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IMPROVING STUDENT'S MOTIVATION AND LEARNING OUTCOMES THROUGH GENETICS E-MODULE

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Abstract

The purpose of this study was to know the impact of the Genetics E-module to improve students' motivation and learning outcomes during the learning process. The method applied was Research and Development (R&D), limited until the implementation stage, using the quasi-experiment method with one group pretest-posttest. The motivation instruments were modified questionnaire by Keller with ARCS model, consist of 4 aspects including attention, relevance, confidence, and satisfaction. The population were all of the students from class of 2017 in Biology Education department, Tribhuwana Tungadewi State University. The pretest was held to know students' motivation and learning outcomes when using a handout from the lecturer, while the posttest was to know students' motivation and learning outcomes when using Genetics E-module. Data were collected from the motivation questionnaire and test. After using E-module, there were 27 students with high ($71,91 \leq x < 86$), 18 students with medium ($57,82 \leq x < 71,91$) and 5 students with low criterion ($43,74 \geq x$) of motivation, and there were 58% students who passed the grade in Genetics test. Based on the data analysis, E-module was feasible to be used to improve students' motivation and also learning outcomes in the Biology Education department.

Keywords: Affective, Genetics, Learning, Module, Motivation.



A. Introduction

Biological topics can be difficult for students to learn; one of those is genetics topics. It is because most of the concepts included complicated structure, process, and mechanisms that cause students confusion, especially similar genetics concepts like the differences between mitosis and meiosis (Bahar, *et al*, 1999; Cimer, 2012; Duncan & Reiser, 2007; Schunk, *et al*, 2012). These difficulties trying to be overcome through lecturers' handouts for students, but it didn't go well. It is because the use of handouts previously couldn't cope with the difficult material in genetics so students like to avoid difficulties.

The students also show disinterest because the handout only provided pictures from literature in black and white. This, of course, has negative effects, and also students more like to learning materials that provided by the lecturer, rather than learning new material on its own, it makes students become passive learners. They think the handouts are complete because they came from the lecturer, so when the lecturer gives different questions from the handout, students prefer to copied answers from others (Tekkaya, *et al*, 2001). This condition also affects student outcomes, by looking at an average value of Genetics quizzes that keep decreased from 46,79 to 38,89.

Experiencing these difficulties, of course, can affect students' motivation (Etobro & Fabinu, 2017), whereas motivation is an important factor in the learning process because it encourages and maintaining certain activities to complete the learning process and improve students' outcomes (Schunk, *et all*, 2012; Mitchell, 1993). There are two types of motivation: (1) Intrinsic motivation, which arises from within. It's generated interest and satisfaction, later stimulate students to make an effort and learning in different ways; and (2) Extrinsic motivation, usually stimulate from the outside by certain environment or rewards. More refers to students' behavior when wanting something, this motivation usually improves if there are any appreciations.



However, in the learning process, lecturers usually have no control over intrinsic motivation, but can create a learning environment to engage extrinsic motivation, then generate intrinsic motivation by stimulating the personal interest of students. According to the theory of Keller (2009), there are four indicators to engaged students' motivation that are called *ARCS Model*. It stands for Attention (A); Relevance (R); Confidence (C), and Satisfaction (S), and usually, students who can fulfill all those indicators will have high motivation and tend to be ready, make the classes more fun, do hard work, and also solve various difficulties, which then leads to a better performance in learning (Wieman, 2013).

For these problems, there must be efforts to improve students' motivation and outcomes in learning genetics. One solution that is deemed appropriate to do it is to replace the use of handout to e-module that can cope all of those students' difficulties. the development of the e-module it because in higher education, lecturer need to create a multimedia environment that must be interactive, repetitious, self-paced, and customizable (Arkoful & Leidner, 2001; Liaw, *et al*, 2007).

Genetics E-module can provide all of those things to make an effective learning environment. It also can cope with all of the motivation indicators, by providing so many interactive elements with a colorful illustration based on real objects and events in students surrounding, and also it can be used anytime because it's mobile so the genetics material can be easy to understanding. Based on the problems mentioned above, the study was conducted to improving student's motivation and learning outcomes as the impact of the implementation of genetics.

B. Method

The study is Research and Development (R&D), using ADDIE from Dick and Carey stands to Analysis, Design, Development and limited to Implementation. From the discovery about products that need to be developed, then it is required a product design, test validity of product by experts, and testing stage to prove the supremacy of product that will be



discussed more in this research. By using the **7** quasi-experiment method with one group pretest-posttest design, the populations are 50 students from the class of 2017 in the Biology Education department in Tribhuwana Tungadewi State University. The sample is all of those 50 students because it's the first batch of 2017 who taken Genetics Class. The form of product development is the Genetics e-module that is given to determine its effect on students' motivation and learning outcomes, when previously only using handouts made by lecturers. As the additional data, students' motivation will be correlated with students' learning outcomes.

C. Result and Discussion

1. Result

Steps with ADDIE which was limited until implementation was done in the Biology Education department, Tribhuwana Tungadewi State University. In the Analyzed stage, the problem has identified that there is a limitation of the use of handouts especially in explaining the difficult concept in Genetics. Design stage, related to the framework on improving handout to electronic use, which is Genetics E-module. Development stage using the validity from the expert judgment in material and media aspect. In material, the eligibility of content score is 4,00; the feasibility of presentation is 3,80 and the feasibility of legibility is 3,82 means that all the material aspect is proper to be used. In media, the feasibility of graphics score is 4,25 and in media and content aspect is 3,89 means that all the media aspect is proper to be used.

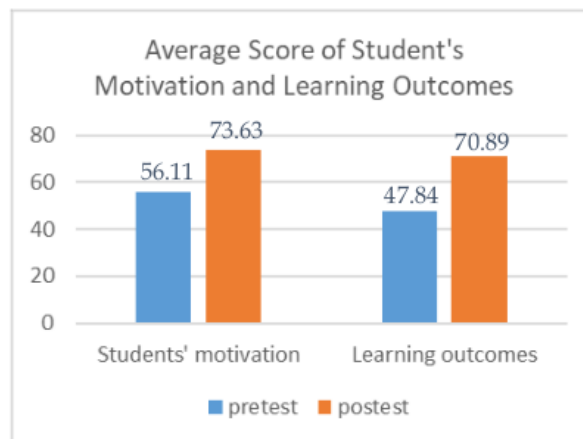
The students' motivation score is obtained from questionnaires with 36 points of statement, contained 10 negative statements and 26 positive statements in the implementation stage. After learning using the Genetics e-module, these data were collected and describe with gain-score, then analyzed using paired sample t-test and correlation analysis between student's motivation and student's learning outcomes.



Table 1. Normalized Gain Score (N-Gain Score) of Students' Motivation and Learning Outcomes

Description	Students' Motivation		Students' Learning Outcomes	
	Pretest	Posttest	Pretest	Posttest
Sample	50	50	50	50
High Score	120	138	70,37	58,2
Low Score	110	127	30	83,8
Total Value	2805,92	3681,8	2392,39	3524,8
Average Value	56,11	73,63	47,84	70,89
N-Gain Score	0,39		0,43	
Category	Moderate		moderate	
Improve (%)	31,2%		48,1 %	

According to N-Gain's result in table 1, after using the Genetics E-module both students' motivation and learning outcomes aspect achieved 0,39 and 0,43 score with moderate category, with the percentage of increase in students' motivation is 3,12%, and 48,1% in learning outcomes. That means that the effectiveness of the genetics e-module is at a medium level to improve students' motivation and learning outcomes. The result of the average score in students' motivation and learning outcomes will show in the following diagram:



Picture 1. Diagram of Average Score between Pretest and Posttest in Students' Motivation and Learning Outcomes Aspect



Picture 1 showed about average score between pretest and posttest in students' motivation and learning outcomes. It showed that after using Genetics E-module, there is a 17,52 increment difference in students' motivation and 23,05 in learning outcome. In motivation aspect, there are 10% with 5 students in the very low category, 56% with 28 students in the low category, 20% with 10 students in the medium category, and 14% with 7 students in high category after doing pretest using lecturer's handout, while after doing posttest using Genetics E-module, there is 10% with 5 students in the low category, 18% with 18 students in the medium category and 54% with 27 students in the high category. In students' learning outcome aspect, there are 6% who passed in pretest while, there are 58% students who passed in posttest genetics test.

Before carrying out statistical tests on students' motivation, the normality test needs to be done. With lilies test, the score is $0,121 > 0,05$ in pretest and $0,119 > 0,05$ in posttest. This means all of the data in students' motivation has a normal distribution. Then a paired t-test was conducted in Tables 2 and 3 below.

Table 2. Paired Sample Correlation of Students' Motivation

	N	Correlation	Sig.
Pair 1 Pretest & Posttest	50	.464	.001

According to paired sample correlation in Table 2, it showed that there is a significant correlation between pretest and posttest, before and after using Genetics E-module with significance $0.001 < 0,05$ with correlation value 0,464. It means that there is a positive correlation between measurements of motivation at pre-test and at post-test that shows the alignment of pre-test and post-test data.

Table 3. Paired Sample Test of Students' Motivation

	mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of Difference		t	df	Sig. (2-tailed)
				Upper	Lower			
Pair 1 Pretest-Posttet	-17.51760	11.47851	1.62331	-20.77976	-14.25544	-10.791	49	.000



According to paired sample test in table 3, it showed that the significance is $0.000 < 0.05$ which means there is a difference in the average value of students' motivation between pretest and posttest. It also proves with t score when compared with t table score, $10.791 > 2.00958$ which also mean there is an impact of using E-module in improving students' motivation.

Then proceed with the statistical test on students' learning outcomes but before carrying out same with students' motivation, normality test needs to be done. With liliefors test, the score is $0,111 > 0.05$ in pretest and $0,087 > 0,05$ in posttest. This means all of the data in students' motivation has a normal distribution. Then a paired t-test was conducted in Tables 4 and 5 below.

Table 4. Paired Sample Correlation of Students' Learning Outcomes

		N	Correlation	Sig.
Pair 1	Pretest & Posttest	50	.307	.030

According to paired sample correlation in Table 4, it showed that there is a significant correlation between pretest and posttest, before and after using Genetics E-module with significance $0.030 < 0,05$ with correlation value $0,307$. It means that there is a positive correlation between measurements of students' learning outcomes at pre-test and at post-test that shows the alignment of pre-test and post-test data.

Table 5. Paired Sample Test of Students' Learning Outcomes

Pair	Pretest- Posttet	mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of Difference		t	df	Sig. (2- tailed)
					Upper	Lower			
1		-22.64820	13.59562	1.92271	-26.51203	-18.78437	-11.779	49	.000

According to paired sample test in table 5, it showed that the significance is $0.000 < 0.05$ which means there is a difference in the average value of students' learning outcomes between pretest and posttest. It is also proven with t score when compared with t table score, $11.779 > 2.00958$ which also mean there is an impact of using E-module in improving students' learning outcomes.



2. Discussion

The implementation of the Genetics E-Module in class could improve student's motivation and also has an impact on students' learning outcomes. It is because Genetics E-module can overcome the previous several weaknesses while using handouts. When handouts only provided monochrome illustration with summary's theory based on literature review, this development of the Genetics E-module so interactive because provided the not only theory of genetics, but also the real example from the research that has been done in University with a colorful illustration, so students can learn the real things that occur in their surrounding and know directly about the benefits.

Though the genetic material can be difficult for students, this colorful representation based on real activity that happens to surround them can build and trigger their attention because students will compare their prior knowledge, with the representation and also with the real research that has been conducted so it's customizable. Furthermore, when students know the benefit from what they learn in E-module it becomes a value because it is relevant to their lives (Keller, 2009; Liaw, *et al*, 2007).

Other differences are the previous handouts didn't provide the various exercises about the material, but this e-module can bring the fun feeling, and involvement of students, because it provides various exercises including *Genetic Games* that can be transformed into a form of tasks, so it can easily facilitate student understanding when they're directly involved in assigned tasks like role-playing or case study. This involvement, of course, can boost their confidence, and understanding because it also has glossaries in it (Dohaney, *et all*, 2017; Keller, 2009; Nurhayati, *et all*, 2017).

Each task in this product produces active learning between students' peers. It also provides direct feedback if they had difficulty to understanding. This activity can gain students' confidence because it creates prompt and helpful communication while doing (Dziuban, *et all*, 2015; Roach & Lemasters, 2006). This genetics e-module also can be used anytime because it can be accessed using the computer or mobile phone so it tends to be repetitious and self-paced because students can study at their

own pace, whether it slow or quick, this autonomous learner of course can improve their satisfaction (Arkoful & Abaidoo, 2014; Ke & Kwak, 2013).

Students' motivation contributed to the learning process because it also correlates with student's learning outcomes. Wigfield and Cambria (2010), said that effective and cognitive components related to the involvement of learner's activities. The strong relationship between motivation and learning outcome is also because of the socio-emotional and intellectual combination that improved student's participation and changes their learning management system and as a result demonstrate better academic performance (Alavi & Leidner, 2001; Benbunan & Hiltz, 2003). Also, it shows the correlation between interest and student conceptual. There were about 35,7% students were under passing grade and 64,2% students were above passing grade in experimental class, and there were about 65,3% students were under passing grade and 39,1% students were above passing grade in the control class. The correlation data is shown in this following table 6 below.

Table 6. Correlation Analysis Between Students' Motivation and Learning Outcomes

		Students' Motivation	Students' Learning Outcomes
Students' Motivation	Pearson Correlation	.186	.186
	Sig. (2-tailed)		.016
	N	50	50
Students' Learning Outcomes	Pearson Correlation	.186	.186
	Sig. (2-tailed)	.016	
	N	50	50

Correlation analysis in table 6., shows the significant correlation on 0,016 significant level (2-tailed). The number of Pearson correlation is 0,186, a show about the level of correlation between student's learning interest and student conceptual understanding in experimental class is in a weak category. It is because the use of the Genetics E-module in this research is not maximized only measured during a few meetings. And for the best result in student's motivation and learning outcomes takes a long sufficient time to bring up the importance of learning in the lives of students



(Mitchell, 1993), but the positive correlation showed that when the students' motivation is improved then students learning outcomes also improved.

D. Conclusion

Based on the result of this research, the implementation of the Genetics E-module can improve the students' motivation by fulfilling all of the motivation indicators such as attention, relevance, confidence, and satisfaction. The increasing of students' motivation also has an impact on students learning outcomes based on correlate analysis with 58 % of students has passed the grade after using Genetics E-module. Even though in the weak category of correlation, it can help by maximizing the use of the Genetics E-module in every learning process.

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