to recombinant engineering material are very necessary [9]. This study aims to validate the learning media in the form of animation video related to recombinant engineering material and its application to produce lipase enzymes for high school students, which is validated through feasibility tests by Biology teachers, and through scores and responses from student questionnaires after video animation learning process.

2. Experimental Method

Qualitative validation is used in the validation process of the feasibility of animation video teaching media about recombinant techniques and production of lipase enzyme materials for high school 12th-grade. Data collection techniques in the form of questionnaires with the type of choice. Data analysis is in the form of descriptive data from assessment data on the feasibility of instructional media products by teachers and students and feedback understand by students. This study carried out in January 2009.

This research was conducted by evaluating two media; textual and animated videos. In both of these materials, each general information is presented about the production of lipase enzymes through recombinant techniques. To test the advantages of animated video media on delivering the material, tests were conducted on two groups of students from high school in Lombok using google form media. Both groups were given the same questions to test students' understanding. One group learned by using animated video (https://bit.ly/LipaseAnimasi) and the other group learned by using textural (https://bit.ly/LipaseTeks). Beside questions related to the material, students were also given questions to find out the feasibility of animated videos [10]. Furthermore, feasibility of animated videos was conducted through questionnaires to biology teachers (http://bit.ly/UjiValiditas) in several schools in Lombok [11].

Animation video validation data on testing students' understanding was analysed by descriptive qualitative method. The data obtained were calculated by using the formula, are as follows:

\[
\text{Percentage(\%)} = \left( \frac{\text{number of students who answered correctly}}{\text{total number of students}} \right) \times 100\%
\]

The same thing for testing students' responses, the percentage was calculated using the formula

\[
\text{Percentage(\%)} = \left( \frac{\text{number of students who answer yes or agree}}{\text{total number of students}} \right) \times 100\%
\]

For the validity test results and the feasibility of animated videos by Biology teachers were calculated using the formula

\[
\text{Percentage(\%)} = \left( \frac{\text{total score}}{\text{maximum score}} \right) \times 100\%
\]

3. Result and Discussion

Based on the results of the google form data collection, 100 students and 25 Biology teachers were assigned as respondents. The results of the animated video validation of students' understanding about recombinant engineering and its application to produce lipase enzyme is presented in the figure below.

From Figure 1, it can be seen that the percentage of students who answered correctly is higher in the group of student that learning by animated videos compared to the group of student that learning by text media, this result shows that students are far more able understanding the material by using animated video [12]
Furthermore, on google form there are also some questions related to student response questionnaires whose results can be seen in the presentation below. In addition, questions on student response questionnaires can be seen in the pictures below.

**Figure 1.** Graph of percentage comparison of student test results who answer correctly using text and videos animation

**Figure 2.** Graph of the percentage of student approval of the question whether the text/video provides additional information

**Figure 3.** Graph of percentage of student approval of the question of whether the information in text/video can be easily understood
From graphics 2, 3 and 4, the results show that students learning using animated video express a higher percentage of agreement. The question of whether the text or video media provides additional information. But the text media there are still students who express their disapproval, while in the animated videos doesn't exist. In the question of whether the information in the text or video is interestingly conveyed, the results show that the agreement is given by all students in the video animation media while in the text media only a few students. So that, it could be said that the use of instructional media through animated videos improves the achievement of average scores, make the learning process more informative, attractive and easy to understand than the textual or lecturing learning [13][14].

Validity testing by Biology teachers with video eligibility criteria based on the content of the material and visualization of the media is presented in the table below.

**Table 1. Results of feasibility tests by Biology teachers on videos animation**

| Aspect                  | Percentage (%) | Keterangan   |
|-------------------------|----------------|--------------|
| Material                | 89             | Very decent  |
| media visualization     | 86             | Very decent  |
| Average                 | 87.5           | Very valid   |

Based on the table above, it shown that animated videos are made very feasible and valid to be used as learning media for recombinant engineering materials and their application in the production of lipase enzymes, with an average percent of 87.5%, where video animation is considered to be very feasible and valid if it has a percentage on average ≥ 80% [15][16].

**4. Conclusion**

The video animation media about recombinant engineering and its application to produce lipase enzyme in this study based on the validation of Biology teacher is very feasible and valid. The results of evaluations on high school students in the Lombok region, animated videos can improve the achievement of average scores, make the learning process more informative, attractive and easy to understood. Therefore, the video animation of recombinant engineering and its application to produce lipase enzyme in sub-chapte of Biotechnology material is declared valid and feasible.

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References

[1] Brenton H, Hernandez J, Bello F, Strutton P, Purkayastha S, Firth T and Darzi A 2007 *Comput. Educ.* **49** 32
[2] Hwang I, Tam M, Lam S L, and Lam P 2012 *Electron, J. E-Learn* **10** 368
[3] Paik E S 2010 *J. Educ. Psychol.* **105** 278
[4] Bradley J S 2014 *Cell Biol Educ J.* **3** 181
[5] Danton H O D 2007 *Life Sci. Educ. J.* **6** 217
[6] Nurizmawati C, Apriliaswati R, and Arifin Z 2015 *J. Educ. Teach.* **4** 1
[7] Yusuf M M, Amin M, and Nugrahaningsih N 2017 *J. Pendidik. Biol. Indonesia.* **3** 254
[8] Ainsworth S 2013 *Learn. Instr.* **3** 37
[9] Anjarwati D, Winarno A, and Churiyah M 2016 *J. Res. Method Educ.* **6** 1
[10] Ismail M E, Irwan M I, Othman H, Amiruddin M H and Ariffin A 2017 *IOP Conf. Ser.: Mater. Sci. Eng.* **203** 1
[11] Cardoso D C, Cristiano M P and Arent C O 2009 *J. Biol. Sci.* **9** 1
[12] Baglama B, Yucesoy Y and Yikmis A 2018 *TEM J.* **7** 670
[13] Liu, C and Elms, P 2019 *ALT J.* **27** 1
[14] Ay Y, Karadag E, and Acat M B 2015 *Comput. Educ. J.* **88** 97
[15] Ruiz J G, Cook D A, and Levinson A J 2009 *Med. Educ. J.* **43** 838
[16] Brinkley-Etzkorn K E 2018 *Internet High. Educ.* **38** 28