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Development of Enviromental Biotechnology Practicum Modules For Biology Education Students

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Abstract: *Development of Environmental in biology education especially in biotechnology subjects is more integrated in the manufacture of organic fertilizers and vegetable pesticides. To increase the knowledge and skills of biology education students in the eco-friendly biotechnology subjects, a learning material was developed in the form of a valid and effective biotechnology practicum module. The objectives of this research development are (1) to find out the feasibility of module validation, (2) to find out the effectiveness of module implementation on environmental knowledge and skills in biology education students. The development module is refer to the ADDIE development model (Analysis, Design, Development, Implementation and Evaluation). The experimental method of pretest posttes. The subjects in this study were 50 students of the 4th semester biology education program. The data analysis is done by qualitative and quantitative methods, followed by a test to see the differences in preetest and posttest using the SPSS 23. The results obtained that the modules are validated by the expert are declared appropriate for use as instructional materials. Modules developed can improve environmental knowledge and skills of biology education students.*

Keywords: *Modul Practicum, Biotecnology, Biology Education Students*

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I. Introduction

The development of students abilities in the field of Biology is one of the keys to the success of capacity building in adapting to changing times and entering the world of technology, including information technology. Education in the present must be able to equip the young generation with scientific concepts carefully, so that problems that will arise in the future can be anticipated. The learning process that has existed so far is still dominated by lecturers, while students only come, sit, listen, take notes, and memorize, situations like this have a negative impact on students, one of which is students only master the material provided. without knowing the benefits and how to apply knowledge or lessons in everyday life. If a learning system like this still happens frequently, there are several bad possibilities that will occur, including the lack of interest in learning in students, then the emergence of boredom, boredom, being passive in attending college.

Efforts to improve the effectiveness of learning and improving the quality of education, therefore it is necessary to make improvements in the learning process. So that the learning process can improve knowledge and skills accompanied by higher learning interests. One of the subjects in the biology education study program that requires more active students is a biotechnology course. Biotechnology is known as a multidisciplinary and applicative science that requires mastery of sufficient basic concepts, and its development is very rapid because the benefits of biotechnology come in direct contact with increasing human living standards (Purwianingsih, 2009).

Mastery of concepts in overcoming the difficulties of learning Biotechnology, especially environmental biotechnology material in conventional ways, it is necessary to do field practicum. Practicum activities are part of the learning process aimed at making students so students can directly apply the theory to practice. The practicum activity is an exercise in scientific activities, in the form of experiments, observations and demonstrations which show a link between theory and phenomena carried out in the laboratory and outside the laboratory (Rustaman, 2003 in Ardli et al., 2012). In practical activities, there is a need for practicum material, practical instructions, tools and materials to be used in the practicum, as well as observation sheets for practical activities to make it easier for students to carry out practicum. Based on the results of observations that have been carried out that in carrying out practicum, especially in environmental biotechnology material, still using conventional methods using student activity sheets accompanied by lecture methods. Practical material has not been focused on the utilization of local potency so that students' knowledge about the utilization of local potential into environmentally friendly biotechnology is very limited.

Environmental education in biology education especially in biotechnology subjects is more integrated into the utilization of local potential, for example in the manufacture of organic fertilizers and vegetable pesticides. To improve the knowledge and skills of biology education students in environmentally friendly biotechnology courses, learning materials are developed in the form of valid and effective biotechnology practicum modules.

II. Research Methods

This type of research is research and development (Research and Development). The development steps used in developing the Environmental biotechnology practicum module in biology education students are in the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). By using the pretest and posttest group experimental design method. The subjects in this study were 50 students of the 4th semester biology education program. The instruments used in support of this study were knowledge tests, skill observation sheets, and instrument validation formats. The technique of collecting data is a module of practicum data validation and instruments as well as module effectiveness data. While the data analysis is done by qualitative and quantitative methods that use the test to see the difference between pretest and posttest using the SPSS 23 application.

III. Research and Development Results

Module Development Results

Module development is a product in the form of a prototype I (initial) as a result of the design at the design stage, including the products produced are: a) module books and, b) research instruments. To develop a product, the prototype that has been designed needs to be validated by experts so that the product developed becomes a valid prototype. A product is said to be valid if it reflects the soul of knowledge (state of the art of knowledge) before being tested. Based on the results of the evaluation of the three validators, the validation data of the teaching material (modules) as shown in Table. 31.

Table 3.1. Module Validation Test Results

No.	Rated Aspect	Validation			X	R	Exp.
		V1	V2	V3			
1	Format of teaching materials (modules)	3.6	3.3	3.1	3.3	1	Valid
2	Contents of teaching material (modules)	4	3.5	3	3.5	1	Valid
3	Language and writing of teaching material (modules)	3.5	3	3	3.1	1	Valid
4	Image Support	3.5	3.3	3	3.3	1	Valid
5	Benefits of teaching material (modules)	3.5	3	3	3.1	1	Valid
Average Aspects Assessed		**3.6**	**3.2**	**3**	**3.3**	**1**	Valid

Source: 2018 Research Results

The results of the evaluation of the validity of teaching materials (modules) are shown in table 3.1. The average value of the validity of teaching materials (modules) in terms of the format of teaching material is 3.3; content of teaching material 3.5; language and writing 3.1; image support 3.3; and the benefits of teaching material 3.1 with an average value of all aspects of 3.3. The validity criteria for teaching material if confirmed by the validity category are 2.5 2,5 M ,53.5 (Arikunto, 2010). Based on these categories, the teaching material (module) is declared "valid" in terms of the format of teaching material, content of teaching material, language and writing, image support, and the benefits of teaching material, with a coefficient of reliability R of 1, so that it can be said that the module book that was made has met the validity standard.

Based on the results of the validation carried out by three validators, some suggestions for improvement were obtained, namely:

Tabel 3.2 Suggestion for Correction From Validator and Revised Result

Suggestion	Revision
Format Module	
Modules should be numbered	Add numbers to each module, starting from modules 1 to module 6
Language and Module Writing	
Language must be more specific	Using language that is easier to understand
Avoid typing in the script	Make improvements to typing in writing
Ilustrasi dan Dukungan Gambar	
Illustration of the image in accordance with the material	Adjust images with material
Addition of images to make it easier to understand	Addition of images of chemical fertilizers and chemical

Each picture is accompanied by a reference source	pesticides Each picture is accompanied by a source
Manfaat dan Kegunaan modul	
At the end of the module add a summary and evaluation	The summary that contains material conclusions is accompanied by questions to make students better master the material

Suggestions and improvements made by the validator as a reference to refine the module so that the environmental biotechnology practicum module meets the validity standard so that it is feasible to be implemented for biology education students.

Based on the description above, in accordance with the opinion of Nievent (1999), that a learning (learning module) can be said to be valid, if it meets two criteria as follows; 1) training material developed based on strong rational and theoretical; 2) there is internal consistency between the components of the material being developed. Thus the biotechnology practicum module developed can be used to increase the knowledge and skills of biology education students after practicing.

Student Knowledge

Based on the results of the t-test calculated with SPPS-23 shown the difference between the preetest (before practicum) and posttest (after practicum) values was 19.82. Whereas the value of t_{count} = 28,648 > t_{table} = 2, 01063 at the level of $\alpha = 0.05$, and the probability value (p) Sig = 0,000 < $\alpha = 0.05$ so that it can be concluded that there is a statistically significant difference between the average value of knowledge biology education students before and after practicum using the environmental biotechnology practice module. The results of the average value of knowledge of biology education students after practicum using the biotechnology practicum module is greater than the average value before taking the practicum (28,340 > 7,020) of the ideal value 35. Therefore it can be concluded that the knowledge of biology education students is much good after practicing. Thus the effect of practicum (module practicum) on increasing knowledge of biology education students = 19.82.

The initial knowledge of educational students before practicing is 20.05% and the final knowledge of educational students after carrying out is 80.97%. Thus the effect of the Environmental biotechnology lab module given in the field practicum increases the knowledge of biology education students from 20.05% to 80.97% so that it increases by 60.92%.

Tabel 3.3. The Result Of Independent Sampel T-Test for pengetahuan mahasiswa

	Mean	N	Std. Deviation	Std. Error Mean
Pretest Knowledge	7.0200	50	2.75896	.39018
Posttest Knowledge	28.3400	50	4.53832	.64182

Increased knowledge of biology education students after practicing is caused by: 1) the practicum material given is new; 2) delivery of material is carried out using the method of lecture, discussion and demonstration; 3) when delivering material students are given the opportunity to ask questions that have not been understood; 4) when delivering material using language that is easier to understand; 5) at the time of practicum reinforced repetition of the material so that students can strengthen the memory of the material given.

Knowledge is the result of "knowing" and this happens after people have sensed a certain object (Haris R et. Al, 2018a). Sensing occurs through the five human senses. Most human knowledge is obtained through the eyes and ears (Ali, 2003). This is in line with Woofolk's (1993) opinion, that knowledge as a result of learning activities is more than just the final product of previous learning but also becomes a new learning guide. Haris R et. al (2018) said that Humans obtain knowledge through learning activities, and knowledge that someone has had becomes a guideline in learning new knowledge. This means that there is a connection between knowledge with one another, and complementary.

Student Skills

The results of the average value of the skills of biology education students in making organic fertilizers and vegetable pesticides after practicum using the biotechnology practicum module is greater than the average value before practicum (4.00 > 1.040) of the ideal value 6. Therefore It can be concluded that the skills of biology education students are far better after practicing. Thus the effect of practicum (practicum module) on improving the skills of biology education students = 2.96.

The initial skills of biology education students before practicum were 17.3% and the final skills of biology education students after practicum were 66.6%. Thus the effect of the environmental biotechnology module given in the practicum increases the skills of biology education students after the knowledge from 17.3% to 66.6% so that the increase is 49.36%.

Table 3.4 T-Test Results of the Skills of Biology Education Students

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest Skills	1.0400	50	.80711	.11414
	Posttest Skills	4.0000	50	.98974	.13997

Based on the results of the t-test calculated with SPPS-23 in table 3.4 above shows that the difference between the preetest value (before implementing the practice) and posttest (after practicing) is equal to 2.64. While the value of t_{count} = 18,326 > t_{table} = 2, 01063 at the level of $\alpha = 0.05$, and the probability value (p) Sig = 0,000 < $\alpha = 0.05$ so that it can be concluded that there is a statistically significant difference between the average value of skills biology education students in making organic fertilizers and vegetable pestisda before and after being given training.

The improvement of the skills of biology education students after practicum is in line with the results of research conducted by Margunayasa (2014) on "The Effect of Science Practicum Guidelines with Conceptual Changes to the Understanding of Science Concepts in PGSD Students" conceptual (t = 12,366; p <0,05). The average understanding of student concepts increases from 50.25 to 80.75.

Notoadmodjo (2007) said that skill is an application of knowledge so that a person's skill level is related to the level of knowledge. Patta B (2016) says skills require training and the basic abilities that each person has can help to produce something more valuable more quickly.

IV. Conclusion

Based on the results of research and development, it can be concluded that (1) the biotenology practicum module in biology education students was developed with the steps of the ADDIE development model (Analysis, Design, Develop, Implementation and Evaluation); (2) Environmental biotechnology practicum modules are valid and used to improve the knowledge and skills of biology education students; (3) Environmental biotechnology practicum modules are effective in increasing the knowledge and skills of biology education students very significantly.

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