



Development of Invertebrate Module Based in PjBL for Class X

Herdiya[✉], Sri Ngabekti, Partaya

Universitas Negeri Semarang, Indonesia

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Abstract

The learning process in the classroom is currently still using sources from textbooks books that make students bored so that students learning interest is reduced and does not arouse students' curiosity in the learning process, the availability of learning support books is needed, one of them is by developing modules. Module specifications were developed based on the results of Invertebrate exploration. The purpose of this study is, (1) to explain the types of Invertebrates found to compile modules, (2) to find the characteristics of modules (3) to test the validity, practicality, and effectiveness of Invertebrate module based in PjBL. This research is an R & D conducted in SMA N 1 Sungai Raya, class X in the 2018/2019 school year. The results showed as many as 20 types of several Invertebrate phylum found on Lemukutan Island and Kakap Estuary Coast. The results of the module validation from the material experts 89.80 and 98.38 media experts with very valid criteria. The practicality results of students 86.46 with very practical criteria, and effectiveness seen from the cognitive results with classical completeness of 97%, and the psychomotor value of students amounted to 91.53 with very good criteria. The conclusion from this study is that the Invertebrate module in PjBL-based is valid, practical, and effective in the learning process.

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[✉] correspondence :
Postgraduate Universitas Negeri Semarang
Jalan Kelud Utara III No.37, Kota Semarang, Indonesia 50237
E-mail: Herdiya@students.unnes.ac.id

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INTRODUCTION

The government is currently implementing the 2013 curriculum to keep pace with scientific and technological progress. The learning process in the 2013 curriculum is carried out through a scientific approach (scientific approach). But the fact is the implementation of the 2013 curriculum still has obstacles, one obstacle is the lack of books that can cause interest and curiosity of students in learning. Based on the results of interviews with biology teacher class X SMA Negeri 1 Sungai Raya learning resources used in the learning process in the form of worksheets and learning media using powerpoint. LKS used by students are a collection of short material that has not been discussed in depth material, and the images presented are not colored, so that there is no standard grade X biology material.

Based on teacher interviews, Animalia material has low completeness. This is because Animalia studies all animal classifications of both Invertebrates and Vertebrates, Invertebrate material is widely discussed material but the classification and examples of animals in LKS are still small. Teachers and students are not enough to just use LKS but also other teaching materials that can help in improving student learning outcomes and scientific attitudes, According to Triwijananti et al. (2014), teachers need to develop teaching materials that are in accordance with the curriculum, learning characteristics, and solve learning problems. including developing modules. Modules based on exploration results can be one of the appropriate alternative teaching materials to help increase student interest and learning outcomes.

One of the media that can help Invertebrate learning is durability. Invertebrate preserves come from the results of Invertebrate exploration found in the Lemukutan Island and Kakap Estuary Coast areas, by using preserved students will be able to see objects directly in the module, so learning becomes a new discovery for students. In addition to the use of modules and durability, the learning process of Invertebrates will also be applied in the school environment, this is intended so that students can see firsthand a natural process that occurs around the school environment, especially in terrestrial invertebrate animal

species. The appropriate learning model for realizing learning is PjBL. Based on the description above, it is important to develop research at SMA Negeri 1 Sungai Raya by using the Invertebrate module based in PjBL for Class X High Schools. The purpose of this study (1) Explain the types of Invertebrates found, (2) Finding the characteristics of Invertebrate module based in PjBL, (3) Test the validity, practicality, and effectiveness of Invertebrate module based in PjBL for grade X high schools.

METHODS

This study uses an R&D method adapted from the ADDIE instructional model. This ADDIE model was chosen based on its simple and systematic structure, Aldobie (2015) The steps or procedures for research and development can be seen in Figure 1.



Figure 1. ADDIE Development Model Diagram

This research was conducted at SMA Negeri 1 Sungai Raya, the research subjects were students of class X in 2018/2019 school year. Research subjects for small-scale product trials consisted of 15 students of class XI, while large-scale product trials consisted of 30 students of class X, The research design uses one group pretest-posttest, which is conducted in a group without a comparison group. Research sources are divided into two, namely research and development research. The source of research data comes from the identification of Invertebrates on Lemukutan Island and the Kakap Estuary Coast. Source of development data is based on the results of determining the validity of modules from experts, response data based on the results of readability and practicality, as well as the effectiveness data from the students' pretest and posttest assessments as a result of the cognitive and psychomotor data of students.

RESULTS AND DISCUSSION

Island and Kakap Estuary Coast, West Kalimantan. The types of Invertebrates found can be seen in Table 1.

Types of Invertebrates found

Invertebrate exploration as preliminary research data was carried out on Lemukutan

Table 1. Types of Invertebrates found

Spesies	Familia	Filum	Location
<i>Haliclona cinerea</i>	Chalinidae	Porifera	Lemukutan Island
<i>Favites</i> sp	Meruliinidae	Coelenterata	Lemukutan Island
<i>Euphyllia glabrescenes</i>	Caryophylliidae		Lemukutan Island
<i>Sinularia</i> sp	Alcyoniidae		Lemukutan Island
<i>Cerithium nodulosum</i>	Cerithiidae	Mollusca	Lemukutan Island
<i>Lambis lambis</i>	Strombidae		Lemukutan Island
<i>Polymesoda bengalensis</i>	Cyrenidae		Lemukutan Island
<i>Gafrarium tumidum</i>	Veneridae		Lemukutan Island
<i>Anadara antiquate</i>	Arcidae		Lemukutan Island
<i>Tridacna crocea</i>	Cardiidae		Lemukutan Island
<i>Octopus</i> sp	Octopodidae		Lemukutan Island
<i>Archaster typichus</i>	Archasteridae	Echinodermata	Lemukutan Island
<i>Diadema antillarum</i>	Diadematidae		Lemukutan Island
<i>Namalycastis rhodochorde</i>	Nereididae	Annelida	Kakap Estuary Coast
<i>Pheretima</i> sp	Pheretimanidae		Kakap Estuary Coast
<i>Haemadipsa zeylanica</i>	Haemadipsidae		Kakap Estuary Coast
<i>Scylla serrata</i>	Portunidae	Arthropoda	Kakap Estuary Coast
<i>Panulirus polyphagus</i>	Palinuridae		Kakap Estuary Coast
<i>Mecopoda elongata</i>	Tettigoniidae		Kakap Estuary Coast
<i>Julus julus</i>	Julidae		Kakap Estuary Coast

Based on Table 1, 20 species of Invertebrates were found, consisting of 13 species found on Lemukutan Island and 7 species found on the Kakap Estuary Coast. The Lemukutan Island area is commonly found in Mollusca, Coelenterata and Echinodermata. One type of Mollusca found is sea slug. Based on research by Magdalena et al. (2019) an environment that is suitable for the diversity of sea snails that is in shallow waters and close to mangrove plants because it indirectly provides adequate nutrition for sea snails. The type of phylum Coelenterata found was *Haliclona cinerea*. At the time it was found to be bright purple, the body was like a tube and attached to a coral. Based on research by Eisapor & Safaeian (2013) *Haliclona cinerea* belonged to the demospongiae class in sheet-form, had round chimneys like tall chimneys, supple and smooth texture, the structure of regular spicules was connected with spongia.

Invertebrate exploration on the Kakap Estuary Coast, one type found was *Namalycastis*

rhodochorde from the phylum Annelida. This worm is found in the mangrove area, flat and there are parapodia on both sides of the body. The habitat immerses itself in moist and watery soils that have high organic levels. Based on Junardi's research (2008) *Namalycastis rhodochorde* prefers soil with organic carbon content resulting from the decomposition process of nipah plant tissue.

Characteristics of module development

The format of the Invertebrate module that was developed included preface, table of contents, material chart, introduction, general characteristics of Invertebrates, phylum parts of Invertebrates, animal preservation, formative tests, LKS, references, and glossary. Characteristics of Invertebrate module based In PjBL. (1) The module is the result of Invertebrate exploration, (2) The information contained in the module is about the characteristics of Invertebrates with the role of Invertebrates, (3) the module developed can add information about

regional Invertebrate diversity, (4) there are formative tests and LKS that can improve student learning outcomes, (5) Invertebrate modules use the PjBL (Project Based Learning) model.

The PjBL-based approach was chosen according to KD 3.9, which applies the principle of classification to classify animals into phyla based on body shape, body symmetry, body cavity and reproduction, KD 4.9 Presenting comparative data on comparisons of the complexity of animal layer constituents (diploblastic and triploblastic), body cavity symmetry and reproduction. According to Tamim & Grant (2013) learning using PjBL helps teachers and students in the learning process including supporting, facilitating, and improving the quality and learning process, research (Muhafid et al., 2013; Elmovriani et al., 2016) learning using modules based on student responses are very feasible to use and help students improve student learning outcomes above KKM.

Module validation by media experts and material experts

Validation is needed as a basis for determining the feasibility of modules developed in the learning process. The module validators consist of one media expert lecturer, one material expert lecturer and one biology subject teacher. The overall results of material validation were 89.80 and the overall results of media validation were 98.38. So the Invertebrate module based in PjBL shows that the criteria are very valid and can be used in learning. Based on suggestions and input from the validator, the developed Invertebrate module has several revisions and improvements to produce a good Invertebrate module. Suggestions from media experts are to improve concept maps into material charts, while suggestions from material experts to improve writing scientific names and conjunctions. A high validity value is given by the validator because the module developed is based on the results of Invertebrate exploration in the West Kalimantan area presented in the learning module so that students can know the diversity of Invertebrates in their area. This is in accordance with Parmin & Peniati (2012) learning modules in the form of research results are very effective and can be used in learning. According to Aidah et al. (2018)

identification teaching materials based on discovery, effective and practical to improve cognitive learning outcomes and science process skills.

Practicality of PjBL-based Invertebrate Modules

Invertebrate modules based in PjBL that have been tested on a small scale are then revised so that the modules can be applied to large-scale test learning. To determine the teacher and student assessment of the practicality of the module, the module practicality questionnaire was used. The results of practicality are seen in Table 2.

Table 2. Results of teacher and students assessment of the practicality of the Invertebrate module based in PjBL.

Aspect	Percentage	
	Teacher	Students
Ease of Understanding	75	88.33
Independence Learning	75	82.50
Effectiveness in Learning	87.50	83.75
Interest	100	85.42
Module Percentage	100	89.17
Module Use	87.50	89.58
Average	87.50	86.46

Based on Table 2, the Invertebrate module based on PjBL is very practical to be applied in Invertebrate learning, this is because there have been several revisions and improvements. With the module, it can add new teaching materials for teachers and become one of the learning resources that are informative for students, based on the results of the student questionnaire assessment of Invertebrate modules that can attract students' attention in learning. According to the biology teacher, the module can help students in achieving learning objectives to find out the characteristics and differences of the types of animals, especially Invertebrates. Modules can also be used independently because in addition to the material presented coherently students can also work on practice test questions for student learning at home. This is in line with research Sukiminiandari et al. (2015) a scientific-based module can help students in the independent learning process, and become an alternative source of learning. Based on the research of Zubail et al. (2018) Learning

using very practical modules is used to improve students' mastery of concept.

The effectiveness of the PjBL-based Invertebrate module

The effectiveness data of Invertebrate modules based PjBL can be seen from the cognitive and psychomotor learning outcomes of students, cognitive learning outcomes can be seen in Table 3.

Table 3. Results of Student Cognitive Value Analysis

Data	Results		Gain	N-Gain	Category
	Pretest	Posttest			
Average value	53	92	39	0,82	High
The highest score	63	97			
Lowest Value	50	70			

*) Note: KKM: 75

The percentage of classical completeness of students after learning to use a module PjBL-based is 97%, and the percentage of students who are incomplete is 3%, to be more clearly seen in Figure 2.

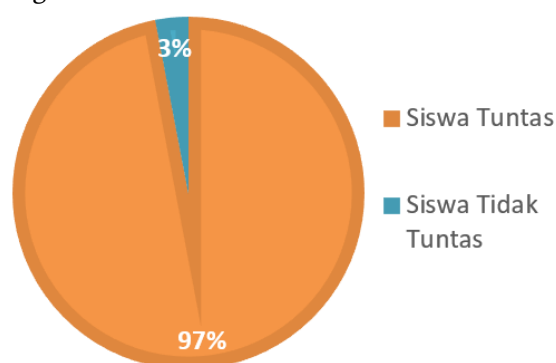


Figure 2. Classical completeness diagram of students

Based on the diagram above, from 30 students in class X, 97% of students experienced an increase in learning outcomes above the KKM. The Invertebrate module which is assisted by the PjBL model requires students to be more active so that student learning outcomes improve. This is in line with research by Rose & Prasetya (2014) which says learning strategies using PjBL and module-assisted learning can improve student learning outcomes seen from students' cognitive, affective and psychomotor assessments. The stages of PjBL learning process by dividing students into 5 groups, then students work on the LKS that are distributed, the purpose of learning with groups so that students can be active and collaborate in observing Invertebrates. This is appropriate. Tempelman & Pilot (2011) Project-based learning encourages students to learn together in collective problem solving.

Based on the recapitulation of students' psychomotor assessments, the students' observations of invertebrates amounted to 91.67 while report assessments amounted to 91.39 which meant that students' psychomotor skills were very good in learning activities. The first project undertaken by students is observing and identifying invertebrate preservation and the second project observing invertebrates in the school environment. Each project has a preliminary report, as preliminary data in the preparation of the results report. Learning activities using the Invertebrate module based PjBL in the classroom and in the school environment are very well applied in realizing student activities because they provide opportunities for students to collaborate in making discoveries, so that the nature of science covering the product process and student attitudes can be realized. According to Syamsudduha & Rapi research (2012) the use of the school environment as a learning resource improves student biology learning outcomes. According to Retnaningsih et al. (2018) PjBL can require students to be active in the process of inquiry such as scientific, surveying, trying, reasoning, and presenting.

CONCLUSION

Conclusions from the results of this study are (1) The results of the study showed as many as 20 types of several invertebrate phyla found on Lemukutan Island and Kakap Estuary Coast. (2) Characteristics of Invertebrate modules based PjBL developed are module materials based on the results of Invertebrate exploration of existing local potential and based on the scientific

approach of the PjBL model that helps teachers in teaching and learning. (3) The results of Invertebrate modules based PjBL validation from material experts 89.80 and media experts 98.38 with very valid criteria. The practicality results of students 86.46 and 87.50 teachers with very practical criteria, and effectiveness results seen from cognitive results with a classical completeness of 97%, and psychomotor students of 91.53 with very good criteria. This research has been well implemented in class X high school. Learning using modules can be used in other learning processes, and in the context of conservation efforts in the area of West Kalimantan it is necessary to have further research in order to find the renewal of Invertebrates in that area.

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