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The effectiveness of the printed books as a learning material in a one-day the molecular biology course

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ABSTRACT

The purpose of this research was to determine the effectiveness of the enrichment book of Conservation Biology Lecture based on normalized gain assessment. The assessment of a lecture can be carried out in the learning process for one. Normalized gain on a class average can be used to make learning assessments. In this assessment, it is expected that the effectiveness of using books as learning media can be achieved by using the normalized gain values. The learning media in this research were printed enrichment books on molecular biology lecture. In this research, it was found that the average score of normalized gain (g) was 0.37 ± 0.03 (moderate). Thus, the results of the assessment show that the book media as a medium for learning material enrichment in the molecular biology lecture is quite effective.

INTRODUCTION

The success of a learning process is affected by various factors or components. One of the important components in learning is the learning material. The learning material consists of various forms. One form of learning material is the learning media. Media is an important and indispensable component in the success of a learning or instructional system design (Kozma, 1994, Reiser, 2001; Ristanto, 2010; Ichsan, et al., 2017).

Learning media can be realized in various forms. Books are one form of learning media which are commonly used in learning. The role of books in learning is not only as a source of learning but also as learning media. One of the printed media used in the learning process is textbooks, enrichment

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books, and other learning resources. Books and other learning resources are media that can enrich the learning process (Unesco, 2014).

Books as learning media can make the learning process more effective. Media can be interpreted as a means to convey the learning process, and media can play more role than just a means. The media itself is defined as technology, symbol systems, and processing capabilities (Kozma, 1991). Media is also defined as anything that has meaning or communication functions. Media in learning can be realized in all forms or formats including symbol systems, such as printed material, graphics, animation, audio, and moving images. Media is a symbol system for educators and students in representing their knowledge (Reeve, 1998; Ristanto, 2011).

Books have several characteristics, such as having a symbol system in the form of text and images. The main symbol system in books consists of orthographic symbols which are generally more stable and recognized by users (Komza, 1991). The orthographic symbol system in this book concerns with the characteristics of writing in printed media, such as spelling, spacing, capital letters, and so on.

The cognitive effect on the use of this media in general is usually not direct in the learning process, although technology will be able to provide direct influence. Media can also modify and improve the dynamic aspects of the model of students or learners. This is related to "*zone of proximal development*" which can affect students' cognitive processes (Vygotsky, 1978).

The book itself can be in the form of textbooks or enrichment books or supporting books. Textbooks and enrichment books have an important role in the success of learning processes and learning results. In the learning process, books can support students' learning activities as learning media or as learning sources. The existence of books in class learning activities can help increase students' concept gaining in understanding a concept and other competencies. Printed books in learning can improve students' literacy skills. The research on the use of biology textbooks in learning showed an increase in the learning process (Luckie et al., 2017).

The existence of printed books in learning is still considered important by students, although many online boooks *(*ebook*)* have been available (Eveland & Dunwoody, 2001; Jeong, 2012). The use of printed books in learning can also improve learning results (Robinson et al., 2014). The books which are commonly used in the learning process at university level are textbooks and enrichment books. The enrichment books are very important to increase students' understanding of the various concepts in the textbook.

In this research, a try out on the use of printed version of enrichment books on molecular biology lecture was carried out. The Biology molecular lecture is one of the subjects often considered difficult by students, especially in the application of biology molecular concepts, such as in the study of genetic populations, biosystematics and others. On the other hand, the enrichment books which use Indonesian language on that particular subject are still limited in numbers.

The enrichment books on the Biology molecular subject using Indonesian Language is still relatively limited in numbers, so that it is essential to develop this book. This biology molecular enrichment book describes and explains the concepts of genetic conservation and populations. The book also discusses about the material which encourages the data processing skill of Biology molecular and its application on the study of genetic population and conservation.

The book used in this research was an enrichment book containing the study on genetic population and conservation using molecular markers of mitochondrial DNA sequencing. The marker genes were *cytochrome c oxidase* 1. The use of this book is expected to strengthen students' understanding and enrich their knowledge about the use of mitochondrial DNA sequencing (CO1 gene) in the study of genetic population and conservation.

METHOD

This research aimed at measuring the effectiveness of enrichment printed books as a learning material in the Biology Molecular learning. The measurement used normalized gain averaga value.

The samples of this research were 24 students. The data were analyzed by using the Normalized gain (g) value (Hake, 1998; Bao; 2007; Colt et al., 2011). The results of the normalized gain were classified into several categories, namely the score or g > 0.70 (high), 0.30≤g <0.70 (moderate), g <0.3 (low) (Hake, 1998).

RESULTS AND DISCUSSION

In this research, a learning process on Biology molecular lecture was carried out by using printed enrichment books on genetic population and conservation. The learning process was used as a way to measure the effectiveness of learning material in the form of the books. This research was analyzed using descriptiptive analysis. The mean pre-test score of the respondents in this research was 44.77 ± 1.38 and the mean post-test score was 66.82 ± 1.42. The description of the data in this research is presented in table 1.

Table. 1. Description of the *pre-test* and *post- test* data

Pre-Test		***Post test***	
Mean	44.77	Mean	66.82
Standard Error	1.38	Standard Error	1.42
Median	42.5	Median	70
Mode	40	Mode	70
Standard Deviation	6.45	*Standard Deviation*	6.65
Sample Variance	41.61	Sample Variance	44.16
Range	20	Range	25
Minimum	35	Minimum	50
Maximum	55	Maximum	75
Number of samples (N)	22	Number of Samples (N)	22
Highest score	55	Highest score	75
Lowest score	35	Lowest score	50
Confidence Level (95.0%)	2,860115332	*Confidence Level* (95.0%)	2,946221915

In this research, the change of learning process had been tested to measure the effectiveness of enrichment book media by using the normalized gain (g) value. The g value was obtained from 24 respondents based on the results of students' pre-test and post-test scores in the Biology molecular subject. The results of the average value of normalized gain of the class in this research was 0.37 with a standard error value 0.13 and standard error 0.03. The normalized gain score in this research was 0.37 and included in the medium category. The pre-test and post-test scores of the respondents are presented in Figure 1.

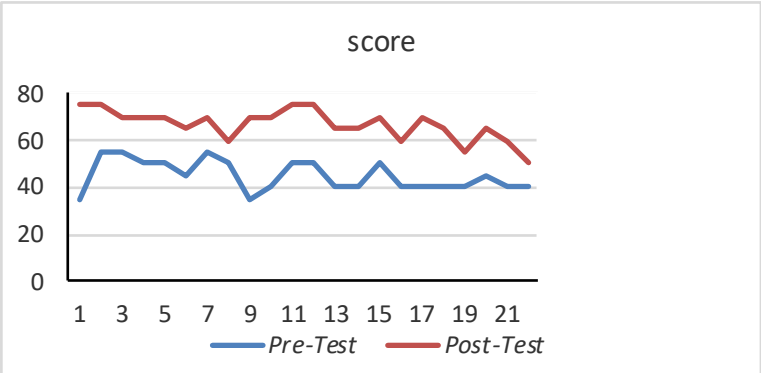

Figure 1. The pre-test and post-test scores.

The normalized gain score illustrates that the learning process is quite effective. The effectiveness of this learning process is certainly influenced by many aspects. The learning process is a multidimensional process so that it can be said a person's learning process towards learning results. One important aspect of the effectiveness of learning is the use of learning media. Learning media functions as a learning material, and it has an important role in the success of the learning process.

In this research, printed books were used as the learning media at university levels. Printed books are selected as learning media in the learning in universities because printed books have several advantages in improving the learning process. Several research results show that printed books have a certain role in the success of the learning process (Jeung, 2012). In this research, enrichment book media are indicated to play a role in improving students' understanding in the learning process of Biology molecular subject.

The effectiveness of this media was tested using normalized gain analysis and descriptive statistics. In this research, the students' mean score showed an increase between the pre-test and post-test. The increase in the mean score from the pre-test to the post-test is relatively good so that the qualitative approach and the descriptive statistic approach found that the book media had a role in increasing students' understanding of the use of molecular markers of mitochondrial DNA sequencing.

In this study, there was an increase in students' understanding of Biology Molecular. This can be seen from the value of the normalized gain. The value of normalized gain is one of the methods to measure the increase or the effectiveness of the learning process based on the pre-test and the post-test scores. The students' mean score was 44.77 ± 1.38. This mean score is categorized as low in the understanding or cognitive measurements on the aspects of genetic population concepts and their knowledge of molecular markers of mitochondrial DNA sequencing.

The mean score of the students' *post-test* was higher than that of the pre-test, which was 66.82 ± 1.42. This increase indicated an increase in the students' understanding of the use of enrichment book media in learning Biology molecular, although this increase was certainly influenced by many factors.

At the beginning of this research, the mean score of the students' pre-test was included in the low category. This condition indicates that students generally did not understand the use of molecular markers for mitochondrial DNA sequencing and their applications. The assessment results of the students' pre-test answers generally have not been able to describe DNA mitochondria and its application in the genetic population study. The use of various molecular markers in conservation studies and genetic populations is still not widely understood by students. Population and genetic conservation studies are not yet taught in special courses, so students also have very low knowledge of these concepts.

In this research, the enrichment book media in the Biology molecular subject contains concepts about DNA mitochondria and its application in genetic population studies. In several chapters, conservation concepts with a genetic approach are also discussed, so that the book is considered to have a role in improving students' understanding of the concepts of conservation and genetic populations using molecular markers of mitochondrial DNA sequencing.

The use of this enrichment book media shows an effective role in the learning process. Media is one of the important aspects in the classical learning process in the classroom. A media should be able to help increase students' level of understanding in the learning process. The selection of media is also very important in supporting the success of the learning process (Kozma, 1994b).

In this research, the book media used in the learning process was printed media. One of the media that has superior characteristics is printed books. Printed book media is quite effective in improving the learning process (Robinson et al., 2014; Luckie et al., 2017). Printed media is known to be effective in the learning process. The graphics characteristics of printed books can facilitate students in understanding a concept. The characteristics of printed books, orthographics and not causing eye fatigue, make printed books effective in helping students understand concepts (Jeung,

2012). The aspects of graphic characteristics are also very important in the use of printed media in the learning process.

The printed book media is commonly used in the learning process, and this media is also known to be effective in improving the learning process. Printed media can encourage students to be active in the learning process, so that active student-centered learning can be optimal. Printed media encourages students to read in situations that are more comfortable in the eyes and easy to use.

Printed media has graphic characters that do not make eyes not tired quickly. The aspect of the eye fatigue is very important in the use of learning media, especially book media. Research results comparing the use of printed books and online books (ebook) show that printed books are more eye-friendly than online books (Jeung, 2012). This print graphic character also helps students understand the learning material. Graphic characters in the printed book media, both in the form of writing (letters) and pictures, can make it easier for students to understand the learning material. Therefore, the printed book media is still very much needed in the learning process.

In this research, media is not specifically seen as having a role in the learning process, because learning process is multidimensional. The role of other aspects of learning in this research is certainly not measured, but the aspect of printed book media cannot be ignored as a contributing factor in the learning process. The role of the media is assumed to have a significant contribution in improving the learning process. Both acknowledged the instructional methods and the delivery medium must be aligned to facilitate learning (Hasting & Tracey, 2005).

The measurement using the normalized gain score can describe the changes or improvements in the learning process. The use of this measurement is expected to describe the increase in students' understanding through the use of learning media. The use of learning media is an essential aspect in the learning process in the field of biology and others.

CONCLUSION

In this research, the measurement of the effectiveness of printed text media used the average score of *normalized gain.* The *normalized gain* score was included in the medium category. Thus, the use of printed enrichment books on Biology molecular subject is considered to effective in achieving success in the learning process.

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