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Development of integrated spermatophyta module potential of local plants on students' independence and concept mastery
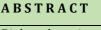
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A R T I C L E   I N F O

A B S T R A C T

Biology learning emphasizes the interaction of students with the object being studied so that the utilization of local potential needs to be done. This study aims to reveal the feasibility and effectiveness of the integrated Spermatophyta module of local plant potential in the Taliabu Island Regency, North Maluku Province. The achievement target is to increase independence and mastery of concepts. This research is development research with the ADDIE model (analysis, design, development, implementation, evaluation). The developed module is assessed by experts, and its effectiveness is tested on the dependent variable. The research population was students of SMA Negeri 4 Pulau Taliabu with a total sample of 28 students of class X. The results showed the Spermatophyta module based on the validation of learning experts 96.25 (very feasible), and media experts 68.98 (decent). The test results of the Spermatophyta module are known to have a significant effect on increasing student learning independence based on the independent sample t-test of .044 (<0.05). The N-gain value for the experimental class is 0.30 (High) and the control class is 0.07 (low). The Spermatophyta module has a significant effect on mastery of concepts known from the results of the independent samples t-test of 0.001 (<0.05). The N-gain value for the experimental class is 0.57 (Quite Effective) and the control class is 0.38 (Not Effective). The conclusion of this study, the Spermatophyta module developed is feasible based on expert validation and tends to be effective for increasing independence, and effective for increasing concept understanding. The Spermatophyta module requires further testing using a larger sample to ensure its suitability and effectiveness

INTRODUCTION

Learning is an activity carried out with guidance or alone. The process of interaction with all situations around the individual is the essence of learning (Rusman, 2012). Learning is not just memorizing, but the process of mastering something meaningful obtained from education, training, and experience that produces relatively permanent changes in behavior as a form of strengthening subject matter or skills (Mulyadi et al., 2017). The learning process is essentially directed at teaching students so that they can achieve their goals (Sanjaya, 2013). In formulating a learning experience a teacher needs to pay attention to the characteristics of the concept, student readiness, and available facilities (Rustaman, 2017). Meaningful learning occurs when students can relate new phenomena to the structure of their knowledge (Syaifurrahman & Ujiati, 2013). While the cause of students not being too able to understand and apply the material in real life is learning that is still only focused on concepts or theories (Hartati & Putri, 2019).

An attitude that is not influenced by others is called independent behavior (Thoha, 1996) and independence can help students manage their thoughts, attitudes, and emotions so that they can achieve learning success (Zumbrunn et al., 2011). One of the characteristics of learning independence that is reflected in students is the necessity to be able to determine goals and how to achieve them (Dabbagh & Kitsantas, 2012) while the factors that affect the independence of a student include learning motivation, availability of learning facilities, learning opportunities, and learning abilities. (Mudjiman, 2008). Implementation of learning as a reflection of efforts to print a quality generation is marked by the ability of teachers to maximize learning activities through various approaches and methods that are by the characteristics of the material and characteristics of students, as well as the ability to read potential such as the surrounding environment as an opportunity to minimize limitations or enrich the facilities and infrastructure of activities learning.

Biology learning emphasizes interaction with the object being studied so that the utilization of the potential of local plants is part of the contextualization of learning. The contextual approach is a learning concept that helps teachers relate the material being taught to the environmental conditions of the students' closest world (Trianto, 2008). Through contextual learning, students will gain a stronger understanding of concepts when compared to the learning process that is only based on general understanding or examples (Rama Yeni et al., 2019), and contextual learning is proven to be effective in increasing students' conceptual understanding of the material being studied (Yudha et al., 2019).

We can see that in nearby schools or colleges there are still many teachers and lecturers who use teaching materials made by other people or factory production when in fact they know and are aware that the teaching materials they use are often inappropriate (Prastowo, 2015). The characteristics of contextual teaching materials as a way to facilitate students in learning have not been found in student books published by the government (Anwar et al., 2017). The use of teaching materials that are not appropriate for learning activities such as the material presenting too many, difficult book language, confusing terms, and less relevant images cannot help students explore, connect, motivate, and respond to the meanings contained in the material (Syukri & Razak, 2021) and one solution to overcome these problems is to develop learning modules that are more in line with needs (Saputra & Advinda, 2018), because the development of modules according to needs can improve the quality of learning (Hartati & Putri, 2019).

Biology learning in high school, both theoretical and practical, requires other learning resources besides textbooks that can support students in understanding biological material (Suryanda et al., 2016) while biology learning at SMA Negeri 4 Pulau Taliabu, North Maluku is limited to the use of textbooks. Data on student learning outcomes obtained in the preliminary study through teacher interviews showed that in 34 students who had studied Plantae (Spermatophyta) material, only one student reached the minimum completeness criteria (KKM) with a score of 75. While the other 33 students were included in the failed category. The unavailability of facilities such as electricity, telecommunications networks, and the internet, and the disconnection of transportation access have made education at SMA Negeri 4 Taliabu Island, North Maluku isolated from the rapid development of science and technology.

Learning activities in schools must be supported by various facilities that aim to facilitate teachers and students in achieving learning goals (Fitriana et al., 2017) and biology learning needs to take advantage of local potential and scope because biology must be relevant to the lives and needs of students (Ismiati, 2020). The teacher's strategy in teaching biology depends on the teacher's perception

of biology. The narrow perception of teachers will have an impact on the learning process (Novana et al., 2014).

A module is a complete unit that stands alone and consists of a series of learning activities (Nasution, 2006). Modules are teaching materials that are packaged completely and systematically that contain a set of learning experiences that are planned and designed as a necessity to help students master specific learning objectives (Daryanto, 2013). The module is a book that is written so that students can study independently (Majid, 2013). The flexibility of the module as a material or learning material is very high which can be developed to meet the needs of increasing graduate competence (Daryanto, 2013). Learning by using modules can provide opportunities for students to learn according to their respective ways and speeds (Nasution, 2006) and a learning module can be developed based on local potential (Novana et al., 2014).

This study aims to reveal (1) the feasibility of the Spermatophyta module based on expert reviews consisting of learning experts and media experts, practitioners consisting of 3 biology teachers, and students. (2) The effectiveness of the integrated Spermatophyta module on the potential of local plants in increasing student learning independence. (3) The effectiveness of the integrated Spermatophyta module on the potential of local plants in improving students' conceptual understanding.

METHODS
Research Design

This research is a type of development research using the ADDIE model which consists of the stages of analysis, design, development, implementation, and evaluation. The analysis phase carried out is an analysis of competence, instructional, and student character as the target of the developed module. The design phase carried out is the systematization of the material, the integration of the material, and the design of the evaluation instrument. The development stage carried out consisted of the pre-compilation stage, draft preparation, editing, revision I, limited trial, and stage II revision. The implementation stage is the module stage which was revised in stage II and implemented to students and the evaluation stage is carried out after a series of learning implementation processes are carried out. Evaluation is carried out as a form of follow-up to the results of the implementation, which is a series of data analysis processes and correcting deficiencies that are still needed. The design of development research using the ADDIE model can be seen in the following Figure 1.
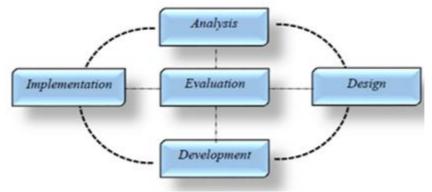

Figure 1. ADDIE Development Model

Population and Samples

This research was carried out in March-April of the 2021/2022 academic year. The population of this study were students of SMA Negeri 4 Taliabu Island, North Maluku, while the samples used to test the effectiveness of the integrated Spermatophyta module on local plant potential were all students of class X, totaling 28 students who were divided into experimental class and control class. The use of a limited sample in this study was because grade X students at SMA Negeri 4 Pulau Taliabu only consisted of 1 class with a total of 28 students. The experimental design used is a nonequivalent control group which in the ADDIE model stage is carried out at the Implementation stage. A nonequivalent control group design in this study can be seen in Table 1.

Table 1.

Nonequivalent control group design

Group	Pretest	Treatment	Posttest
Experiment	O_1	X	O_2
Control	O_3		O_4

Information:

O_1 = Pretest of the experimental group

X = Module learning

O_2 = Post-test of the experimental group

O_3 = Pretest of the control group

O_4 = Post-test of the control group

Instrument

The instrument used in the research to produce an integrated Spermatophyta module for local plant potential consists of a preliminary study teacher interview guide sheet, a questionnaire validation sheet for learning experts and media experts, a biology teacher response questionnaire sheet, a student response questionnaire sheet, a pretest-posttest questionnaire sheet for student learning independence., and the pretest-posttest questions for understanding the concept which consists of 5 description questions. The instruments used in the study were adapted and modified from Aprilia, (2019) and have been validated by experts.

Procedure

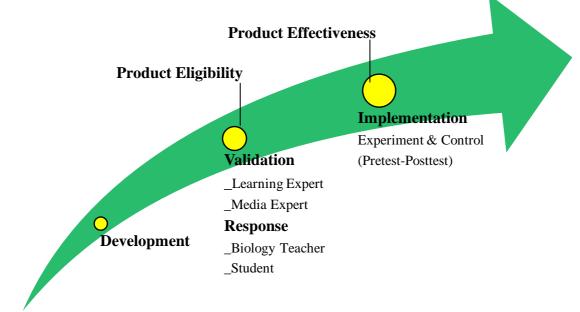The procedure for collecting research data can be seen in the flow chart in figure 2.

Figure 2. Research Data Collection Procedure

Data Analysis Techniques

Analysis in this study used statistical analysis of the SPSS-22 for windows program and calculation of the N-gain score. Statistical analysis was carried out through the prerequisite test for normality, and homogeneity, and continued with parametric statistical analysis with the Independent Sample T-test. The results of the analysis are data that show students' learning independence and mastery of concepts

RESULTS AND DISCUSSION

The development of an integrated Spermatophyta module with the potential of local plants to increase learning independence and understanding of students' concepts has been carried out by following the steps of the ADDIE development model which consists of five stages. The final result of this research is the Spermatophyta learning module which will be used in biology learning for X-grade high school students to increase independence and mastery of concepts. The results of the feasibility

assessment of the integrated Spermatophyta module on the potential of local plants by learning experts, and media experts are presented in the following Table 2.

Table 2.
Recapitulation of Feasibility Validation of Spermatophyta Module

Validator	Rated Aspect	Score	Category
Learning Expert	Aspects of Relevance and Significance of Learning Design	96,25	Very Worthy
Media Expert	Competency Conformity Aspect	71,42	Very Worthy
	Language Aspect	58,33	Quite Decent
	Presentation Aspect	79,54	Very Worthy
	Graphic Aspect	66,66	Worthy
	Average	= 68,98	Worthy
Average		**82,62**	**Very Worthy**

Based on the data recapitulation in Table 2. it is known that validation by learning experts obtained a score of 96.25 including in the very feasible category and media experts 68.98 eligible categories. The average score of the Spermatophyta module assessment results by learning experts and media experts is 82.22. The amount of the score obtained from the validation results is based on the value submitted by Riduwan, (2007) the value of 82.62 is in the range of values of 81-100 with a very decent category. The conclusion from the validation is that the Spermatophyta module is very feasible to be implemented in biology learning.

In addition to expert validation, this study also involved three biology teachers with undergraduate education qualifications who had more than 3 years of experience teaching biology subjects and class IX students who were assumed to have completed studying the Spermatophyta material. The collection of data on the responses of biology teachers and students using a questionnaire instrument and the average value obtained from biology teachers is 94.53 and students are 87.97 both of which are in the very feasible category.

To support students in understanding learning biology material, they need other learning resources besides textbooks and one of them is a module. The character of the module as an independent study material can further increase independence. Independence is not an innate character but the result of the learning process and the development of the Spermatophyta module is carried out for students to use so they can learn independently. The use of modules can train students' independence because the self-instruction possessed by a module allows students to learn on their own or not depend on other parties. In addition to independence, one of the important goals of learning science which includes biology is to increase understanding of concepts. To improve understanding of concepts, modules can be developed by utilizing the potential of local plants so that students can more easily relate learning materials to real objects that are often witnessed in everyday life.

To determine the effect of the integrated Spermatophyta module on the potential of local plants on student learning independence, prerequisite tests are needed through normality tests, homogeneity tests, and hypothesis testing. The normality test was conducted to determine whether the research sample data were normally distributed or not. A homogeneity test was conducted to determine whether the research sample data had a homogeneous variance or not.

The normality test was calculated using the SPSS-22 for windows program through the Shapiro-Wilk test. Based on decision making: If the significance value is > 0.05 then the data is normally distributed and if the significance value is < 0.05 then the data is not normally distributed. The results of the normality test are presented in Table 3.

Table 3.
Results of the Normality Test

Class		Shapiro-Wilk		
		Statistic	df	Sig.
Experiment	Pre-Experiment	.923	14	.322
	Post-Experiment	.925	14	.255
Control	Pre-Control	.933	14	.339

Class	Shapiro-Wilk		
	Statistic	df	Sig.
Post-Control	.914	14	.179

Based on the results of the test of normality it is known that if the significance value of the pretest-posttest experimental class and class control is greater than 0.05 (> 0.05), then the conclusion of the normality test is that the data is normally distributed. Because the data is known to be normally distributed, the further test uses parametric analysis.

The homogeneity test criterion is if the significance value the Based on a Mean > 0.05, then the sample data has a homogeneous variance. Meanwhile, if the significance value on the Based on Mean <0.05, the sample data has a non-homogeneous variance. Results of the SPSS homogeneity test are presented in Table 4.

Table 4.
Result of Homogeneity Test

	Levene Statistic	df1	df2	Sig.
Base on Mind	.750	1	26	.394

Based on the results of the homogeneity test, it is known that the significance value (Sig.) Base on Mean is 0.394 or greater than 0.05, meaning that the data group has homogeneous or the same variance. This test concludes that the experimental class and the control class used in the study came from a homogeneous or the same population.

The effectiveness of using the integrated Spermatophyta module on the potential of local plants in increasing self-reliance was measured through hypothesis testing. The data from the analysis is data that shows the independence of students after studying in the experimental class using the Spermatophyta module developed in the study and comparing it with data in the control class who learns using textbooks. The hypothesis in this study is H_o: There is no significant difference in the independence of students who use the Spermatophyta module and those who do not use the Spermatophyta module. H_a: There is a significant difference in the independence of students who use the Spermatophyta module and those who do not use the Spermatophyta module. The hypothesis test criteria are if the value of Sig. (2-tailed) < 0.05 then H_o is rejected and H_a is accepted, and if the value of Sig. (2-tailed) > 0.05 then H_o is accepted and H_a is rejected. The results of hypothesis testing are presented in Table 5.

Table 5.
Result of Hypothesis Test

	t-test for Equality of Means		
	t	df	Sig. (2-tailed)
Equal variances assumed	.750	26	.044

The results of the Independent Sample T-Test were obtained by Sig. (2-tailed) of 0.044 < 0.05 so that it refers to the hypothesis test criteria, it can be concluded that H_o is rejected and H_a is accepted or some differences tend to be significant between the experimental class that learns using the Spermatophyta module and the control class that learns using textbooks.

The data on the results of the calculation of the N-gain score for the learning independence of the experimental class and control class students are presented in Table 6.

Table 6.
Result of N-Gain

Class	Mean Score		N-Gain Score	Category
	Pretest	Posttest		
Experiment	79,22	85,71	0,30	High
Control	77,91	80,59	0,07	Low

A review of the N-Gain score on student independence obtained results for the experimental class 0.30 (> 0.07) including the high category, while the control class was 0.07 (< 0.3) with the low category. Thus, it can be seen that the increase in learning independence of the experimental class students who studied with the Spermatophyta module was higher than the control class that carried out conventional learning. The results of the N-Gain score in the experimental class (0.30) which is higher than the control class prove that the integrated Spermatophyta module learning the potential of local plants is more

effective in increasing students' learning independence. The magnitude of the increase in student learning independence can be seen from the comparison of the average pretest-posttest scores of the experimental class that uses the integrated Spermatophyta module of local plant potential and the control class that does not use the Spermatophyta module in learning activities as shown in Figure 3
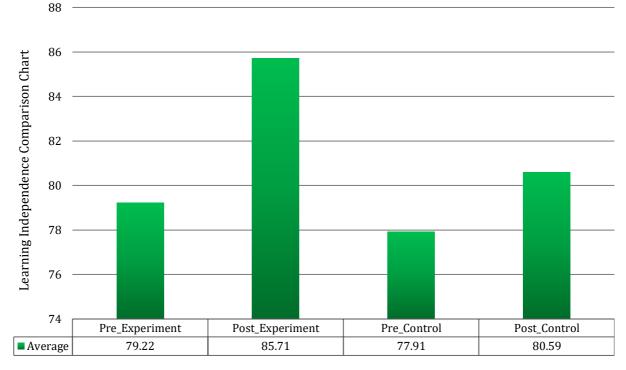

	Pre_Experiment	Post_Experiment	Pre_Control	Post_Control
Average	79.22	85.71	77.91	80.59

Figure 3. Comparison of the Average Value of Student Learning Independence

To determine the effect of the integrated Spermatophyta module on the potential of local plants to increase students' mastery of concepts, prerequisite tests were also carried out through normality tests, homogeneity tests, and hypothesis testing. The results of the normality test are presented in Table 7, the homogeneity test is in Table 8, and the hypothesis test is in Table 9.

Table 7.
Results of the Normality Test

Class		Shapiro-Wilk		
		Statistic	df	Sig.
Experiment	Pre-Experiment	.923	14	.322
	Post-Experiment	.925	14	.255
Control	Pre-Control	.933	14	.339
	Post-Control	.914	14	.179

Based on the results of the normality test it is known that the significance value of the pretest-posttest in the experimental class and the control class is greater than 0.05 (> 0.05), then the conclusion of this normality test is that the research sample data is normally distributed.

Table 8.
Result of Homogeneity Test

	Levene Statistic	df1	df2	Sig.
Base on Mind	.750	1	26	.869

Based on the results of the homogeneity test, it is known that the significance value (Sig.) on the Base Mean is .869 or greater > 0.05 so the research data group has homogeneity or the same variance. This test concludes that the experimental class and the control class used in the study came from a homogeneous or the same population.

Table 9.
Result of Hypothesis Test

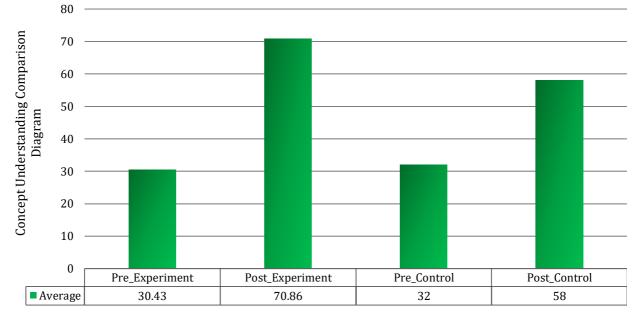|	t-test for Equality of Means		
	t	df	Sig. (2-tailed)
Equal variances assumed	3.609	26	.001

Based on the output of the independent samples t-test, it is known that the significance value of Sig. (2-tailed) is .001 < 0.05 so that it refers to the hypothesis test criteria, this test concludes that H_o is rejected and H_a is accepted, or it is known that there is a significant difference in the mastery of the concepts of experimental class students who learn to use the Spermatophyta module and control class students who learn to use textbooks.
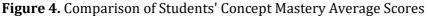
The data from the calculation of the N-gain score for the concept mastery of the experimental class and the control class students are presented in Table 10.

Table 10.
Result of N-Gain

Class	Mean Score		N-Gain Score	Category
	Pretest	Posttest		
Experiment	30.43	70.86	0.57	Quite Effective
Control	32.00	58.00	0.38	Not Effective

Review N-Gain score on students' concept mastery obtained a score for the experimental class 0,57 (quite effective), while the control class 0,38 (not effective). The results of the calculation of the N-gain score can be seen that the increase in conceptual understanding of the experimental class students who study with the integrated Spermatophyta module, the potential of local plants is higher (0,57) compared to the control class (0.38) which carries out conventional learning. The N-Gain score of 0,57 in the higher experimental class proves that the integrated Spermatophyta module learning the local plant potential is effective in improving students' conceptual understanding.

	Pre_Experiment	Post_Experiment	Pre_Control	Post_Control
■ Average	30.43	70.86	32	58

Figure 4. Comparison of Students' Concept Mastery Average Scores

One of the important goals of learning science including biology is to increase mastery of concepts because mastery of concepts is the intellectual foundation for studying scientific processes. To improve students' understanding of concepts, it can be done by contextualizing learning materials, namely linking learning materials with real objects that are familiar in everyday life. This needs to be done because learning biology emphasizes interaction with the object being studied. As one of the teaching/learning materials, the Spermatophyta module which was developed by utilizing the potential of local plants has been proven to improve conceptual mastery. The effectiveness of the Spermatophyta module in improving students' mastery of concepts can also be seen from the comparison of the average value of the experimental class taught using the Spermatophyta module and the control class taught using a textbook as shown in Figure 4.

Based on the diagram above, it is known that the pretest results of the experimental class students' mastery of concepts obtained an average value of 30,43 and post-test 70,86. In the control class, the average score for the pretest was 32 and the post-test was 58, so it can be said that the module learning in the experimental class had a greater influence on increasing students' mastery of concepts. This result is also supported by the effectiveness of the Spermatophyta module learning in achieving mastery learning. The data on student learning outcomes who took part in the module learning were 14 students, 9 of whom achieved the minimum completeness criteria (70%) in other words more than 60% of students could achieve learning mastery. In the control class with conventional learning of 14 students who took part in the lesson, there were no students who achieved the minimum completeness criteria.

Learning includes activities that can be done with assistance/guidance and can also be done alone. To achieve good learning outcomes, it is necessary to be supported by independence, learning facilities, and the acquisition of learning opportunities. A person's learning independence can support academic achievement (Barnard-Brak et al., 2010), and high learning independence can have a significant influence on biology learning outcomes (Puspadita, 2018). This is evidenced by the difference in the level of learning independence of students in the experimental class which is higher and achieves greater learning success than students in the control class.

A learning activity needs to be supported by various facilities (Fitriana et al., 2017), and in the teaching and learning process, there are several important roles for a teacher including as a transmitter of information, facilitator, or mediator, and as an evaluator (Rustaman, 2017). Conventional learning habits carried out by teachers with low levels of student learning success can be caused by the ability factor and the limitations of the teaching materials they have. According to Maryono, (2016), among the reasons for conventional learning to be carried out are limited time and learning resources. The limitations of learning resources at SMA Negeri 4 Pulau Taliabu require teachers to implement learning using conventional methods. The presence of the Spermatophyta module which was developed by integrating the potential of local plants can be a teaching/learning material that supports the implementation of biology learning as stated by Ismiati, (2020) that biology learning needs to utilize local potential and scope, and a learning module can be developed based on local potential (Novana et al., 2014).

Although there are various limitations, the module is a curriculum package provided for independent study (Nasution, 2006). Module learning is more optimal for exploring independent learning because students can learn according to their style and pace (Aprilia & Suryadarma, 2020), and provides freedom for students and a sense of responsibility in learning (Moore & Diehl, 2019). Giving freedom to learn and responsibility can increase self-confidence and for someone who has high self-confidence, the higher the level of independence they have (Pratiwi & Laksmiwati, 2016). The low effect of learning the Spermatophyta module on increasing student learning independence is influenced by the short treatment time for learning and learning the new module for the first time so it takes longer for students to adapt. Subali, (2016) suggests that treatment or treatment given in a short time can cause students to be exposed to effect testing. This provides information that the increase in the independence of students who are classified as low may be caused by the short duration of the treatment given. Although relatively low, the level of independence of the experimental class students with module learning is still higher than the control class with conventional learning.

The module as a teaching material developed in direct contact with learning objects has the potential to provide students' understanding of concepts (Situmorang, 2016). Concept understanding is the construction of meaning from messages obtained from teaching, books, or learning media (Anderson & Krathwohl, 2010). An improved understanding of concepts can be obtained through contextual learning. Through contextual learning, students will gain a stronger understanding of concepts when compared to the learning process that is only based on general understanding or examples (Rama Yeni et al., 2019). Understanding the concept of Spermatophyta material with a higher level of achievement of learning outcomes in the experimental class is an indicator that the use of the Spermatophyta module in learning activities has a significant effect on improving student learning outcomes. This is to the opinion of Yudha et al., (2019) that contextual learning is proven to be effective in increasing students' conceptual understanding of the material being studied.

One of the benefits of module learning for a teacher/researcher is when it succeeds in delivering students to achieve optimal learning outcomes. With the acquisition of optimal learning outcomes, a

teacher/researcher will feel he has done a good job. The module developed through this research departs from the limitations of teaching materials in the implementation of biology learning at SMAN 4 Taliabu Island, North Maluku with the hope of contributing to minimizing the limitations of learning/study materials, increasing independence, and learning biology outcomes. Elements of local plant potential that are integrated with module materials are carried out as an effort to contextualize learning materials with real objects that are familiar in everyday life. The use of local plants in Taliabu Island Regency, North Maluku Province, in the module is placed as a support for each explanation of learning material so that the discussion or explanation of the Spermatophyta module material is always followed by real examples that students often find in everyday life. Through the utilization of the potential of local plants, students can easily connect new knowledge with the knowledge they already have which in the end students' understanding of concepts can increase.

Modules can be used by students to carry out learning without having to rely on limited teaching materials or study with teachers in class. This is due to the use of simple and easy-to-understand language such as the language of teachers or friends, the use of scientific terms accompanied by explanations in the glossary, each learning activity accompanied by instructions, and part of the learning evaluation which students can use to measure their learning success. By utilizing the Spermatophyta module, students' learning independence can be increased. The Spermatophyta module that was developed using the ADDIE development model with a series of validation processes and effectiveness tests in this study has displayed in Figure 5. below:
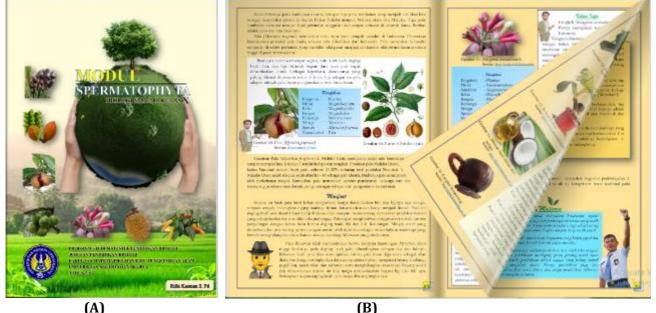

| (A) | (B) |

Figure 5. Product Display Development Results, (A) Front Cover, (B) Content View.

CONCLUSION

The results showed that: The Spermatophyta module which was developed by integrating the potential of local plants is very suitable for use in biology learning based on expert validation and the responses of practitioners and students. The effectiveness of the Spermatophyta module based on hypothesis testing tends to have a significant effect on increasing students' learning independence and also has a significant effect on students' mastery of concepts. The effectiveness of the Spermatophyta module based on the calculation of the N-Gain value has a moderate influence on the aspect of independence and is categorized as quite effective in increasing students' conceptual understanding. The influence that still tends to be significant or the results of the calculation of the moderate N-Gain value on the aspect of independence is caused by the short duration of treatment and students' unfamiliarity in learning to use the module. The research product can be used for the implementation of biology learning on the same or related material and can also be used for implementation in other schools by considering the similarity of the potential of local plants in each area.

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