



## The Development of Ecosystem Module Based on Science Literacy in Senior High School

Dina Novera , Dyah Rini Indriyanti, Aditya Marianti

Universitas Negeri Semarang, Indonesia

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### Abstract

Ecosystem materials taught with contextual examples need to be arranged in a type of teaching material for students. One teaching material that can be used is a module. Modules can be used by students with or without teacher guidance, so that students more easily understand material that is close to their daily lives. This study aims to analyze the effectiveness of the module on learning outcomes and students' scientific literacy abilities, as well as the module development response for teachers and students. This study used a pre-experimental method with the design of one group pretest-posttest design. Based on the results of the ecosystem module research based on scientific literacy effectively increasing student learning outcomes seen from the value of n-gain 0.70 in class X MIA 1 and 0.73 in class X MIA 2 with each criterion high. Effective module on the value of scientific literacy of students with a value of 84.15 in class X MIA 1 and 84.79 in class X MIA 2. Teacher responses to ecosystem modules based on scientific literacy results of 91.30% development of highly feasible criteria and student responses to ecosystem modules science-based literacy results of 85.50% development criteria are very feasible.

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## INTRODUCTION

Indonesia included in the country with classified as low literacy. based on the result of Science literacy by PISA (Programme for International Student Assessment). Indonesia students in a position to 62 of 70 countries who participated in the assessment (OECD. 2016). Based on the low research of result in students literacy. then science literacy needs to be a purpose as the important education.

Low literacy. estimated by learning process in the class. Learning in class. just focused with understanding concept without Implements the learning. which empasize the ability of scientific thinking. toward science concepts and natural phenomenon. Learning should be designed with learning scientific approach. or scientific method. to make students have a good science literacy (Asyhari & Hartati. 2015).

Learning based on the surrounding environment. becomes a way to train the ability of Science literacy Students (Juntunen & Aksela. 2013). The source of learning that based on the surrounding environment. is the effective learning source to students thinking process. because it includes the example of learning that they know everyday (Cimer. 2012). Learning directly will be more meaningful for students because they can see an example concretely. Learning directly. require guidelines in practice. Carry out of learning directly with teachers and teaching material. is an important things to support the learning purpose.

According to the observations in Senior High School 01 Pemulutan Barat. South Sumatera. Teaching material that used in learning process. just only one of the book course (Observation. 2018). Students gained a little knowledge from that book. Ecosystem lessons form that book is not related to the surrounding environment yet. Though the environment around the school is very close to various kinds of ecosystems. such as river

and garden ecosystems. This surrounding environment can be used as student study source (Nisa et al.. 2016). Therefore. it is necessary to use research materials based on the surrounding environment as a supplement to support the learning process. Teaching materials that can be used. one of which is a module.

Module as one kind of teaching material. is effective in learning process. Because module. consist of teaching material completely. also with the exercise to improve students ability. Module is a book. that can make students study or learning independently without teacher guidance (Depdiknas. 2011). Module as media of learning. can explore students knowledge and analyze a problem that can be found (Minarti et al.. 2012). Module in this research. arranged base the results of research in students surroundings environment.

Modules compiled based on the results of research in the environment around students have never been used in the learning process. Therefore the modules arranged need to be tested. The module test aims to determine the effectiveness of the module on learning outcomes and on improving students' scientific literacy. In addition. module trials were also conducted to determine the response of students and teachers as users. Based on this. teaching materials in the form of modules are needed to facilitate students to carry out the learning process and to be able to improve students' literacy skills. So it's necessary to have the research about development ecosystem module base on science literacy.

## METHODS

The research was carried out by Pre-Experimental method with research design One Group Pretest-Posttest Design. The

design of this study was carried out with three steps. 1) giving a pretest. 2) giving experimental treatment to the subjects (applying ecosystem modules based on scientific literacy). and 3) giving posttest. The valuing of pretest and posttest produced from the same or relatively the same / identical measuring instruments (Sudjana & Ibrahim. 2009). Modules used as experimental treatments are modules derived from research results and have been declared valid by expert validators.

The research subjects were 30 students of class X MIA 1 and 30 students from X MIA 2. Data analysis techniques include 1) effectiveness analysis of cognitive values of student learning outcomes 2) effectiveness analysis of the value of scientific literacy tests based on the students answers to scientific literacy questions in the module. and 3) response analysis based on the results of questionnaire assessments given to teachers and students.

The study was conducted by giving the pretest and posttest questions as many as 20 multiple choice questions used to measure student learning outcomes. Pretest was carried out before the implementation of learning activities using modules based on scientific literacy. Posttest was measured after the implementation of learning using modules that produced scientific literacy. In addition to measuring student learning outcomes, the use of ecosystem-based science literacy modules also measures students' scientific literacy abilities.

The science literacy skills which assessed are. science literacy skills in aspect of *knowing* (science knowledge). *valuing* (making science as basis of thinking). and *doing* (sensitive/ caring for the environment, especially the ecosystems after understanding science. Aspect of knowing is measured based on the posttest of students value. The valuing and doing aspects are measured based on students answer from valuing and doing

paper in the module. The ecosystem module based on scientific literacy after being used by students through learning, is then judged to be feasible or not by giving questionnaires to users. Users of the science literacy based ecosystem module in this study are teachers and students.

## RESULTS AND DISCUSSION

### The Effectiveness of Ecosystem Module Based on Students Science Literacy

Student learning outcomes show improvement after the application of learning using literacy-based ecosystem modules. The value of the pretest and posttest of learning outcomes can be seen in Table 1.

**Table 1.** Student Pretest and Posttest Values

Data	Score (average)		N-gain	N-gain Category	
	Pretest	Posttest			
	Value	Value			
X MIA 1	37.00	80.67	43.67	0.7	High
X MIA 2	36.33	82.32	46.00	0.73	High

The pretest scores of students in class X MIA 1 or X MIA 2 have not been able to meet the Minimum Completion Criteria (KKM) determined by the school for Biology subjects at 75. The posttest value of students increases after the implementation of learning using ecosystem-based science literacy modules. The value obtained after using a module that has met the classical completeness requirements of  $\geq 80\%$ .

The low value of pretest students was 37.00 in class X MIA 1 and 36.33. far from the value of KKM because the learning resources of students were less able to meet the cognitive needs of students in the

ecosystem material. In fact students are close to various kinds of ecosystems in the surrounding environment. Ecosystem materials presented in textbooks that students use so far have not presented facts according to their surroundings. The ecosystem material in the textbook used by students has only provided material examples that they have never or very rarely encountered. Through ecosystem modules based on scientific literacy, the results of developing students can better understand ecosystem material with concrete examples of the environment around them. According to Cimer (2012) Learning resources based on the surrounding environment are effective learning resources for students' thinking processes because they contain learning based on examples they know. According to Shofiyah et al. (2014) The use of learning modules based on the surrounding environment can increase students' interest in learning because the learning resources used are able to be applied in everyday life.

Science literacy based ecosystem modules can improve student learning outcomes as evidenced by the n-gain values which are in the high category. The high n-gain category comes from the comparison of the students' pretest and posttest scores. The gain value shows an increase in students' conceptual understanding after learning with an ecosystem literacy based ecosystem module. The increase in the average value of student learning outcomes is obtained from the value of student learning outcomes that are low at the pretest value and increase in the posttest value. The n-gain value shows the advantages of the application of learning by using ecosystem literacy based science modules that can improve student learning outcomes.

Improving student learning outcomes after the application of ecosystem literacy modules based on science is because modules are arranged based on the results of research

from the environment around students. The research modules that are applied in the learning process present ecosystem material with examples they know in everyday life. The module contains examples of species as a component of the ecosystem. They can observe these ecosystem components directly and be presented with information related to the role of ecosystem species.

Several previous studies regarding the use of modules that can improve learning outcomes. Winarti et al. (2015) which states that the ecology module produced by development is effectively used as an ecological material teaching material through the application of problem based learning models. Triwijananti et al. (2014) which states that the development of conservation modules is effectively applied to learning biodiversity material. Purnomo et al. (2013) which states that the application of modules as a source of biology learning has a significant effect on learning achievement in the domains of cognitive, affective, and psychomotor.

Ecosystem literacy based ecosystem modules are compiled based on scientific literacy. The science-based ecosystem module based on development contains aspects of scientific literacy in the form of 1) Aspects of *knowing* science (presenting scientific knowledge). 2) Aspects of *valuing* science (presenting information on the usefulness and role of species in ecosystems). and 3) Aspects of *doing* science students (presents science activities and activities that encourage students to take action / determine attitudes towards ecosystems based on the scientific knowledge they obtain).

The aspects of knowing, valuing, and doing that can be achieved by students with good results are equivalent to the explanation of scientific literacy according to Chiapetta et al. (1991) which states that scientific literacy in teaching materials must fulfill aspects of science knowledge, investigations about the

nature of science. science as a way of thinking. and interactions between technological science and society. The results of students' scientific literacy values after learning by applying ecosystem-based science literacy modules are shown in Table 2.

**Table 2.** Student Science Literacy Values

Clas s	Score (average)			Total (average )
	<i>Knowin g</i>	<i>Valuin g</i>	<i>Doin g</i>	
X MIA 1	80.67	86.00	85.77	84.15
X MIA 2	82.33	85.83	86.20	84.79

Based on the results obtained by the use of ecosystem modules based on scientific literacy. make good results on students' literacy skills. This is evidenced through the values of students in the three aspects of scientific literacy. namely aspects of knowing, valuing, and doing. Table 2 has the value of scientific literacy of students in the third aspect Science literacy has met the minimum completeness criteria set by the school at  $\geq 75$ . The results obtained are in line with the research by Widiyanti et al. (2015) which states that the application of nature-based scientific literacy to science teaching is effective against student activities and learning outcomes.

The good scientific literacy-based ecosystem module used which has presented a variety of scientific knowledge on ecosystem material based on research. This making students' literacy skills in knowing aspects are fulfilled. Ecosystem literacy module based on science also provides useful information on each species making up the ecosystem module so that students can appreciate science as a basis for thinking and determining attitudes. This making students' scientific literacy skills in valuing aspects are

fulfilled. This science literacy-based ecosystem module presents the demands of activities aimed at students to be sensitive/ caring for the environment especially for ecosystem materials. This making the students' scientific literacy abilities on the doing aspects fulfilled. Crall et al. (2012) stated that science education given in schools would affect students' knowledge and attitudes towards science resulting in changes in behavior towards the surrounding environment.

The *knowing* aspect of module is presented with ecosystem materials in the form of research on components of river ecosystems and garden ecosystems. patterns of species distribution in ecosystems. interactions between ecosystem components. interactions between species. energy flows. and ecosystem damage and maintenance efforts. The presentation of knowing aspects in the module makes students have scientific knowledge. Science knowledge presented in the module is the basis or initial concept that students must have to understand science and have good scientific literacy skills.

The *valuing* aspect of module is presented with questions that lead students to give answers to assess their thinking processes. Student answers show their attitude as someone who values science and makes basic science think and determine attitudes. Students can answer questions on valuing aspects because modules are structured with information about the usefulness of species and the role of species in the ecosystem. Through this information students' literacy skills become good.

The *doing* aspect of module is presented with activities that direct students to do things both thinking and acting sensitive to the environment. especially those related to ecosystem material. These activities show the attitude of students as someone who understands science in everyday life. Students can think and act wisely as someone who

understands science because the activities presented in the doing aspect direct students to be sensitive to the environment after understanding science. Assessment of doing activities is able to show students' scientific literacy skills to be good.

### Response to Module Development for Teachers and Students

The teacher response questionnaire was given to the teacher as the respondent to find out the impact of developing ecosystem modules based on scientific literacy on the implementation of the teacher's task in preparing lesson plans, implementing learning, and evaluating learning outcomes. Questionnaire response to find out the usefulness of the module for students in the implementation of learning and to find out the usefulness of the module content to facilitate students in understanding learning material. The results of user responses can be seen in Table 3.

**Table 3.** User Response to Science Literacy-based Ecosystem Modules

Users	Score	Criteria
Teacher	91.30	Very decent
Students	85.50	Very decent

Table 3 shows that teachers provide a very decent response to the implementation of learning using module-based scientific literacy with a percentage of 91.3%. This science literacy-based ecosystem module is stated to be very feasible because the module can be an alternative source of teaching materials used by the teacher. The module contains ecosystem material that contains facts in the surrounding environment. The module also contains questions that are able to direct students to use science as a basis for thought processes. Learning activities in the module make the module feasible to use in assessing students' abilities. Based on this, the ecosystem literacy-based ecosystem module

facilitates the teacher's assignment in the RPP compiler, in the implementation of learning, and in evaluating student learning outcomes. Hung et al. (2016) states that the modules used in the learning process have fewer students using this module based on the results of the study and are teaching materials that contain local potential that is close to the student learning environment.

Students provide a very feasible assessment of learning using science-based modules with a percentage of 85.5%. Modules are declared appropriate for students because the module contains materials that make it easier for students to understand learning. In addition, the module contains clear images and learning activities outside the classroom so that it is interesting for students to learn. Based on this, the science-based science literacy module is interesting to learn from students both in terms of learning and from the interesting and useful side of the modules used. Neik et al. (2016) stated that interesting and interactive teaching materials bring a positive attitude to students. Holbrook & Rannikmae (2009) states that science will be easier to learn when what is learned makes sense in the views of students and is related to human life.

### CONCLUSION

The results showed that ecosystem based on science literacy modules effectively improved students learning with n-gain values of 0.70 in class X MIA 1 and 0.73 in class X MIA 2 with showed high criteria. An effective science literacy base on ecosystem module used to measure science literacy skills of students with a value of 84.15 in class X MIA 1 and 84.79 in class X MIA 2 who had fulfilled  $KKM \geq 75$  for Biology subjects. The teachers response to the use of modules is 91.30% with very feasible criteria, and students responses to module are 85.50% with very good criteria.

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