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Development Of E-Module-Based Problem Based Learning (PBL) Applications Using Sigil The Course Ecology And Environmental Education Students Master Of Biology

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***Abstract*—The development of science and technology today has an influence on the world of education. Rapid advances in technology and information in the world of education can make learning better and more interesting, thus creating skills in mastering science, technology, being capable, creative, independent, and responsible. Learning is currently done *online, the* effectiveness of online learning in ecology and environment lectures is not yet effective. Second, lack of student motivation in the learning process. Third, students are less enthusiastic and focused during the learning process in online learning. Fourth, students find it difficult to find appropriate references in the learning process. Fifth, electronic learning materials in the form of *e-modules are* not yet available. The purpose of this study is to produce an *e-module* based on *Problem Based Learning* (PBL) using theapplication *Sigil* in ecology and environment courses for biology education students at Padang State University. This type of research is the study of design and development(*designand*development).This development model uses *four-D-models*. The 4-D development model consists of 4 stages, namely *Define*, *Design*, *Develop*, and *Disseminate*. The results showed that the e-module-based *problem-based learning* (PBL) usingapplications *Sigil* very validwith a value of 84.27% based on the validation conducted validator. The results of the practicality assessment by the lecturers showed a score of 84.40% with very practical criteria and the results of the practicality assessment by students getting a score of 75.93% with practical criteria. The results of the effectiveness test show that there is an influence on students' affective and psychomotor learning competencies, so that *thee-module* -based *problem-based learning* (PBL)using theapplication is *Sigil* very effective in the learning process.**

Keywords*— *Sigil, Problem Based Learning (PBL), E-Module, Ecology and Environment

I. INTRODUCTION

The development of science and technology today has an influence on the world of education. Rapid advances in technology and information in the world of education can make learning better and more interesting, thus creating skills in mastering science, technology, being capable, creative, independent, and responsible [1]. The success of a nation's education cannot be separated from the various roles of education personnel who implement educational activities, one of which is educators. Educators are required to create a conducive environment to improve the teaching and learning process that is effective and efficient (Mulyasa, 2008). At this time, educators cannot fully carry out the teaching and learning process effectively and efficiently due to thepandemic *covid-19*. The existence of thepandemic *COVID-19* requires educators to continue carrying out the learning process as usual, as it should with different methods such as online learning.

Online learning is distance learning with a set of teaching methods where there are teaching activities that are carried out separately from learning activities [2]. In online learning, there were problems for UNP Postgraduate students based on the results of interviews with lecturers who teach Ecology and Environment courses, namely Biology Education Lecturers from questionnaire

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observations on Class B students of 2019 Class B. *First*, the problems obtained are the ineffectiveness of online learning in ecology and environment lectures with 92.9% questionnaire results. *Second*, lack of student motivation in the learning process with 100% questionnaire results. Third, students are less enthusiastic and focused during the learning process in online learning with a questionnaire result of 85.7%. *Fourth,* studentsdifficult to find itfind appropriate references in the learning process with 100% questionnaire results. Fifth, electronic learning materials in the form of *e-modules are* not yet available 100% of the results of the questionnaire. Regarding cognitive learning outcomes, UNP Postgraduate students are already optimal. Based on the problems above, understanding learning really requires the existence of learning materials used by students as teaching materials such as modules.

Modules are learning materials that are systematically designed based on a certain curriculum and packaged in the smallest learning unit. This supports the learning process independently in a certain time unit [3]. In online learning, modules should be used as learning materials by students. This is reinforced by the statement by Akbar and Razak (2019), namely the need for innovation to create or develop learning materials that are able to improve learning according to the characteristics and needs of students. One of the media that can play a role in the online learning process is *e-module.*

E-module as a learning material designed for online learning [4]. *E-module* is a development of print module which is packaged in digital form. According to the Ministry of Education and Culture (2017) *e-module* is an independent teaching material that contains video, animation, and audio presented in electronic form and connected by a link so that learning becomes easier. *E-module* itself when viewed in terms of its benefits in addition to being able to make the learning process more interactive, it can also make the learning process interesting, can be done anytime and anywhere, and can improve the quality of learning itself [5]. *E-module* can be used as a solution to student problems in online learning with-based learning *Problem Based Learning* (PBL).

Problem Based Learning (PBL) is learning that provides problems to students and students are required to be able to solve and provide solutions to these problems [6]. In themodel, *Problem Based Learning* (PBL)students are required to be active in solving problems, exploring the concepts themselves that must be mastered, as well as being active in asking questions and arguing through discussion, honing investigative skills, and undergoing scientific and creative work procedures. *e-module* -based *Problem Based Learning* (PBL)in this study will be developed using theapplication *Sigil*. *Sigil* is an application for the management and creation of digital books in theformat *epub* [7]. Sari (2016) states that *Sigil* emphasizes the use of internet technology to deliver learning materials in increasing knowledge, so that with theapplication it *Sigil* can provide opportunities for every student to be able to understand learning materials well wherever they are. With the existence of an *e-module* based on *Problem Based Learning* (PBL) using theapplication, it is *Sigil* hoped that it can help solve problems during online learning, especially in Ecology and Environment Courses.

Ecology and the Environment is a compulsory subject in the Postgraduate Biology Education Study Program UNP. In the ecology and environment course, the reciprocal relationship between living things and their environment is discussed. *e-module* -based *Problem Based Learning* (PBL)using theapplication is *Sigil* expected to be a solution to overcome student problems in the learning process. Previous research by Kimianti & Prasetyo (2019) conducted research on the development of science e-modules based on *Problem Based Learning* to improve students' scientific literacy. Research by Saputra and Razak (2020) conducted an analysis of the problems and needs *of-e-module for* anbased *android* biological materials at SMAN 3 Padang. Research by Sari (2016) conducted research on the development of digital books through theapplication *Sigil* in thecourses *cookies* and *candys.* Research by Sugihartini & Jayanta (2017) conducted research on the development of e-modules for learning strategy courses. Based on these results, this study aims to determine the knowledge of E-modules based on *Problem Based Learning* (PBL) using the Sigil application on ecological and environmental materials for biology education masters students.

II. METHOD

Research is a type of development research (R & D). Development research is a type of research that goes through the process of developing and validating an educational product [8]. This study uses a 4D research model consisting of 4 stages, namely *Define, Develop*, and *Dessiminate.* The research was carried out in December – February 2021 on master students of biology education at Padang State University who were. The subjects of this research are the first semester biology education master students who have taken ecology and environment courses totaling 21 people. The instruments used are validity, practicality, and effectiveness instruments. Data collection techniques are questionnaires and documentation. Data analysis was in the form oftest *Mann Whitney*

to determine differences in student affective and psychomotor learning outcomes.

III. RESULT AND DISCUSSION

A. RESULT

E-module -based *Problem Based Learning* (PBL)that has been designed is continued with validation activities by experts in the field of study consisting of 3 validators. The results of the validation and suggestions given by the validator are used to revise the *e-module* based on *Problem Based Learning* (PBL) so *e-module* that the resultingis valid. Before validating the *e-module* , the instrument is validated first by the validator. The results of the validation of thevalidation instrument *e- module* based on *Problem Based Learning* (PBL) using theapplication are *Sigilshown* in the table. 1.

Table 1. The results of the validation of the e-module validation instrument based on *Problem Based Learning* (PBL) using theapplication *Sigil*

Number of Items	**Assessment Validator**			**Total**	**Score Maximum**	**Value Validity (%)**	**Criteria**
	1	2	3				
1.	4	4	3	11	12	91.67	Very Valid
2.	4	3	3	10		83.33	Very Valid
3.	4	3	3	10		83.33	Very Valid
Total						258.33	Very Valid
AverageThe						86.11	

Results of the validation of theinstrument *e-module* based on *Problem Based Learning* (PBL) using theapplication *Sigil* on Table. 1 above obtained an average of 86.11 with a very valid category. These results have covered all aspects of the validation instrument assessment, starting from the relationship between the questionnaire indicators and the statement items in the questionnaire, technical aspects, and the sentences used in the questionnaire. The results of thevalidation *e-module* based on *Problem Based Learning* using theapplication *Sigil* can be seen.

TableTable. 2 Results Analysis Validation Test Data *e-module* Rate-based *of Problem Based Learning* to use the application *Sigil*

No	**Component Rating**	**Points Item**	**Ratings Validator**			**Total**	**Score Max**	**Value Validity (%)**	**Criterion**
			1	**2**	**3**				
1.	Aspects of Construction	A	4	4	4	12	12	87	Very Valid
		B	4	3	3	10	12		
		C	4	3	4	11	12		
		D	3	3	3	9	12		

		E	3	3	4	10	12		
	Total		18	16	18	52	60		
2.	Content Aspects	A	4	4	3	11	12	87.5	Very Valid
		B	4	4	3	11	12		
		C	3	3	3	9	12		
		d	4	3	4	11	12		
	Total		15	14	13	42	48		
3.	Aspect Graphical	a	4	3	3	10	12	79.16	Valid
		b	4	3	3	10	12		
		c	3	3	3	9	12		
		d	3	3	3	9	12		
	Total		14	12	12	38	48		
4.	Aspect Language	a	4	3	3	10	12	83.33	Very Valid
		b	4	3	3	10	12		
	Total		8	6	6	20	24		
Total								336.99	Very Valid
Average								84.27	

Based on the validation results in the Table 2, it can be concluded that the requirements to meet the criteria for the validity of the *e-module* based on *Problem Based Learning* using theapplication *Sigil* have been met. This can be seen from the overall average value of thevalidation *e-module* based on *Problem Based Learning* using theapplication *Sigil* is 84.27% (very valid). Therefore, the *e-module* based on *Problem Based Learning* usingapplication *Sigil* the developedcan be used for the next stage of testing.

Thise-module -based *Problem Based Learning* (PBL)was assessed by a lecturer who is in charge of the Ecology and Environmental Education course in Biology. Filling out the questionnaire was done by observing the learning process taking place on the material of energy flow in ecosystems and aquatic ecology. Before being assessed by the lecturer of the course, the practicalities of *e-module* questionnaire-based *Problem Based Learning* (PBL) by the lecturer does validation instrument by the validator. The results of the practicality instrument validation are in TableTable

Table.3 The results of the data analysis on the validation of thepracticality instrument *e-module* based on *Problem Based Learning* (PBL) using theapplication *Sigil* for lecturers

Number of Items	**Validator PenilIn**			**Total**	**Score Max**	**Value Validity(%)**	**Criterion**
	1	**2**	**3**				
1	4	4	4	12	12	100	Very Valid
2	3	3	3	9		75	Valid
3	4	3	4	11		91.67	Very Valid
Total						266.67	Very Valid

The results of the validation of thepracticality instrument *e-module* based on *Problem Based Learning* (PBL) using the application *Sigil* for lecturers, obtained an average of 88.89% with a very valid category. These results cover all aspects of the validation instrument assessment, starting from the relationship between the questionnaire indicators and the statement items in the questionnaire, technical aspects, and the sentences used in the questionnaire.

Table. 4 Results of practical data analysis of *e-modules* based *Problem Based Learning* (PBL)using theapplication *Sigil*

No	**Aspect Rating**	**Average (%)**	**Category**
1.	Ease of Use	85.71	Very Practical
2.	Learning Time Efficiency	85.5	Very Practical
3.	Benefits	80	Very Practical
Total		**253.21**	**Very Practical**
average		**84.40**	**Very Practical**

Based on the results of data analysis Tabel. 4 practicalities of e-module-based *Problem based Learning* (PBL) usingapplication *Sigil* obtained an average that is 84.40% with a very valid category. This shows that *thee-module* -based *Problem Based Learning* (PBL)using theapplication *Sigil* is practical and can be used to test its effectiveness. Practical test of *e-module* based on *Problem Based Learning* (PBL) using theapplication *Sigil* for students to be used in the learning process that takes place in actual conditions, so that it looks practical *e-module* based on *Problem Based Learning* (PBL) using theapplication *Sigil*. In this study, a practical test ofwas conducted *e-module* based on *Problem Based Learning* (PBL)using theapplication *Sigil* in an experimental class of 13 students. Aspects seen include ease of use, efficiency of learning time, and benefits. Prior to the practicality assessment by students, the practicality instrument has been validated by the validator. The results of the student's practicality instrument validation are in.

Table. 5 The results of the validation of thepracticality instrument *e-module* based on *Problem Based Learning* (PBL) using theapplication *Sigil* for students.

Number Item	**Assessment Validator**			**Total**	**Score Max**	**Value Validity(%)**	**Criteria**
	1	**2**	**3**				
1.	4	4	4	12	12	100	Very Valid
2.	3	3	3	9		75	Valid
3.	4	3	4	11		91.67	Very Valid
Total						266.67	Very Valid

Based on Table. 5 the analysis above shows the practical results of *e-module* based on *Problem Based Learning* (PBL) using theapplication *Sigil* for students. Where, obtained the results of the analysis with a total of 227.8 and an average of 75.93 with a practical category. This shows that *thee-module* -based *Problem Based Learning* (PBL)using theapplication *Sigil* is practical and can be used to test its effectiveness. Affective competence is obtained from non-test techniques in the form of observation sheets of student activities during learning. In this affective competence the assessment is carried out based on a rubric that has been

validated by the validator. The results of the validation of the affective domain instrument are in Table 14.

Table. 6 Results of Data Analysis of Student Affective Instrument Validation Assessment

Number Item	**Validator Assessment**			**Total**	**Score Max**	**Value Validity(%)**	**Criteria**
	1	**2**	**3**				
1.	4	4	4	12	12	100	Very Valid
2.	4	3	4	11		91.67	Valid
3.	4	4	4	11		100	Very Valid
Total						297.67	Very Valid

The results of the analysis of the validation assessment data of student affective instruments by 3 validators, obtained a total of 297.67 and an average of 99.22% with very valid criteria. It can be concluded that this instrument can be used in affective assessment for students. The affective domain is obtained from observing student attitudes during the learning process. There are 3 categories of assessment in the affective domain, namely responsibility, discipline, and cooperation. In summary, the average results and the results of thetest in the *Mann Whitney* affective domain can be seen in .

Table. 7 The Average Results (Mean) of the Effectiveness Test in the Affective Area

Class	Average (Mean)
Experiment	78.85
Control	67.57

Based on Table 7 . The average results (*Mean*) of the effectiveness test in the affective domain are in the experimental class with an average (*Mean*) of 78.85%, while in the control class an average (*Mean*) of 67.57%. It can be concluded that there is a difference in terms of the average (*Mean*) of the experimental class and the control class. The results of thetest *Mann Whitney* in the affective domain can be seen from Table 16.

Table. 8 Mann Whitney Test Results in the Affective

Class	RealmAsym.sig (2-Tailed)	Sig	Category
Experimental Control	0.003	0.05	H_1 Accepted H_0 Rejected

Based on the table. 8 obtained the value of Asym.sig (2-Tailed) 0.003 < sig value of 0.05, it can be concluded that there is a difference in affective values between the experimental class and the control class. Thus, this indicates that the existence of an *e-module* based on *Problem Based Learning* (PBL) using theapplication *Sigil* has an effect on students' affective competence during learning.Psychomotor competence data was obtained through making a journal review. In the psychomotor domain, the assessment is carried out based on a rubric that has been validated by the validator. The results of the validation of the psychomotor domain

instrument are in Table. 9

Table. 9 results of Data Analysis of Student Psychomotor Instrument Validation Assessment

Number Item	**Validator Assessment**			**Total**	**Score Max**	**Value Validity(%)**	**Criteria**
	1	**2**	**3**				
1.	4	4	4	12	12	100	Very Valid
2.	4	3	4	11		91.67	Valid
3.	4	4	4	12		100	Very Valid
Total						**297.67**	**Very Valid**
Average						**99.22**	

Based on the Table. 9 results from data analysis of student psychomotor instrument validation assessments from 3 validators, namely the amount of 297.67 and an average of 99.22% with a very valid category. For this reason, it can be said that this instrument can be used in reviewing journals to determine student psychomotor competence. The results of the psychomotor assessment of students in reviewing journals so that the average value (obtained*Mean*) isin Table 18. and thetest *Mann Whitney* in the psychomotor domain can be seen from the summary table. 19

Table 10 . The Average Results (*Mean*) of Effectiveness Test in the Psychomotor Realm

Class	Average (Mean) %
Experiment	81.03
Control	66.67

Based on Table 10 The average result (*Mean*) in the experimental class was 81, 03%, while the average (*Mean*) in the control class obtained an average (*Mean*) of 66.67%. It can be concluded that there is an average (*Mean*) between the experimental class and the control class. The results of thetest *Mann Whitney* in the psychomotor domain can be seen from the summary of Table 19.

Table 11. Thetest results *Mann Whitney* in the Psychomotor

Class	RealmAsym.sig (2-Tailed)	Sig	Category
Experiment Control	0.000	0.05	H_1 Accepted H_0 Rejected

Based on Table 11 .test results *Mann Whitney* in the psychomotor domain obtained the Asym.sig (2-Tailed) value of 0.000 < sig value 0.05, it can be concluded that there is a difference in psychomotor values between experimental class with control class. Thus, this indicates that there is an effect of *e-module* -based *Problem Based Learning* (PBL)using theapplication *Sigil* on the psychomotor competence of students during learning.

B. DISCUSSION

Development of an *e-module* based on *Problem Based Learning* (PBL) using theapplication *Sigil* in the Ecology and

Environment course aims to improve student learning competencies in the affective and psychomotor domains. This research was conducted at Padang State University on 13 students of Postgraduate Biology Education Class A. The resulting product is an *e-module* based on *Problem Based Learning* (PBL) usingapplication *Sigil* a valid, practical, and effective. *e-Module* -based *Problem Based Learning* (PBL)using theapplication is *Sigil* designed to be used as learning material in the learning process. In line with this, Nova et al. (2018) states that the variation of learning materials in the learning process is expected to stimulate students to be more motivated in learning.

e-Module -based *Problem Based Learning* (PBL)using theapplication is *Sigil* designed systematically. This is because the *e-module* involves displaying images, audio, video, and animation [9]. For this reason, the existence of an *e-module* based on *Problem Based Learning* (PBL) using theapplication *Sigil* can improve student learning competencies in Ecology and Environment courses. The process of developing an *E-Module* based on *Problem Based Learning* (PBL) using theapplication *Sigil* starts from curriculum analysis. This curriculum analysis was carried out for the first step in the preparation of an *e-module* based on *Problem Based Learning* (PBL) using theapplication *Sigil.* Based on the curriculum analysis that the researcher has done, it can be determined learning outcomes, learning indicators, and subject matter. And in the curriculum analysis there are components of attitudes, general skills, and special skills. According to Permendikbud (2014) curriculum is a set of plans and arrangements regarding graduate learning outcomes, study materials, processes, and assessments that are used as part of the guidelines for implementing study programs. The next consideration is student analysis. Student analysis was carried out to find data from student problems in thelearning process *online* during *COVID-19*. The data was obtained from the distribution of *questionnaires* to students. According to Kusmanto (2021) the *questionnaire* is the basis of a system that helps the teaching and learning process run as well as in conducting campus research.

The results of thedistribution *questionnaire* so that the student's problems are known, namely: First, the problems obtained are the ineffectiveness of online learning in ecology and environment lectures with 92.9% questionnaire results. Second, lack of student motivation in the learning process with 100% questionnaire results. Third, students are less enthusiastic and focused during the learning process in online learning with a questionnaire result of 85.7%. Fourth, students find it difficult to find appropriate references in the learning process with 100% questionnaire results. Fifth, electronic learning materials in the form of *e-modules are* not yet available 100% of the results of the questionnaire. According to Saifuddin (2017) the existence of problems in the online learning process is expected to be a momentum to develop innovative technology-based learning models with the hope of being effective in replacing learning with face-to-face systems in the classroom (*teacher-directed learning*).

validation *e-module* -based *Problem Based Learning* (PBL)using theapplication *Sigil* has been validated by 3 validators. The validator stated that the *e-module* based on *Problem Based Learning* (PBL) using theapplication *Sigil* that the researcher designed was included in the very valid category with an average value of 84.27%. *e-module* -based *Problem Based Learning* (PBL)using theapplication is *Sigil* said to be very valid because it has fulfilled all four aspects, namely construction, content, graphics, and language. According to Fortuna, et al (2021) the validity of a product is used to determine the extent to which the product developed meets the criteria of validity based on the assessment of experts.

e-module -based *Problem Based Learning* (PBL)using theapplication *Sigil* fulfills the construction aspect because it is designed to be used on *android* and *desktop.e-module* -based *Problem Based Learning* (PBL)using theapplication *Sigil* contains visual media components in the form of text, images, and videos, and is designed based on learning outcomes. The results of thevalidation *E-module* based on *Problem Based Learning* (PBL) using theapplication in *Sigil* the construct aspect are 87% with very valid criteria. This is in accordance with what Arikunto (2013) stated that if the data generated from a product is valid, then it can be said that the product developed has provided an overview of the development objectives correctly and in accordance with the reality and actual conditions.

e-module -based *Problem Based Learning* (PBL)using theapplication *Sigil* fulfills the content aspect because it includes concepts related to Ecology and Environment materials. Presentation of difficult concepts such as object shapes and processes has been visualized with pictures and learning videos. The results of thevalidation *E-module* based on *Problem Based Learning* (PBL) using theapplication *Sigil* in terms of content aspects are 87.5 with a very valid category. This is in line with the statement from Munawaroh, et al (2019) that the *e-module* developed does not only contain material concepts, but also contains pictures and videos. Furthermore, it is reinforced by the results of research from Sendur, et al (2011) which states that providing analogies with image visualization is needed in the learning process, especially for abstract chemical concepts such as chemical bonds. The results of the

validation of the *e-module* based on *Problem Based Learning* (PBL) using theapplication in *Sigil* the graphic aspect were 79.16% with a valid category. *e-module* -based *Problem Based Learning* (PBL)using theapplication *Sigil* has fulfilled the graphic aspect because it already contains text where there is writing consisting of type, size, and color and is equipped with proper punctuation marks. Furthermore, the image that is in accordance with the explanation of the material, has the appropriate size so that it is easy to see. There are videos that are in accordance with the concept of the material. *e-module* -based *Problem Based Learning* (PBL)using theapplication *Sigil* already has an attractive overall design. This is in line with the opinion of Prastowo (2013) that the presentation of pictures is needed to support and clarify the content of the material. These pictures can also add to the attractiveness of students to learn it.

The results of the validation of the *e-Module* based on *Problem Based Learning* (PBL) using theapplication, *Sigil* the language aspect is 83.33% with a very valid category. The language aspect in *thee-module* -based *Problem Based Learning* (PBL)using theapplication *Sigil* is in accordance with good and correct writing of Indonesian Language Rules. According to Khotijah (2019), language is functioned as the realm of conveying information. For this reason, in writing an *e-Module* based on *Problem Based Learning* (PBL) using theapplication, it *Sigil* is very importantpay attentionlanguage so totothat students can easily understand every aspect of the *e-Module*.

The practicality *of thee-module* -based *Problem Based Learning* (PBL)using theapplication *Sigil* was assessed by the lecturer in charge of Ecology and Environment courses, namely Prof. Dr. Abdul Razak, M.Si with an average of 84.40% with a very valid category. Furthermore, an assessment was carried out by students of Class A Postgraduate Biology Education UNP with an average of 75.93 with a valid category. Practical aspects of *e-module* -based *Problem Based Learning* (PBL)using theapplication *Sigil* can be seen from the ease of use, efficiency of learning time, and benefits. Based on the ease of use, there are not too many obstacles, but it's just that downloading thefile is a *e-module* bit long because the delivery is done on the drive and the file is also large because there are 5 materials in the *e-module* based on *Problem Based Learning* (PBL).applications *e-module* -based *Problem Based Learning* (PBL)that have been installed on the desktop and *android* can be used properly and there are no *errors* or sudden stops. And also in its use a supporting application is needed to open the file. On the desktop the supporting file is *readium*, while on *android it* is *reasily*. This is in accordance with Nieven, et al., (2006), the practicality of a teaching material can be measured based on the ease of use in learning activities based on the development objectives. Furthermore, Prabowo (2016) stated that the assessment of the practicality of the module was carried out by lecturers who teach courses on campus as practitioners who know the conditions of learning in the classroom.

Based on the efficiency of learning time, it appears that the use of *e-module* based on *Problem Based Learning* (PBL) using the application *Sigil* can save time studying students because it can easily understand the material, and students can memaanfaatkan time to be able to learn to use *e-module* based on *Problem Based Learning* (PBL) use theapp *Sigil* anytime and anywhere with ease. Furthermore, the presence of learning images and videos will further accelerate students' understanding in understanding materials and processes that cannot be observed directly. This is also stated by Hidayat (2016) where the practicality of the module can be seen in terms of material presentation and time efficiency used in the learning process.

Based on the benefits *ofe-modules* -based *Problem Based Learning* (PBL)using theapplication *Sigil* can help students understand learning materials, make the learning process fun, increase enthusiasm for learning, and can be used as a means in the learning process. This is in line with the opinion of Sirate and Ramadhana (2017) learning to use modules has many benefits, students can be responsible for their own learning activities, learning with modules really respects individual differences, so students can learn according to their level of ability, so learning is more effective and efficient . Based on the researcher's observations during the practicality test, it was seen that students were more enthusiastic and enthusiastic in learning by using *e-modules* -based *Problem Based Learning* (PBL)using theapplication *Sigil*. Students also think that *thee-module* -based *Problem Based Learning* (PBL)using theapplication is *Sigil* easy to use because it can be installed on the desktop and on *Android* and can be opened *offline.*

The results of the psychomotor domain of students by conducting the Mann Whitney test obtained an Asym.sig (2-Tailed) value of 0.000 < sig 0.05, it can be concluded that there is a difference in psychomotor scores between the experimental class and the control class. Thus, this indicates that there is an effect of Problem Based Learning (PBL)-based e-module using the Sigil application on students psychomotor competence of students during learning. The assessment of the psychomotor domain is carried out by assessing the journal reviews that have been made by students in the experimental class and control class. According to the Directorate General of Primary and Secondary Education (2017), product assessment is an assessment of students' ability to be

creative in making products. the holistic way is an assessment that is based on the whole product and is carried out only at the stage of evaluating the product. The assessment of the journal review is seen from the first review format consisting of title, identity, abstract, keywords, introduction, method, results, discussion, conclusion, suggestions, and bibliography. Second, the rules in journal review writing, which consist of the use of standard language, writing systematics, citations, presentation of illustrations, and ways to make a bibliography. According to Sudaryono (2012) the assessment of this skill aspect includes the ability to carry out a skill consisting of various components, smoothly, precisely and efficiently, as well as combining several sub-skills into an overall regular movement.

IV. CONCLUSION

Based on the results of the research that has been done, the following conclusions are obtained.

1. Problem Based Learning (PBL)-based e-Module using the Sigil application in the Ecology and Environment course that has been developed has validity with a very valid category based on the validator's assessment.
2. Problem Based Learning (PBL)-based E-Module using the Sigil application in the Ecology and Environment course that has been developed has practicality with a very practical category based on an assessment by the lecturer while the assessment by students is valid.
3. E-Module-based Problem Based Learning (PBL) using the Sigil application in the Ecology and Environment course that has been developed has effectiveness, namely that there are significant differences between the control and experimental classes in both the affective and psychomotor domains.

REFERENCES

[1] Afandi, R., & Rocmah, LI 2011. "Pramuka Sebagai Wadah Mengembangkan Life Skill Mahasiswa Calon Guru Pada Perguruan Tinggi LPTK". *Pedagogia: Jurnal Pendidikan*, 4(2), 135-140.

[2] Akbar, A., and Razak, A. 2019. Module Development Based On PBL (Problem Based Learning) On Environmental And Ecosystem Change Materials For Student Of Class X SMAN 1 Singkarak. *International Journal of Progressive Sciences and Technologies (IJPSAT)*. 15(2) 46-52. ISSN: 2509-0119.

[3] Alessandro, B. 2018. *Digital Skills and Competence, and Digital and Online Learning*. Turin: European Training Foundation.

[4] Amalia, F., dan Kustijono, R. 2017. Efektifitas Penggunaan *E-Book* Dengan *Sigil* Untuk Melatihkan Kemampuan Berpikir Kritis. *Seminar Nasional Fisika (SNF)* 2017, 81-85.

[5] Arifin, Z. 2012. *Evaluasi Pembelajaran*. Bandung: Remaja Rosdakarya.

[6] Arikunto, S. 2013. *Dasar-Dasar Evaluasi Pendidikan Edisi 2*. Jakarta: Bumi Aksara.

[7] Asrial, dkk. 2020. Ethnoconstructivism *E-Module* to Improve Perception, Interest, And Motivation of Students in Class V Elementary School. *Jurnal Pendidikan Indonesia*, *9*(1), 30–41. https://doi.org/10.23887/jpiundiksha. v9i1. 19222

[8] Asyhar, R. 2012. *Kreatif Mengembangkan Media Pembelajaran.* Jakarta: Referensi.

[9] Diantari, dkk. (2018). Pengembangan E-modul berbasis Mastery Learning untuk Mata Pelajaran KKPI Kelas XI. *Jurnal Nasional Pendidikan Teknik Informatika (Janapati)*, *7*(1), 33–48.