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Development of Natural Sciences Module with Reflective Learning Journal to Enhance Student's Reporting-Interpretative Skills

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Abstract

One of the successful factors of the curriculum 2013 implementation is the availability of appropriate and relevant teaching materials. Teaching materials can be textbooks, interactive videos, virtual labs, maket and so on. Unfortunately, there are still found many materials that are less in accordance with the curriculum of 2013. Therefore it should be developed a more appropriate teaching materials, one of them is a natural sciences module with reflective learning journal. The development of natural sciences module was done with research that aims to develop and analyze the effectiveness of natural sciences module with reflective learning journals. This research was an R&D research using development research procedure according to Thiagarajan that known as 4D (define, design, develop and dessiminate). The data collection was done by test and non-test technique. Instrument that used in non test technique are interview guides, product validation sheet, students' response sheet to the readability of science nature modul with reflective learning journal., meanwhile the instrumen that used in test technique is essay question with reporting-interpretative skills's indicators. The results showed that the leligibility of the natural sciences module with reflective learning journal was categorized as appropriate and effective to improve student's reporting-interpretative skills.

How to Cite

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INTRODUCTION

Modern era require changes in various sectors of life including education. Education should be continuously make better innovation to face the future challenges and meet the society need. One of effort can be done to realize these expectations is by providing the comply facilities and appropriate with science and technoloy development. Embodiment fulfillment facility can be done in school which are educational institutions which directly contribute to produce thinkers in the future. One of the educational facilities that must be available is teaching materials (Padmapriya, 2015)

Teaching materials can be interpreted as materials or subject matter that is compiled in a complete and systematic based on the principles of learning used by teachers and students in the learning process. Teaching materials can be categorized into print and non-print (Depdiknas, 2008). Printable teaching materials can be textbooks, modules, worksheet, practical guide, and so on, while non-printable materials can be online games, e- modules , interactive videos, virtual labs and so on. Selection of the teaching materials using must be determined wisely according to the intactness and student's character (Wenno, 2010)

Good teaching materials should be in accordance with the curriculum used and environmental conditions of the students so it can apply easily. Good teaching materials not only can improve the conceptual understanding, but also enhance skills such as analyzing, interpreting, summarizing, and solving problems with creative solutions (Barron & Hammond, 2008). These abilities are very much needed in this modern era (Muqodas, *et al.*, 2015).

Observation results at SMP Negeri 1 Lasem on the availability of teaching materials at school found that the teaching materials used still show some weaknesses. The material in the textbook is still incomplete, some directions of learning activities not systematic and contextual. Aspects of legibility and language in the teaching materials are still difficult to understand, the evaluation test also less empowering thought process learners and some questions are found less in accordance with learning objectives. The results of questionnaires that given to learners also show that most them feel uninterested in reading the material.

The existence of the gap between the ideal conditions and the reality, requires improvement in the quality of teaching materials. One of them

by developing teaching materials in the form of modules. Modules and appropriate learning process can generate motivation and learning stimulation, also provide good psychological effects for learners (Novitasari, *et al.*, 2016).

The module is teaching materials that are arranged systematically to achieve the competencies and specific objectives expected. A good module is a module with three components of appropriateness according to the National Education Standards Board (BSNP), which are the appropriateness in content, language and presentation (Millah, *et al.*, 2012).

Learning using the appropriate module will also motivate learners to learn independently, so that, it can deceive their thinking ability. Modules are designed by presenting a real example likes in daily life can develop learners literacy and mastery of the new concept (Awang & Zakaria, 2012).

One of the components of module is the learning activities. Good modules not only contain a collection of material, but there are also learning activities that accommodate the active process. Learning activities should be contextual with student environment (Widodo, *et al.*, 2017). Beside that, good learning activities can be an additional supplement to the active process of discovery concept, so the knowledge gained in the learning is more accurate and memorable because they are practiced directly (Ali, *et al.*, 2010).

Learning activities are organized into modules should be practiced by learners independently and able to develop their active process (Bradley & Brown, 2006). Learning activities that develop an active process can be prepared by incorporating elements scientific approach of the curriculum 2013. The preparation of learning activities that accordance with a scientific approach, can be applicated easily because more coherent and logic (Taufiq, *et al.*, 2014).

The use of module would be optimal if at the end of each learning followed by reflection. Reflection is a cognitive activity that involves understanding or grasping what is happening, contemplating, evaluating and projecting experience in the future (Rawahi & Balushi, 2015). Reflection has a role in improving thinking process because it involves integrating process of the knowledge that learners know before, during, and after learning (Towndrow, *et al.*, 2008).

Reflection activities can be set on reflective learning journals that are included in the natural science learning module. The reflective learning journals added in the learning module aim to provide learners to reflect and summa-

alize the learning process thoroughly (Sadeh & Zion, 2011). Writing reflective learning journals can develop many skills, such as informative writing skills, organizing data, creating tables, writing observations, drawing conclusions of investigation, and reflecting their experiences and knowledge (Backstead, 2014).

Based on the explanation above, we need optimizing the learning process by developing sciences modules with reflective learning journal. In addition we also need to know the effectiveness of the module to improve their ability of reporting-interpretative skills.

METHODS

This is a Research and Development (R&D). The R&D is employed to develop a particular product and test the effectiveness of the product. The product developed in this research was sciences module with reflective learning journal. The target of the module were students in junior high school grade 7th. Products were developed to improve the reporting-interpretative students' skills outcomes.

The subject of this study was the seventh graders at SMP N 1 Lasem Rembang in the second semester of academic year 2017/2018. Product trials were conducted in January to February 2018 at SMPN 1 Lasem Rembang in two phases, namely the limited field trial (trial I) and the main field trial (trial II). The first trial was carried out in the non-class samples to analyze and to explore responses, reactions, comments of teachers and students. The first trial was conducted on 30 students of class VII C. In the first trial students were given questioners about their response towards natural sciences module especially about its readability. The second trial was done in two classes, the class that applied the natural sciences module with reflective learning journal (as an experimental class) and the control class used module or textbook that applied as usual. The experimental and control class were selected with preceded by pre-test and post-test. The subjects to limited trial (trial I) were 30 students of class VII were selected randomly. While in the main field trials (trial II) composed of class VII A and VII B that selected from nine classes of seventh graders at SMPN 1 Lasem Rembang. The determination of the experimental class and the control class was done randomly with the results of class VII A as an experimental class and class VII B as the control class. The data collection was done by (1) non-test techniques by interview guideline, product validation sheet, students' response to

the readability (2) the testing techniques was an essay test about the interaction living thing with their environment with reporting and interpretative skills aspects. Reporting and interpretative skills aspects. Each aspect is outlined into indicators that modified by Kendra (2008) and Verkade (2015) presented in Table 1.

Table 1. Aspects and Indicators of Reporting and Interpretative Skills

Aspects	Indicators
Observation	1 Identify problem based on the observation result
	2 Predict the impact of the problem
Data Calculation	3 Collect and classify data in table/ graphic
Interpretation of data experiment	4 Write the analysis of experiment result based on the reference
Conclusion	5 Make a conclusion

This research followed 4D (*define, design, develop, and disseminate*) procedure according to Thiagarajan (1974). In the define step (research and information collection) was done first data collecting by literature study, introduction study, and need analysis. In design, as second step, product was planned about how it will be developed such as determine component, purpose of developing and target of natural sciences module' user. The develop step included by develop preliminary module, preliminary field testing and main product revision. In the primary of develop step was done product development and validation. The validation was done by the expert (lecturer, science teacher and peer review) to know the module's appropriateness. The appropriateness test was seen from five aspects, such as content appropriateness, presentation, language, graphics and characteristics. The appropriateness standard of the developed natural sciences module was based on the classification of four categories according by Widoyoko (2012). The validated natural sciences module was tested on the field test. The first field test is limited test done by given questioners to the student about their responses towards the module. There are 30 students as the respondents. Total score from the students was converted into interval data with four categories by Widoyoko (2012). The result of this limited test was used to revise and complementary the product. The revision then become main product to be tested in main field test.

The question of reporting and interpretative skills that used to analyze module's effectiveness has been validated. The validity of reporting and interpretative skills questions was counted based on Aiken's V formula. An item could represent measured construct if it was relevant with determined indicators. The range of V score was in range of 0 to 1.00, an item could be valid if had value $V \geq 0.50$ (Azwar, 2014). Reporting and interpretative skills questions validated by expert then tested in thirty two students 9th as empiric test. The result of empiric test inputed in ANBUSHO to analyze the appropriateness and counted by Alpha Crobach formula to analyze the reliability amount that classified on five categories (Rosana & Setyawarno, 2016).

The effectiveness of natural sciences module determined by learning outcome improvement. The improved learning outcomes were analyzed based on the normalized gain average score (<g>). Value of obtained <g> was consulted with three categories, namely (1) high: <g> = 0.7; (2) medium: $0.3 = <g> < 0.7$; and (3) low: $<g> < 0.3$ (Hake, 2007). The improvement can indicate natural sciences module's effectiveness. But to make sure of its effectiveness, should be analyzed based on the normalized gain average score and statistic test with independent sample t test at 0.05 significance level with SPSS 22. Normality and homogeneity tests were performed on pretest reporting-interpretative skills as prerequisite of t-test. Normality test was performed by Kolmogorov-Smirnov test on SPSS 22 with a significance level of 0.05. The acceptance criterion H_0 is H_0 accepted if the significance value is greater than 0.05 (≥ 0.05). The acceptance criterion H_0 in independent sample t test is H_0 accepted when the significance value is greater than 0.05 (≥ 0.05). The t test hypothesis is as follows:

H_0 : Natural sciences module with reflective learning journals cannot significantly improve the reporting and interpretative skills of junior high school student grade 7th

H_a : Natural sciences module with reflective learning journals can improve reporting and interpretative skills of junior high school student grade 7th significantly.

RESULTS AND DISCUSSION

The results of this research is a natural sciences module with reflective learning journal based on the procedure that developed through 4D (define, design, develop, disseminate). In the definition step, analyzing about teaching materials that used by junior high school students, es-

pecially in SMP Negeri 1 Lasem was done. The result of the definition of the availability of teaching materials in the junior high school are still have a few weakness. The material presented in the textbook is still incomplete, some instructional lesson activities were not systematic and contextual, the aspect of legibility and language also difficult to understand, the evaluation test also less empowering thought process learners and some questions are found less in accordance with learning objectives. The results of questionnaires given to learners also show that most learners are less motivated to learn the teaching materials.

The available teaching materials did not provide space for learners to reflect their learning outcomes. Whereas reflection activities are very important to train students' thinking skills, especially in understanding or capturing what is happening, reflecting on them, evaluating and projecting future experiences. Learners tend to assume that they must understand all the content of their teaching materials without interpreting the whole content of teaching materials, so that understanding is just a knowledge for themselves, not as a guideline to deal daily life.

After getting the data from the prior analysis on availability of teaching materials in junior high school grade VII, then researchers design the learning materials needed by learners to develop their abilities. Teaching materials that designed by researchers is science natural module with reflective learning journal for grade VII in junior high school.

The natural sciences module was designed with three main components namely introduction, content, and closing. The introductory section consists of basic competencies, indicators and learning objectives. Basic competence in developed module is 3.7 that is analyzing interaction between living creature and their environment and population dynamics as result of that interaction and 4.7 which presents the results of observations on the interaction of living things with the surrounding environment. Indicators and learning objectives are then derived from these basic competencies.

The content consists of materials, learning activities that students can learn wherever they are, and as a complement there is a reflective learning journal that helps to reflect learners' understanding. The material in the natural sciences module was divided into two units, namely the understanding of environment and ecosystem in unit I while the energy flow in unit II. Each unit begins with a article that can stimulate the curiosity of students to the problems around them. The

Table 2. Results of Validation of Natural Science Module Assisted Reflective Learning Journal by Expert on Each Aspect of Appropriateness

Validation	Validator			Average	Category
	Lecturer	Science Teacher	Peer review		
Appropriateness of Content	3.25	4.00	3.62	3.62	Very Good
Presentation	3.50	3.50	3.75	3.58	Very Good
Language	3.20	3.70	3.60	3.51	Very Good
Graphic	3.62	4.00	3.87	3.83	Very Good
Characteristics	3.25	3.50	3.50	3.42	Very Good
Average	3.25	3.74	3.62	3.59	Very Good

selected article were adjusted to the environmental conditions of the students who are subjected to the use of sciences modules in order that the developed natural sciences module is more contextual and generates its learning motivation because of the problems presented close to daily life. The proximity of the material with learners will stimulate the curiosity and interest of students to learn deeper modules by doing learning activities in the module with pleasure. After doing the learning activities as in the module guide, learners could write their reflection in the level of understanding and feelings during learning the teaching materials in the module. The students' reflection could be written in column provided in each final unit. The column reflective learning journal consist of learning objective, discussion result with teacher and friends, observation result, conclusion, self assesment, and students' feeling expression toward learning material.

Students' understanding on teaching materials in the module, then can be tested through evaluation questions contained in the closing of the module. The evaluation questions are arranged in the module in the form of multiple choice and essays. The closing section is also designed with key answers and evaluation guidelines for facilitated learners to know the results of their evaluation independently and can reflect on the understanding directly, which material has been understood, and which material should be re-learned. Science nature module that was designed then have been validated.

Product Validation Result

Product validation is done by two expert lecturers, three science teacher of junior high school and two peer review. The mean of score results from the three validator categories for each aspect are presented in Table 2.

Table 2 shows that the mean value of the contents of the module is 3.62. The presentation module is 3.58; 3.51 of language modules,

graphic 3.83, and the suitability of the module with the natural science module characteristics assisted reflective learning journal is 3.42. The average of all appropriateness aspects for the value of nature modul supported by reflective learning journal is 3.59. The average score of natural sciences module can categorized as "appropriateness".

In addition to the obtained data from expert validation, the appropriate of natural sciences module can be shown from questionnaire response data of students. Questionnaire response data of students toward natural sciences module were tabulated in Table 3.

Table 3. Recapitulation of Students Response Data Toward Science Nature Modul

Validation	Average	Category
Appropriateness of Content	3.61	Very Good
Presentation	3.70	Very Good
Language	3.47	Very Good
Graphic	3.83	Very Good
Average	3.65	Very Good

The average of all appropriateness aspects from questionnaire response data of student toward nature module with reflective learning journal is 3.65. The average score of natural sciences module can categorized as very good and also it indicated that the module "appropriate".

After limited field test was done by questionnaire respon from the students, nature module should be effectiveness test especially in improving reporting-interpretative skills students grade 7th. The effectiveness test was done as main field test. The test was done used essay question that made with indicator of reporting and interpretative skills which has been tested for its validity and reliability.

Table 4. Recapitulation Result of Empiric Test from Anbuso

Level of Difficulty	Category of Difficulty	Index of Discrimination	Appropriateness Criteria
0.48	Medium	0.13	Appropriate to Use
0.41	Medium	0.20	Appropriate to Use
0.35	Medium	0.20	Appropriate to Use
0.33	Medium	0.30	Appropriate to Use
0.40	Medium	0.25	Appropriate to Use

Validity and Reliability of Test

The validity of essay test has been rated by validator and empiric test. The rated calculation with formula of V Aiken was results that the five essay question of reporting and interpretative skills had content validity 1.00 that indicated valid. Essay questions that has been valid then do empiric test in student grade 9th to know the appropriateness. Theirs appropriateness was analyzed by Anbuso. The analysis result presented in Table 4.

Beside be used to determine the question's appropriateness, the empiric test result then be used to analyzed reliability of the test. Based on that test, the reliability had 0,47 that indicated the reliability level of essay question was medium. After the product was concluded 'valid' and 'reliable', it was ready to implemented in main field test.

Analysis of Main Field Test Result

The main field test was done in 31 students of class A as experiment class and 31 students of class B as control class. The result of average score of normalized gain (<g>) in experiment and control class showed in Table 5.

Table 5. Gain Category of Reporting-Interpretative skills

Class	<g>	
	<g>	Category
Experiment	0.48	Medium
Control	0.35	Medium

Based on the Table 5, the experiment and control class result of the analysis average score of normalized gain (<g>) showed the improvement of reporting-interpretative skills outcomes in experiment and control class is in medium category, but experiment class have greater gain score than control class. The result of analysis average score of normalized gain (<g>) should be confirmed by statistic test with independent sample t test to know the significance of the improvement. Before the independent sample t test

was done, the gain had been tested for normality and homogeneity using the Kolmogorov-Smirnov and Levene tests. The result of both test shows that H₀ received in both class. Experiment and control class have significance level greater than 0.05 (≥ 0.05). Normality test of experiment class have significance level 0.75 and control class have 0.91, while the significance of homogeneity test is 0.311. Acceptance of H₀ on both tests means that the study sample both control and experiment class has normal data distribution and homogeneous.

After through the prerequisite test, the independent sample t test was done. The result of t test showed amount of significance value on the gain score of reporting-interpretative skills is 0.005 that is smaller than 0.05. The smaller significance indicates that H₀ was rejected and H_a was accepted. It means that the natural sciences module with reflective learning journal effective to improve reporting and interpretative skills of students grade VII significantly. The effectiveness of module usage is indicated by a greater increment score in the experimental class than the control class.

The results are consistent with the research conducted by Akerson and Young in Toppen (Toppen, 2014). Their previously research stated that natural sciences module facilitates the learning process of learners more meaningfully with the existence of more contextual learning activities and complete materials. Thinking abilities such as observing, analyzing, interpreting, and concluding learners can be more developed. In addition the availability of reflective learning journal columns can provide space for learners to systematically and coherently expend their experiences. When the learners write down their learning experiences, the understanding of the concept and the ability to interpret and report the data increases. Learners become more free to express their findings during the learning process and their understanding of a concept will be more depth and detailed (Toppen, 2014).

CONCLUSION

Based on the data and result analysis, it could be concluded that natural sciences module with reflective learning journal : (1) appropriate to use for material teaching in interaction between living creature and their environment topic, (2) effective in improving reporting-interpretative skills of students grade VII of JHS. Science teachers are expected to use this module during learning process. Students will also understand more about nature and environment that around them.

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