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Developing learning module of environmental pollution materials based on the borg and gall model to students at public junior high school 3 Tondano

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Abstract
The purpose of this study is to produce teaching materials for Science Learning Modules to improve student learning outcomes on environmental pollution materials. This research refers to the procedure for implementing the "Research and development" research following the stages of implementation according to Borg and Gall (Palilingan, 2014), and was carried out at SMP Negeri 3 Tondano in March-April in the even semester of the 2020/2021 school years. The field trial subjects consisted of learning material experts, learning module experts in the field of science and 5 students. The instruments used were questionnaires and learning outcomes tests. The data obtained were analyzed significantly and using the t test (paired sample t-test) significant 0.05. The results of the product validation of the expert 1 learning materials are in the valid category with a value of 79.12%, the results of the product validation of the expert 2 learning materials are included in the valid category with a value of 85.22%, the results of the expert validation of the learning module are included in the valid category with a value of 91.11%, and The results of the limited scale field trial test were included in the valid category with a value of 82.22%. The average value of learning outcomes that have used the science learning module product is 46.50 higher than not using the science learning module product, which is 39.00, so H0 is rejected and H1 is accepted. This study concludes that science learning products are good for use in the implementation of learning in the classroom and can improve student learning outcomes.

Keywords: learning module, borg and gall model, learning outcomes

Introduction

Learning activity requires appropriate learning resources and learning models. In addition to the use of learning models that affect the learning process, success in learning is highly dependent on the use of learning resources or media used during the learning process. One of the appropriate and appropriate learning resources for independent learning is a module, namely teaching materials that are systematically designed based on the curriculum and packaged in the form of the smallest learning unit and studied independently in a certain time unit so that students master the expected competencies (Erlinda, 2017) [2]. Furthermore, Rusmiati (2013) [8] states that independent learning is an active way of learning to develop each individual who is not tied to the presence of friends or teachers.

The use of learning modules depends on the fact that if students are given adequate time and learning conditions, students will master a competency completely. Learning using modules can improve student learning outcomes (Danny, 2009) [1]. Learning that is associated with everyday life motivates students to understand the meaning of the subject matter they are studying (Johnson and Smith, 2002) [3].

Environmental pollution material for junior high school students relates to understanding concepts, principles, and their application to examples related to everyday life to determine how to prevent it, and has an important role in other fields of science. If you look at the basic competencies of science learning according to the 2013 revised 2017 curriculum, learning in junior high schools builds the ability to explain, identify, analyze, present observations through experiences experienced.

The results of observations at Public Junior High School 3 Tondano through interviews with science teachers, it is known that students learn science by memorizing so that students are less active in learning. This is because the teacher delivering the material is still dominated by the lecture learning method so that students only pay attention to the teacher's explanation without being actively involved in learning. The available teaching materials do not activate students' environmental care behavior. In addition, attitudes towards science learning are not understood by students. The solution that can be done is to use a science learning module based on the Borg and Gall model that is able to produce a product that has a high validity value because it goes through a series of field trials and is validated by experts. The Borg and Gall model is a process used to develop and validate educational products (Palilingan, 2014) [7].

The development of science learning modules based on the Borg and Gall model of environmental pollution was chosen so that students could better understand the surrounding environment. Dale in Wagner (1970) states that learning activities that involve the surrounding environment can absorb up to 90% of the knowledge learned. So that learning activities using the science learning module on environmental pollution are directed so that students can gain a direct understanding of the surrounding environment.

The module is a learning process regarding a particular unit of discussion that is arranged systematically and directed for use by students, and allows students to acquire competencies that have not been mastered (Mulyasa, 2006) [4]. The module is a complete unit that stands alone and consists of a series of learning activities that are arranged in such a way as to help students achieve goals that are specifically and clearly formulated (Nasutin, 2003). In line with this opinion, (Parmin and Peniati, 2012) [5] suggested that the module is a component that has an important role in the learning process, the availability of modules can help students in obtaining information about learning materials.

Based on the above understanding, it can be concluded that the module is a form of print media that contains a learning unit equipped with various components so as to enable students who use it to achieve their goals independently. The module can also be formulated as a complete unit that stands alone on a series of learning activities that are structured to help students achieve the goals that have been formulated.

The steps for compiling or developing a module (Nasution, 2003) [6]: 1) formulating clear learning objectives, 2) compiling reasons or rationales for the importance of the module for students, 3) determining learning activities carried out by students to assist and guide students in achieving competence -competencies that have been formulated in the learning objectives, 4) compiling post-tests to measure student learning outcomes, 5) preparing reading sources that are open to students whenever needed.

Materials and Methods

Natural Sciences (IPA) is a branch of science that begins with natural phenomena. Science is defined as a collection of knowledge about objects and natural phenomena obtained from the thoughts and investigations of scientists carried out with experimental skills using the scientific method.

This research uses research and development (R&D) methods. This research follows the steps of development research according to Borg and Gall (Palilingan, 2014) [7], as described below:

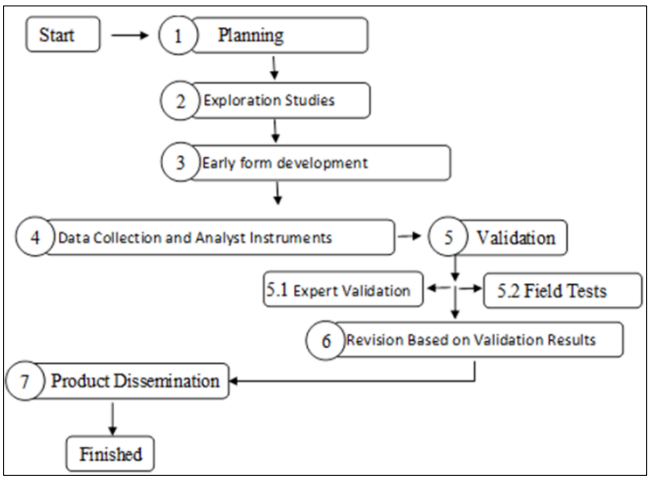

Fig 1: Product Development Procedure

This research will use research and development steps according to Borg and Gall (1983) revised by Palilingan (2014) [7]. 1) Planning, this stage includes: researchers design products that will be developed into teaching materials that help teachers in the learning process. 2) Exploratory studies, this stage includes: identification and observations made to obtain information on the state of the school. 3) Development of the initial form, this stage includes: researchers prepare learning materials, learning evaluation tools, and handbooks. At this stage the product produced is in the form of printed materials, namely modules. 4) Instruments of data collection and analysis, this stage includes: researchers make questionnaires and tests to be tested on validators and students. 5) Validation, this stage includes: a) involving expert validators who will test the developed product. b) Field trials on a limited scale, involving class VII Public Junior High School 10 Bitung with a total of 5 respondents. c) Field test involving class VII Public Junior High School 3 Tondano with a total of 20 respondents. 6) Revision based on validation results, this stage includes: making improvements to the results of field trials. 7**)** Product dissemination, this stage includes: research is ready to report or present products that have been produced at scientific meetings.

Results and Discussion

Lesson planning is carried out to identify the learning objectives achieved and develop the manufacture of science learning modules on environmental pollution material. Learning planning is outlined in the form of a lesson plan (RPP) which is adjusted to the 2013 revised 2017 curriculum in schools.

Module planning is the stage of realizing the initial form of the module which includes collecting subject matter from various sources, making modules, approval of learning material experts, revision of learning modules and modules for testing.

The stages of this exploratory study were observations of the schools that were being researched. The observations were carried out by conducting interviews with science subject teachers. The results of the interviews obtained data that the learning process carried out was still lecture or focused on the teacher as the main source of knowledge and the learning process was carried out online (in the network). In addition, teachers also have not optimally implemented learning with science learning modules.

The material in the module is taken from several sources, namely printed books, existing journals, then processed into MS-Word and adjusted to the learning objectives to be achieved to produce a science learning module for environmental pollution.

The data collection instruments used in this study are as follows. 1) Questionnaire for assessing learning materials in the module to evaluate the feasibility and effectiveness of learning materials. Questionnaire for the assessment of the media expert module to evaluate and the effectiveness of the modules used in learning. 2) Test. The tests used to measure the success of student learning outcomes consist of pre-test and post-test given before and after learning activities.

The data analysis technique used the SPSS 26 application to test for normality using the Kolmogrof-Smirnov test statistical analysis according to the SPSS 26 application and to test the Paired sample t-test.

Validation of Learning Material Experts. Learning material experts assess as in the table below:

Table 1: Material Expert Assessment

No	Component	Validator	
		1	2
Kelayakan ISI			
1	Conformity with SK, KD and Objectives	5	5
2	The truth of the substance of the learning material	5	4
3	Concept and definition accuracy	5	4
4	Use examples and cases	5	4
5	Benefits to add insight	5	4
Language			
6	Legibility	5	4
7	Information clarity	5	5
8	Conformity with good and correct Indonesian language rules Indonesia	5	4
9	The language in the module is adapted to the developmental stage of the student	5	4
10	Use language effectively and efficiently	5	4
Presentation			
11	Clarity of goals to be achieved	5	5
12	The table of contents and instructions for using the module are easy to learn	5	5
13	Order of serving	5	5
14	Giving motivation and attraction	5	4
15	Interaction (providing stimulus and response)	5	4
16	The images presented are related and support the clarity of the material	4	4
17	Complete information	5	4
Graphics			
18	Use of font size and type	5	5
19	Layout or layout	5	4
20	Illustration or picture	4	4
21	The illustration of the cover of the module describes the content/materials presented	5	4
22	Display design	5	4
23	The module content material is not easy to tear, tightly bound and not easy to come off	5	4
Total score achieved		113	98
Maximum score		115	115
Percentage		98,26	85,22

The calculation shows that the percentage of material expert 1 is 98.26%, the percentage is included in the valid category (needs to be revised). The percentage of material expert 2 is 85.22%, this Percentage is included in the valid category (needs to be revised). The module media expert assesses the environmental pollution module as shown in the table below:

Table 2: Expert Assessment Module

No	Component	Validator
Language		
1	Legibility	5
2	Information clarity	5
3	Conformity with good and correct Indonesian language rules Indonesia	5
4	The language in the module is adapted to the developmental stage of the student	5
5	Use language effectively and efficiently	4
Presentation		
6	Clarity of goals to be achieved	4
7	The table of contents and instructions for using the module are easy to learn	5
8	Order of serving	5
9	Giving motivation and attraction	5
10	Interaction (providing stimulus and response)	5
11	The images presented are related and support the clarity of the material	4
12	Complete information	4
Graphics		
13	Use of font size and type	4
14	Layout or layout	5
15	Illustration or picture	4
16	The illustration of the cover of the module describes the content/materials presented	4
17	Display design	4
18	The module content material is not easy to tear, tightly bound and not easy to come off	5
Total score achieved		82
Maximum score		90
Percentage		91,11

The calculation obtained a percentage of 91.11%, the percentage is included in the valid category (needs to be revised).

Field test (Limited Scale). Based on the data obtained in the table below:

Table 3: Limited Scale Trial Assessment

No	Component	Scoring Scale			
		SS	S	KS	TS
	Organizing				
1	Interesting module content organization	4	1	0	0
	Legibility				
2	Sentences in the module are easy to understand	4	1	0	0
3	The writing in the module is clear	3	2	0	0
	Attractiveness				
4	Attractive module display	5	0	0	0
5	The illustrations used are interesting	4	1	0	0
	Material integration				
6	The material combines meaningful science content	4	1	0	0
7	The relationship between concepts becomes meaningful	5	0	0	0
	Experimental activities				
8	The table of contents and instructions for using the module are easy to learn	3	2	0	0
9	The table of contents and instructions for using the module are easy to learn	5	0	0	0
Total score achieved		37	8	0	0
Maximum score		45			
Percentage		82,22	17,78	0	0

The calculation of the percentage of the 9 score indicators achieved for the strongly agree category is 82.22%, for the agree category 17.78%, for other categories each is 0%. Thus it can be concluded that students gave a positive response to the science learning module on environmental pollution material and there were no changes to be revised in the second revision, so the trial could proceed to the field test stage.

The field test for the control class not using the learning module is given the symbol VIID and the field test for the experimental class using the learning module is given the symbol VIIC. The field test was carried out in class VIIC of Public Junior High School 3 Tondano as many as 20 students. This field test obtained data including learning outcomes through the scores of the initial and final tests and the responses of the experimental class students to the given module. Initial test scores are given before learning or when both samples have not been treated, and final tests are given after learning or when both samples have been treated.

Data on learning outcomes from the control class through written tests on 20 students obtained the highest score was 95, while the lowest was 75 (Appendix 5:57). Data on learning outcomes from the experimental class through written tests on 20 students obtained the highest score was 100, while the lowest was 75 (Appendix 6:58). Students assess whether the module is good or not well used in learning. Based on the data, the number of categories strongly agree (SS) = 219, category agree (S) = 116, category disagree (KS) = 21, and category disagree (TS) = 4

The steps for testing the normality of the data are as follows: 1) Determine the test hypothesis, H0: data is not normally distributed, H1: data is normally distributed. 2) Testing criteria. Reject H0 if the probability value > 0.05. Accept H0 if the probability value < 0.05. Significant level 0.05 with n = 20.

Table 4: Normality Tests Data

	Tests of Normality							
	Kelas		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Mean	Df	Sig.	Statistic	Df	Sig.
Hasil	Pre_Eks	.156	41.00	20	.200*	.945	20	.293
	Post_Eks	.152	87.50	20	.200*	.938	20	.219
	Pre_Kont	.099	44.50	20	.200*	.960	20	.543
	Post_Kont	.182	83.50	20	.080	.924	20	.117

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Kolmogorov-Smirnov analysis. The significance column is known to be 0.200, 0.200, 0.200 and 0.080 with probability > 0.05, so it can be concluded that the data is normally distributed.

The steps for testing the homogeneity of the data are as follows:

1) Determine the test hypothesis. H0: data is not homogeneous. H1: data is homogeneous. 2) Testing criteria. Reject H0 if the value of sig based on Mean > 0.05. Accept H0 if the value of sig based on Mean < 0.05. Significant level 0.05 with n = 20.

Table 5: Homogeneity Test Data

Test of Homogeneity of Variance					
	Levene Statistic		df1	df2	Sig.
Hasil_belajar	Based on Mean	1.620	1	38	.211

	Based on Median	1.710	1	38	.199
	Based on Median and with adjusted df	1.710	1	37.985	.199
	Based on trimmed mean	1.590	1	38	.215

Levene Statistical Analysis. In the sig Based on Mean column, it is 0.211 with a probability > 0.05, so it can be concluded that the data is homogeneous.

Paired Sample T-Test. Hypothesis Testing. The steps for testing paired sample t-test data are as follows: 1) Determine the test hypothesis: H0: $\mu 1 \leq \mu 2$, student learning outcomes using science learning modules are lower than student learning outcomes not using science learning modules. H1: $\mu 1 > \mu 2$ Student learning outcomes using science learning modules are higher than student learning outcomes not using science learning modules.

Table 6: T Test Data

Paired Samples Test									
		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PreEks-PosEks	-46.500	16.311	3.647	-54.134	-38.866	-12.749	19	.000
Pair 2	PreKon-PosKon	-39.000	10.208	2.283	-43.778	-34.222	-17.085	19	.000

Determine t count and significance: In the Pair 1 and Pair 2 columns, it can be seen that the t count is -12.749 and -17.085 with a significance (2-tailed) of 0.00 and 0.00

Define t table: The t table can be seen in the statistical table at significant = 0.05: 2 = 0.025 (two-sided test) with degrees of freedom (df) n - 1 = (20 - 1 = 19) then the t table is 2.093. Test criteria: By significance: Reject H0 if the value is if the significance value is < 0.05. Accept H0 if the value is if the significance value is > 0.05

Hypothesis testing using t-test statistics with two-party test:

Reject H0 if the value if the value of t count < t table. Accept H0 if the value if the value of t count > t table

Making conclusions, because the significance value < 0.05 (Pair 1 = 0.00 < 0.05 and Pair 2 = 0.00 < 0.05) and the t count < t table (Pair 1 = -12.749 < 2.093 and Pair 2 = - 17.085 < 2.093), then H0 is rejected and H1 is accepted. So it can be concluded that the science learning module on environmental pollution can improve student learning outcomes.

Conclusions

1. Based on the results of the analysis and discussion conducted, it can be concluded as follows:
2. The feasibility of the science learning module on environmental pollution material after being tested for validation was obtained from material experts and module experts with valid, overall good and decent categories.
3. Student response after using the science learning module on environmental pollution in learning is very good.
4. Learning science on environmental pollution based on the Borg and Gall model can improve student learning outcomes at SMP Negeri 3 Tondano.

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