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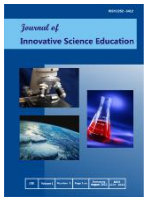

The Development of Biodiversity Module Using Discovery Learning Based on Local Potential of Wonosobo

Sri Sunarsih[1] ✉, Margareta Rahayuningsih[2], Ning Setiati[2]

[1.] SMA N 1 Kertek, Indonesia
[2.] Universitas Negeri Semarang, Indonesia

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Abstract

A module is a mean of supporting Biology learning in addition to the textbook as a reference. The reference book that is used, still presents theories, concepts, and general examples and does not represent the local environment. Meanwhile, Wonosobo has the potential for interesting biodiverstity to be used in learning. The use of Discovery Learning is suitable to be applied to biodiversity material because it provides opportunities for students to get material through the surrounding environment. The research aims to develop and find out the appropriateness and the effectiveness of biodiversity module using Discovery Learning model on local potential of Wonosobo. The module was developed according to the research and development procedures by Sugiyono (2015). The test sample was taken using a purposive sampling technique. Small-scale test sample was done on 10 students. The large-scale trial design used the pretest-posttest control group design, class X MIPA 1 as a trial class of 32 students and class X MIPA 2 as a control class of 31 students. The results of the T-test obtained a value of 0,000 <α which showed a significant difference. The increase in learning outcomes (N-Gain) in the experimental class is 67% in the medium criteria, the achievement of the KKM was 75% of students with an average value of 71.88. The research result shows that the development of biodiversity module using Discovery Learning based on local potential of Wonosobo is appropriate and effective to be used in SMAN 1 Kertek.

✉ Correspondence address:
Jl.Raya Kertek km 06 Wonosobo, Indonesia
Email : srisunarsihbio@yahoo.com

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INTRODUCTION

A module is a supporting tool in Biology learning that cannot be separated from the learning model used by the teacher. So far, the teacher uses a handbook that has been determined by the government as the main reference, but the book tends to present general theories, concepts, and examples and does not represent local environmental conditions. Students need learning tools that explore local potential so they can encourage students to be more concerned with the environment. Building students' character through learning is one of the ways in SMA N 1 Kertek as the National Adiwiyata School in realizing a school that is enviromental cultured.

The use of local potential as a learning resource is also one of the characteristics that is expected by the curriculum so that learning becomes applicable and meaningful (Sarah & Maryono, 2014a). The use of local potential also supports the application of 2013 Curriculum which wishes the teachers to play a role in building the character of students through learning activities. One of the ways is through the Discovery Learning that provides opportunities for students to find a concept through the examples that are found in everyday life. It will help students in understanding the material concepts so as to improve student learning outcomes and foster an environmentally caring attitude towards students (Azhari, 2015; Sukardi et al., 2015; Muthmainah et al., 2016; Wahjudi, 2015).

Preliminary research shows that 93% of teachers have never applied teaching materials or modules based on local potential. Nevertheless, all teachers agree with the use of local potential as a learning resource and agree that the preservation of local potential starts from the introduction of local potential. The results of the questionnaire with 25 students as the respondents from class X MIPA 3, shows that 100% of students have not been able to associate the concept of biodiversity with local potential that exists around them.

Wonosobo has the interesting potential for biodiversity. These potentials include the Dieng Plateau, Pengilon Lake, Telaga Warna, Tuk Bimalukar, Sikidang Crater, Sileri Crater, tea garden area, potato farms and vegetables farms that reflect a diverse ecosystem. In addition, the Tuk Bimalukar cultural heritage and science area (Kejajar Subdistrict) has the potential as a source of learning for spring water conservation (BPS Wonosobo, 2012). Wonosobo also has a typical dieng plant, carica (*Carica pubencens*) which shows diversity and a unique phenomenon in the form of dreads in Dieng which shows the diversity of genes. The environment around the school also has a great potential because in the school environment there are artificial and natural ecosystems. Artificial ecosystems such as ponds, gardens, rice fields, greenhouses, and parks, while natural ecosystem is a river. Biodiversity in both the school and Wonosobo environment has great potential as a source of learning.

Learning is an effort of a learner to develop the entire personality, both physical and psychological (Suyono, 2016). Therefore, learning is developed so that students have the ability that includes three domains namely cognitive, psychomotor and affective domains. The affective aspects in SMA 1 Kertek have not been seen in learning. Based on the results of learning on Biodiversity material, students of class X MIPA 3 SMA N 1 Kertek academic year 2017/2018 on average 64, with KKM (minimum competency criteria) 75. Percentage of students completed the KKM at 72%. The data shows that the class average is below the KKM standard expected by the school.

Previous research on the use of modules and their effects on learning outcomes has been widely carried out. Learning outcomes that have been studied by researchers include cognitive, psychomotor, and affective aspects. Research results of Novana et al. (2014), shows that students who use guided inquiry modules based on local potential have cognitive, affective, and psychomotor learning outcomes that are better than conventional learning. Wahyuni (2015) examined critical thinking skills through

research using local wisdom-based learning tools capable of improving critical thinking skills in the medium category. The results of the study above are supported by research by Pamungkas et al. (2017) that shows that science learning modules based on local potential are able to improve the learning outcomes of students' cognitive domains. Awang and Zakaria (2012) stated that modules that present real examples in everyday life and are related to learning topics can help in mastering the concepts that have just been learned. Local potential provides an opportunity for teachers to make it easier to associate new knowledge to be conveyed to students (Sajidan, 2014). This can be done by incorporating elements of local potential in learning activities.

Wahyuni et al. (2016) using Biology module based on inquiry real world application to effectively improve spiritual aspects, social aspects, skills aspects and knowledge aspects with diverse results. Meanwhile, Sarah and Maryono (2014b) shows that learning tools based on local potential can improve living values as the main factor to build student character. Other studies support that learning tools based on local potential can influence student character. Hasanah et al. (2016) states that the attitude of caring for students' environment between before and after learning has increased.

Local potential is the potential of specific resources possessed by a region including natural, human, technological and cultural resources that can be developed to build national independence (Sarah and Maryono, 2014a). Local potential-based education has a positive goal for students, namely a) improving living values that can be directly observed (tangible) such as religious, caring for the environment (clean, neat, safe, comfortable, beautiful, calm, and cool), discipline, empathy , cooperation, courtesy, friendliness, smile, and greetings (Sutjipto, 2011), b) forming students who have character as part of school life (Romanowski, 2005). Ibrohim (2015) said that learning that utilizes teaching materials taken from the context of the surrounding environment is expected to make students care about the environment. Therefore, it is important to develop and determine the feasibility and effectiveness of biodiversity module on local potential of Wonosobo toward the learning outcomes.

METHOD

The study uses a research and development procedure that has been modified from Sugiyono (2015). This study begins with problem analysis, development, and trying out. Development of local potential module design is adjusted to Core Competence (KI), Basic Competence (KD), and indicators of achievement on biodiversity material. The module design was validated by four validators, namely two validators were science study program lecturers of postgraduate UNNES and two Biology teachers. The validated module was tried out on 10 students of class XI MIPA. This limited scale trial aims to test the level of readability of the module. The module trial uses the pretest post-test control group design. Sampling at the trial phase uses purposive sampling technique. The sample in this study was 32 students in the experimental class and 31 students in the control class. Data collected in this study include data on potential analysis and problems that were gathered by using questionnaires for development needs and observation sheets, data on module feasibility by experts were gathered by using validation sheets, data of readability level from the modules by students were gathered by using questionnaires, data on student activities collected through questionnaire, and data on student learning outcomes in biodiversity material in the form of cognitive tests obtained from post-test scores and affective tests obtained from questionnaires. Data were analyzed qualitatively and quantitatively.

RESULTS AND DISCUSSION

The development of Biodiversity Module Using Discovery Learning Based on Local Potential of Wonosobo

The result of preliminary research indicates that biodiversity modules of local potential-based have never been used. Data was taken through questionnaires given to students who had obtained biodiversity material and Biology teachers in Wonosobo District. The first factor that caused the absence of this module was because there was no inventory of local potential and a lot of material on the Basic Competence (KD) made the Biology teacher in Wonosobo Regency did not have time to enrich the analysis of KD material. This problem is common to the majority of teachers because the change in the teacher's mindset to the scientific approach is not easy and it takes many years to learn and get used to it (Sukowati et al., 2017), whereas the richness of natural and cultural resources in Indonesia can be adjusted to science is relevant in the form of modules or textbooks (Parmin et al., 2015). The existence of local potential based books is proven to bring students to understand the concept of environmental material while recognizing local potential in their area (Ilma & Wijarina, 2017).

The second factor is the lack of awareness and concrete action from students and teachers to preserve local potential that starts from the introduction of local potential through education. Biodiversity has enormous directly benefits for society such as economic, biological and indirect benefit. Sufficient and serious understanding can even lead to sustainable development in a country. According to Canhos et al. (2015), environmental preservation as a source of sustainable development, regulations and actions must start from the local scale to national scale and diversity data collection not only increases access and use of data for science but also to support education and public regulations that are effective for countries with megadiversity. The concept of biodiversity is very complex in Biology which shows the importance of the role of teachers in the classroom. Motokane (2017) develop the level of concept of learning biodiversity in three levels consists of prevention, conservation and rehabilitation of biodiversity. These three actions can be started if students recognize the potential that exists in their environment.

Analysis of local potential that can be used to develop biodiversity modules is spread in the school environment and in the Wonosobo district. The biodiversity of the ecosystem is in the form of parks, greenhouses, tea gardens, vegetable gardens, fish ponds, rice fields, forests, craters, ponds, reservoirs. Species diversity is in the form of Carica pubencens which has the same genus as papaya. The diversity of genes is in the form of local durian varieties in Wonosobo and the phenomenon of dreadlocks in Dieng. In addition, there are environmental problems such as environmental damage due to potato farming and exploitation of natural resources that can provide concrete examples to students regarding environmental problems. This module is a learning module that can be used as an additional source of learning for biodiversity materials based on the local potential of the Wonosobo area.

Feasibility

The design of local potential-based biodiversity module was produced based on the results of the needs analysis. The module was designed based on the Discovery Learning model and used local potential then developed and get criticism and suggestions from validator education experts, material experts and Biology teachers. The validator assessed local potential-based biodiversity module.

Table 1. Results of Validator Assessment of Local Potential-Based Biodiversity Module

No	Component	Validator 1	Validator 2	Validator 3	Validator 4	Mean
1	Content Feasibility	28	28	29	28	
2	Language	27	25	26	25	
3	Delivery	19	18	18	19	
	Total Score	74	67	73	72	
		92.5	83.8	91.3	90	89.4
	Level	Very feasible	Feasible	Very feasible	Feasible	Feasible
	Criteria	Valid	Quite valid	Valid	Quite valid	Quite valid

The results of the validation of the four validators obtained an average value of 89.4 in the level feasible with quite valid criteria. It shows that the appropriate local potential-based biodiversity module can be used with a slight revision according to the suggestions and advises from the validators.

The first disadvantage of the local potential-based learning module according to the validator lies in the failure to fulfill module indicators that can invite children to be able to develop entrepreneurship. The directing indicators are limited to the question of triggering the idea of selling local potential Carica. Effective development of entrepreneurship based on local potential requires several stages that lead in the fields of production, training and marketing (Malik & Mulyono, 2017). Another study is needed to integrate with other subjects because the time allocation and syllabus and effective hours of learning and teaching activities are limited.

Biodiversity material can be integrated with entrepreneurial subjects. In the curriculum and syllabus of entrepreneurship education there are planning, production, marketing and evaluation materials in the sub-fields of cultivation and crafting. Cultivation of food crops, ornamental plants, ornamental fish, consumption fish, laying hens and broilers. While from the craft that is crafting objects and non objects, as well as waste objects. Cultivated plants or animals can be used as integrated material regarding the types of diversity that affect the marketing of a cultivation product. While handicrafts show various types of economic benefits of biodiversity in economic terms.

The second drawback is the lack of clues that direct students to be able to learn independently and reflectively without a teacher. It is because the module does not function as a primary learning resource so students can search for and use other learning resources.

The advantages of biodiversity modules based on local potential material lie in the typical characteristics of the module, namely the number of activities that invite students to recognize and use the diversity of local potential as a source of learning. Integration of local potential makes learners (students) directly come into the life to implement theories and develop creative and critical thinking skills (Juniati & Sari, 2016). Integration in learning by utilizing local potential can even improve vocational skills, namely life skills that can be used daily. Vocational skill-based learning models based on local potential proved effective in increasing the value of student appreciation for the local potential of *jengkol* fruit and increasing attitudes and entrepreneurial skills (Lia et al., 2017).

Local potential-based biodiversity module that has been revised through small-scale trials. The results showed that the average rating of students on the module readability level of 84.4% was included in the good category. All respondents agreed that the activities in the

module could increase their knowledge about the local potential around them. A large-scale test was conducted on class X students of SMA 1 Kertek using control and experimental classes.

Module Effectiveness

Local potential-based biodiversity module that has been revised based on small scale trial was tested for their effectiveness on learning outcomes. The test was conducted with the quasi-experimental method in class X MIPA 1 as an experimental class with 32 students. Data obtained from this trial is the data on the number of scores on student learning outcomes. Student learning outcomes in the form of post-test scores, the score of environmental care attitude, and the score of student activities.

1. Post-test Score

Student learning outcome is taken from the score of post-test on biodiversity material. The results of students' post-test scores show that the experimental class N-Gain reached 67% and the control class only reached 23%. Based on the reference that (<g>)> 70 categorized on the high category, 30 <(<g>) <70 medium and (<g>) <30 low. The experimental class N-Gain value was 67% in the medium category. It shows that there are differences in post-test results between classes using local potential-based module and learning that does not use local potential-based module.

Testing the hypothesis must meet the requirements of homogeneous and normal data. Homogeneity can be seen from the normal test value of 0.466. The homogeneity test results are 0.162 which indicates that the data is homogeneous, so that it can use the T-test. The results of the T-test obtained a sig value of 0,000. The sig value $<\alpha$ so H_0 is rejected. So there is a significant difference between the control class and the experimental class (the module being developed is effective).

Based on the attainment of reference minimum competency criteria set at 68 data obtained 75% of students declared complete that is as many as 24 students from a total of 32 students in the experimental class. It is in accordance with the effectiveness criteria for using module in the experimental class.

2. Score of the implementation on student activities

This data was taken using a learning implementation questionnaire with 31 item statements. Questionnaires were filled by students in the experimental class (class X MIPA 1) as many as 32 students and the control class (class X MIPA 2) as many as 31 students.

The result shows that in general the activities of the experimental class students are better than the control class. The experimental class activity was 65.6% very good, 31.3% good, 3.1% sufficient and 0% less. It means that all students who get good and very good scores are 96.9%.

3. Score of students' environmental care attitude

Attitude scores were taken through questionnaires about students' environmental care attitude. In this questionnaire there are 24 items with two categories of answers, namely the answer (score 1) and no (score 0). The maximum score of this questionnaire is 24. Questionnaires were filled by students of the experimental class (class X MIPA1) as many as 32 students and the control class (class X MIPA2) as many as 31 students. The results of filling out the environmental care questionnaire showed that in general the experimental class students had a good caring attitude (59.4) and very good (37.5%) a total of 96.9%.

The results of the study showed that learning using a local potential-based biodiversity module was effectively applied in SMA N 1 Kertek. Student learning outcomes in the experimental class are generally better than the control class, seen from cognitive, affective, and psychomotor aspect. The difference between experimental and control class cognitive learning outcomes is caused by differences in learning methods and teaching materials. In the experimental class students carry out various learning activities using local potential-based module. Control class learning is done by doing learning that is usually done in SMA N 1

Kertek. Control class learning uses discovery learning but still uses phenomena or material in general, not yet using local potential in learning. The experimental class has the advantage that the use of local potential has a large impact on student learning outcomes. As stated by Prabowo et al. (2016) which states that local potential-based module make it easier for students to learn. According to Situmorang (2016) nature gives great potential as a contextual learning resource. Contextual learning is able to improve critical thinking skills in students (Habibah et al., 2017).

Learning that starts with reading the module and making observations makes students able to think critically. The module adds new knowledge to students and then connects the environment and the concepts listed on the practice and thinking. The following is one form of student thinking results in answering questions in the module. Local potential that is integrated with learning can increase the level of critical thinking of students. Local potential in integrated learning helps students to gain deeper experience from the surrounding environment in the form of facts, concepts, principles, natural laws, models, and theories that build the knowledge (Dewi et al., 2017). The module supports discovey learning where students will find out and investigate themselves so that the experience gained is longer in the brain. (Puspitasari et al., 2018).

Local potential-based learning module also makes more student activities than the control class. The module directs students to use various media such as mobile phones, images, the surrounding environment and so on. The use of media is used for activities and learning processes of observation worksheets, practice worksheets, critical thinking worksheets and forms of appreciation of the environment make students do more learning activities compared to the control class. Learning media influences student learning activities (Istiqomah et al., 2016). Khoiri (2016) states that learning that connects local potential contexts with learning material will help students to achieve learning goals. This is in line with the statement of Sudarmin & Samini (2015) which state that learning using integrated ethnoscience modules in problem-based learning provides opportunities for students to be directly involved and active in scientific activities and provide valuable experience to students about science learning in the context of local wisdom.

The use of the school environment as a learning object makes students close to learning material. Learning objects that are close to students also make students interested in environmental issues around them. It fosters a sense of pride and gratitude as a Wonosobo community that has natural beauty and abundant product. In addition to the potential, the problems that occurred in Wonosobo were also appointed, so that students knew the potential as well as the existing problems. Students are also encouraged to find out about environmental problems faced and are guided to provide solutions to save the surrounding environment, so that a generation that cares about the environment is formed.

The use of local potential helps students be able to determine the type of ecosystem based on the ecosystem in the Wonosobo area. The existence of a local ecosystem enriches students' knowledge. Students are also able to connect the concept of ecosystems in general and the types of vegetation that exist in the local environment. It is important for the sustainability of various types of potential ecosystems. Moreover, the majority of ecosystems are exploited as a source of ecotourism and economy. Integration of local potential in contextual learning activities in addition to adding insight also encourages students to develop and strengthen regional potential as one of diversity conservation (Rizqiya et al., 2018).

This module supports the implementation of learning so students are able to actively explore the school environment so that they can observe and collect the data. The questions in the module also lead students to draw conclusions about the diversity of genes. In line with it, learning by exploring the environment makes students able to classify observed events so as to increase students' understanding of

concepts (Afifah et al., 2017). Understanding of concepts is seen when students of the experimental class show the results of observations correctly. In the module, the material about diversity of genes is centered on examples of gene diversity in durian, chicken and humans, but when faced with a school environment that has different examples of material they are able to answer well.

Students recognize the potential of local durian well so that it makes it easier for students to understand the material level of gene diversity. The difference in size, color of fruit flesh, thickness of meat in durian makes it easy for students to understand that the differences are caused by genes. Another potential in Wonosobo in the form of dreadlocks also makes students aware that there is a striking diversity in humans so students can analyze the level of biodiversity.

Diversity of species uses the example of Carica known to students as a typical Dieng plateau plant. The differences found between carica and papaya make it easier for students to understand the concept of species level diversity. The concept of species-level diversity is limited to the area where the organism is present, reinforced by observing species diversity in the school environment. Learning becomes more interesting and fun. Ecosystem diversity is presented by the "Let's Practice" activity which displays various ecosystems in Wonosobo such as natural lake, tea plantation craters and parks. Students' ability to identify these ecosystems shows the achievement of learning indicators.

Module effectiveness is closely related to the learning process using discovery learning methods. This method guides students to organize material concepts independently. Through this module students gain new knowledge through fun learning activities. Students are invited to explore problems and phenomena that occur directly in the surrounding environment. This learning focuses on student activities as a center of learning, so that students' activeness plays an important role in the success of learning. This is supported by the results of the analysis of Putri et al. (2017) that there are differences due to the influence of the Discovery Learning learning model on student learning outcomes.

The module being developed also invites students to develop a culture of literacy. Student activities in learning are developed so that students' scientific literacy is formed. Module as supplementary teaching material consists of material descriptions, student activities in the form of observation activities, let's practice, let's think, let's appreciate, how aware you are and competency tests. Integrated science learning materials based on scientific literacy are proven to be able to improve students' literacy skills (Christina et al., 2016).

In the 21st century, scientific literacy is the focus of science education (Safitri et al., 2015). According to PISA, scientific literacy is the ability to use science, identify questions, make conclusions based on evidence that makes decisions in everyday life and interactions between humans and nature (Bybee & McCray, 2011). So, student learning activities are expected not only limited to understanding the concept but students are expected to be able to apply the knowledge gained to solve everyday problems and other problems in their environment. In addition, the results of the study indicate that the development of local wisdom-based science module is suitable for improving students' scientific literacy skills (Setiawan et al. 2017).

The attitude of caring for the environment as a social attitude developed in this Basic Competence was explored using a questionnaire. The advantage of this technique is that students fill in according to their own assessment according to their respective circumstances. The weaknesses that students fill without mature thinking so that they answer randomly. The results of the experimental class attitude obtained 19% results were very good, 31% were good, while the control class was 16% very good and 42% good. It shows that the assessment of environmental care does not show a striking difference. Very good attitude (19%) in the experimental class was higher than the control class (16%). A positive attitude towards the

environment relates to activities in working on local potential-based module. Activity in the local potential module invites students to observe the surrounding environment. Students see the environmental conditions directly problems that exist, and directed to analyze the causes, impacts and solutions that can be used to overcome these problems.

The thinking process begins with an understanding of the faced problem. In addition, Mumpuni et al. (2013) stated that the form of integration of learning material in accordance with environmental issues, could facilitate students in solving environmental problems. Student activities in learning can foster a sense of belonging to the environment which will later make students have an attitude that cares about the environment. It is in line with the opinion of Marlina et al. (2015) which states that local potential modules can improve students' environmental care attitude. The school environment and local potential that is raised make students closer to the existing environmental problems, thus fostering an attitude of student concern for the environment.

CONCLUSION

The development of biodiversity module using Discovery Learning based on local potential of Wonosobo is feasible enough and effective to be used in SMA N 1 Kertek. The feasibility was seen from the result of expert validation. The effectiveness was seen from the post-test result, questionnaires on environmental care attitude, and questionnaires on students' attitude.

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