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Feasibility of Inquiry-Based Science E-Module Guided by Material Interaction of Living Beings with Environmental Learning Resources to Improve Science Literacy

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Abstrak: This type of research is development research that aims to determine the feasibility of the E-Module for the Interaction of living beings based on guided inquiry to improve the science literacy of grade VII students. The development model refers to the Borg and Gall development model with modifications as needed in the field consisting of 9 stages, namely: Research and information collecting, Planning, Developing a preliminary form of product, Preliminary feed testing, Main product revision, Main field testing, Operational product revision, Operational field testing, E-module final product. The instruments used are feasibility assessment sheets of material experts, media experts, linguists, and learning experts. The research found that the guided inquiry-based E-module material on the Interaction of living beings with environmental learning resources is suitable for learning.

Keywords: E-Module; Guided inquiry model; Interaction of living beings; Science Literacy

Introduction

Natural science (known with IPA) is learning about a structured and logical universe. IPA is essentially a product, process, attitude, and technology. Students must be directly involved in finding knowledge or phenomena, prove it scientifically, conclude, and ultimately be able to create tools or technologies that can solve various problems in society. The science includes facts, concepts, principles, laws, and theories. Science is divided into three: biological sciences, physical sciences, and earth sciences. The three sciences are combined in science so that students can use, preserve, and protect the environment on earth. Science as a process is a verb to achieve something. Students not only learn concepts by rote memorization but through scientific procedures-science as an attitude in the form of motivating students always to be involved in learning. Students must develop the search for answers to problems related to natural phenomena through a scientific process. Proper science learning will improve students' higher-order thinking abilities. Meanwhile, as technology is learning for students, science can learn about real life, identify problems, and utilize technology (Kristyowati & Purwanto, 2019).

The 2013 curriculum, according to the Regulation of the Minister of Education and Culture Number 22 of 2016, uses *a scientific approach* to learning activities. The scientific method used in learning activities has its objectives, namely, so that students' enthusiasm is more motivated to carry out learning activities actively. The stages contained in the scientific approach can construct the knowledge possessed by students. Students are expected to develop their potential in attitudes, skills, and learning through knowing, understanding, applying, analyzing, evaluating, and creating activities (Sufairoh, 2016; Permendikbud, 2016). The scientific approach was chosen to foster students' active attitudes

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in learning to build their knowledge by learning to explore nature directly (Sufairoh, 2016). Direct learning of the environment will make it easier for students to find solutions to problems. In addition, students will also remember the concepts, principles, and theories obtained in learning in the long term (Muakhirin, 2014).

Based on the 2018 Program for International Assessment of Students (PISA), Indonesian students' science literacy ability is ranked 71st. Students in Indonesia have difficulty explaining scientifically and have not been able to understand experientially the evidence provided (Safitri et al., 2018). Students have not been able to communicate concepts and also relate them to everyday life. Science learning still uses student worksheet learning resources (LKS) that are not made by the teacher himself and the BSE (Electronic School Book) book, so the tedious learning process is only the transfer of information from the teacher, and there is no active role of the student. Science learning needs much improvement to optimize students' science literacy skills (Perwitasari et al., 2016).

Science literacy is an essential ability that humans must possess in the form of organizational skills, analysis, and interpretation of phenomena obtained properly (Widayoko et al., 2018). Students who have good science literacy will be able to connect between science, technology, and society. Students also have a sensitive attitude towards the environment. Good literacy skills will also enable students to analyze various phenomena scientifically with knowledge of science (Braaten & Windschitl, 2011; Seah, 2016). Science literacy is essential for students because, with science literacy, students can meet various demands of the 21st century, including becoming *problem solver* who is competitive, creative, innovative, creative, collaborative, and character. Through science literacy skills, students can develop these 21st-century competencies (Yuliati, 2017).

Based on the interviews conducted with junior high school science teachers in Ponorogo, it is known that the science learning carried out so far has been dominated by the provision of teaching materials that are not integrated with the learning model. Education is only guided by student companion books, power points, and pdf-shaped materials that are distributed to students. Teachers have never developed their worksheets or textbooks that are adapted to the conditions of students and school conditions. Because of these things, students have difficulty applying the concept of science to daily life. Learning activities are still content-oriented without attaching importance to meaningful learning. According to Dedi et al. (2016), the student companion book (BSE) of science subjects that exist today is still incomplete, and the material is not based on the circumstances of the surrounding environment.

Based on the results of the study, it is necessary to improve the quality of learning. One way to improve the quality of education is by connecting learning with phenomena or events in the surrounding environment. Learning using the surrounding environment will make it easier for students to do meaningful learning. For example, inquiry-based learning using learning resources in the surrounding environment is one of the practical learnings used to grow students' science literacy (Khoiri, 2016).

Inquiry is a student center learning model. Students are required to be able to solve problems in learning through self-planned observation (Gormally et al., 2015). Students can develop their abilities through inquiry learning because students are encouraged to engage in direct physical and mental engagement. Inquiry learning is used to solve existing problems and make decisions appropriately. Guided inquiry learning tends to be fun and beneficial for students to improve science literacy and their learning outcomes (Wen et al., 2020). According to several research results, guided inquiry can complement students' knowledge including critical thinking, creativity, communication, and self-evaluation (Gormally et al., 2015).

Science learning is related to nature, the environment, and the advantages of the archipelago region so that local wisdom / regional potential can be used as a learning resource (Permendikbud, 2016). Many neighborhoods around the area can be raised in science learning but have not been utilized, one of which is the Telaga Ngebel environment. Telaga Ngebel, one of the advantages of Ponorogo Regency, can be used as a learning resource. The Telaga environment, located close to schools or students' homes, can be integrated through teaching materials used for the learning process. Although students do not go to the field in learning activities, teachers can present phenomena related to diversity in the surrounding environment by presenting teaching materials based on the environment around the house or school. One of them is teaching materials that can be used, namely electronic modules or e-modules.

E-modules are electronic learning resources containing interestingly designed and systematic learning materials (Laili et al., 2019). For example, the inquiry learning e-module with environmental learning resources around Telaga Ngebel was developed to optimize the use of the surrounding environment in an area. E-modules can help students learn science with learning resources that they are used it. With the e-module, students get examples of facts or phenomena to carry out learning activities according to the surrounding environment.

The advantage of developing electronic modules is that they carry out student-centered learning that trains student cooperation in problem-solving. Furthermore,

the content in the electronic module is presented as more attractive than in standard modules, so it is expected to motivate students to learn and improve learning outcomes. In addition, students can use electronic modules for self-study at home (Pertiwi & Masugiono, 2017).

Based on the background of the above problems, it is necessary to develop a guided inquiry-based science e-module with learning resources in the surrounding environment that can foster the active role of students in learning activities. Therefore, the e-module material is the Interaction of living things adapted to student conditions, school conditions, the environment around the school and students' homes, namely Telaga Ngebel, and student achievements.

Method

This research is a type of research and development or *Research and Development* (R &D). This research and development implementation uses the borg & gall (1983) development model. The stages in the modified Borg & Gall development model include: 1) Preliminary research and *information collecting*, 2) Planning, 3) Initial product development (*develop a preliminary form of product*), 4) preliminary *field testing*, 5) Revision of the main product (*primary product revision)*, 6) main field testing, 7) product revision, 8) operational field testing, 9) final product improvement (*final product revision*), 10) dissemination and *implementation*. In this study, the researcher only conducted research until the 8th stage, namely operational field testing, because the researcher only wanted to test the product's effectiveness.

Validation tests are carried out on material experts, media experts, linguists, and learning experts. The seven expert validators consist of 2 media expert validators, two material expert validators, one linguist validator, and two learning expert validators. Media expert validators are 2 FKIP lecturers at Sebelas Maret University, Material expert validators, namely one lecturer at FKIP Sebelas Maret University and one lecturer at FKIP PGRI Madiun University, linguist validators, namely one lecturer in Indonesian Education, Sebelas Maret University, and learning expert validators, namely 2 FKIP lecturers at Sebelas Maret University.

In this study, data collection instruments included: E-module validation sheets given to material experts, media experts, linguists, and learning experts whose results were used to test the feasibility of the e-module before being tested. The data analysis techniques used in this study include. Qualitative and quantitative, to analyze the validation questionnaire from the expert assessment with feasibility criteria determined based on Table 1.

Table 1. Instrument Eligibility Criteria

Value (%)	Criterion
80 – 100	Very Worthy
66 – 79	Proper
56 – 65	Decent Enough
40 – 55	Less Viable
30 – 39	Not Worth It

(Source: Arikunto, 2016)

Results and Discussion

The research and development that has been carried out have produced a product in the form of an inquiry-based E-Module guided by the Interaction of living things with learning resources for the Telaga Ngebel environment.

Designing learning activities with guided inquiry syntactic. Guided inquiry syntax includes formulating problems/exploration of phenomena, focusing questions, planning investigations, carrying out investigations, analyzing data and results, compiling new knowledge, and communicating the steps and results of experiments.

The e-module developed in this study is in the form of digital media that can facilitate the display of text, images, audio, and video with high quality. The e-module was developed using the *theft Adobe InDesign 2020.* E-module products can be accessed using *mobile phones*. Design includes: (1) *Cover*; (2) Explanation related to the environment of Telaga Ngebel; (3) Menu List, which consists of instructions, competencies, concept maps, learning activities, assessments, glossaries, references, and author profiles; (4) Instructions, containing instructions for the use of e-modules (5) Competencies, containing core competencies, basic competencies, and achievement indicators; (6) Concept map, containing a concept map of the material interaction of living beings; (7) Learning activities, containing learning activities 1 component of environmental constituents, learning activities 2 interactions between components constituents of the environment, and learning activities 3 efforts to preserve the environment; (8) Assessment, containing tests to measure students' science literacy ability; (10) Glossary, containing a list of terms in the material of the Interaction of living beings supplemented by definitions for such terms; (11) References, containing all books or scientific writings to which they are referring; and (12) Author profiles, containing biographies of the author. The following is the appearance of menus and learning activities in the e-module can be seen in Figure 1 and 2.

Figure 1. Home e-module

Figure 2. learning activities

The developed science e-module can be accessed on each student's mobile phone and is used to improve students' science literacy skills. The development of e-modules is based on the tendency of students to learn and find various information through gadget technology, one of which is cell phones. So that through the development of e-modules, it is hoped that it can meet the needs of students to access information without being limited in time and place.

The product developed as a guided inquiry-based e-module is tested for validity by expert validators before being tested in schools. There are seven expert validators: media expert validators, material expert validators, linguist validators, and learning expert validators. Media expert validators are 2 FKIP lecturers at Sebelas Maret University, Material expert validators, namely one lecturer at FKIP Sebelas Maret University and one lecturer at FKIP PGRI Madiun University, linguist validators, namely one lecturer in Indonesian Education, Sebelas Maret University, and learning expert validators, namely 2 FKIP lecturers at Sebelas Maret University.

The validation stage is carried out to get assessments, criticisms, and suggestions related to the e-module that has been developed so that it can be said to be feasible. The validator assessment results are in the form of scores according to the Likert scale. The following are the analysis results of expert validation data material presented in Table 2.

Table 2. Material expert validation results

Aspects	ΣP	Criterion
Conformity of the material with Core Competencies and Basic Competencies	94	Very Worthy
Accuracy of the material	95	Very Worthy
Supporting materials	100	Very Worthy
Material updates	96	Very Worthy
Serving	96	Very Worthy
Collapse and cohesiveness of thought plots	94	Very Worthy

The results of material expert validation obtained a validity of 96%, which stated that guided inquiry-based e-modules are very feasible in terms of material. The feasibility of the material is in the form of the feasibility of content and presentation. The content's feasibility consists of the material's suitability, the material, the accuracy of the material, the supporting material, and the update of the material. The feasibility of presentation is in the form of presentation techniques, supporting the display, presenting learning, and the collapse of the integration of the mindset. The advice of the material expert validator is to justify links that cannot be accessed yet. The following validation result is the validation of media experts presented in Table 3.

Table 3. Media expert validation results

Aspects	ΣP	Criterion
Screen design view	89	Very Worthy
Ease of Use	88	Very Worthy
Consistency	83	Very Worthy
Benefits	85	Very Worthy
Display	75	Proper

The results of the validation of media experts obtained a validity of 84%, which stated that guided inquiry-based e-modules are very feasible in media. The feasibility of media is in the form of screen design display, ease of use, consistency, expediency, and appearance. Media expert validators suggest adding a whole way of use as an appendix to the e-module and a brief explanation related to the e-module. The following validation result is the validation of the linguist presented in Table 4.

Table 4. Linguist validation results

Aspects	ΣP	Criterion
Media size	100	Very Worthy
Layout, typography, and cover illustrations	100	Very Worthy
Layout, typography, and content illustrations	93	Very Worthy
Use of terms, symbols, and icons	88	Very Worthy

The results of the validation of linguists obtained a validity of 96%, which stated that guided inquiry-based e-modules are very feasible in terms of language. Language feasibility is in the form of the physical size of the media, media *cover* design, *cover* typography, *cover* content illustration, media content layout, media content typography, media content illustration, and the use of terms, symbols, and icons. The suggestion of the linguist validator is to revise the fragments of words that are still found in the e-module. The following validation result is the validation of learning experts presented in Table 5.

Table 5. The results of the validation of learning experts

Aspects	ΣP	Criterion
Lesson Plan	93	Very Worthy
Evaluation	93	Very Worthy

The results of the validation of learning experts obtained lesson planvalidity of 93% and the validity of the evaluation of 93%, which stated that both were feasible. Lesson plan eligibility is in the form of completeness of lesson plan components, content feasibility, learning activities, learning resources, assessment, and language. The average evaluation feasibility is in the form of the correctness of concepts, materials, constructions, and language. Suggestions from media expert validators are to write down learning objectives in the ABCD pattern, add assessment procedures for skills and attitudes, and add instructions for working on questions

Based on the data above, the average value of the validation results of the sequence is in the category of feasible and very feasible. Therefore, it can be concluded that the inquiry-based science e-module guided by the Interaction of living things with learning resources for the environment around Telaga Ngebel is suitable for product trials.

The feasibility of the material in the e-module developed is shown by the suitability between the material and Core Competencies and Basic Competencies 3.7 analyzes the Interaction between living things and their environment and population dynamics due to these interactions, and Basic Competencies 4.7 presents the results of observations on the Interaction of living things with the surrounding environment. The collapse of the material is explained in 3, namely the components that make up the environment, interactions between members of environmental constituents, and efforts to preserve the environment. In addition, there are supporting materials that are adapted to the environment of Telaga Ngebel.

Learning with learning resources that utilize the environment around students has a tremendous influence on realizing the achievement of student learning outcomes. Through the surrounding environment, the learning carried out by students will be more meaningful because it can increase the sense of care and love for the environment so that the Telaga Ngebel ecosystem is well maintained (Sobel in Sribekti, et al., 2016). Furthermore, adjustment of the material to the surrounding environment can facilitate students to connect their experiences with new information (Irwandi & Fajeriadi, 2020). This is in line with kristyowati and Purwanto 's research (2020) entitled "Learning Science Literacy through Environmental Utilization." This research shows that utilizing the environment as a source of learning science will give students a better understanding of science literacy skills.

Scientific literacy relates to the general ability to find and use scientific information in a wider context. By integrating the concept of scientific literacy into student learning, it will help relate material to the environment so that learning will be close to students. Through

scientific literacy, students are equipped with lifelong thinking skills and good literacy in science and information that will develop (Berman & Kuden, 2017).

The feasibility of the e-module media developed is shown from the attractive design and appearance of the e-module in terms of color, images, and writing, ease of use by presenting learning in sequence, ease of access to e-modules using *cellphones*, there are instructions for use that make it easier for students to access and the benefits of e-modules that can increase students' attention to learning materials.

According to the Ministry of Education and Culture (2017), E-modules have characteristics: (1) *Self Instruction*, allowing students to learn independently and not depend on other parties. (2) *Self Contained*, all required learning materials are contained in the module. (3) *Stand Alone*, the module developed does not depend on other teaching materials or does not have to be used with other teaching materials. (4) *Adaptive*, the module can adjust the development of science and technology, flexible. And (5) *User Friendly* (friendly), the module has instructions and exposure to information is simple, easy to understand, and uses commonly used terms.

The feasibility of the language in the e-module developed is shown by the size of the e-module that follows the *mobile phone* screen, consistent *layout* design, does not use too many typefaces, the placement of decorations/illustrations as a background is not disturbing, the words and sentences used are following Indonesian language rules and are easy to understand by students.

The feasibility of the lesson plan prepared is shown by the conformity of the lesson plan with the Minister of Education and Culture Number 22 of 2016. In addition, the e-module developed is based on the learning model suggested by the 2013 curriculum, namely a guided inquiry learning model. Guided inquiry learning activities can take advantage of the environment around students to be used for learning resources (Sudarisman, 2013). The stages in guided inquiry learning are formulating problems, focusing on questions, planning investigations, conducting investigations, analyzing data and results, compiling new knowledge, and the last is communicating (Llewellyn, 2013). Based on several research results with guided inquiry can improve students' scientific literacy abilities. It is hoped that this increase will be in line with the formation of a society that has a variety of scientific ideas, intellectual abilities, is creative, has high reason and most importantly is sensitive to the environment (Holbrook & Rannikmae, 2009). The high validity of the evaluation is because the questions developed to follow the aspects assessed in the form of the correct concept, the appropriate material in each question item, clarity of work instructions, and formulation of question items.

The inquiry learning model is well used in the learning process. The inquiry model prepares students in situations to conduct extensive self-experiments. Students are trained to acquire new knowledge, abilities and attitudes through the scientific method. For example in doing something, asking questions, looking for answers themselves and connecting one discovery with other findings in scientific disciplines. The main objective of guided inquiry learning is to develop the ability to think systematically, logically and critically. Students not only master the learning material but also have good scientific literacy, so that they can use the abilities they have in everyday life. (Lee, 2011).

The indicators of scientific literacy used are, according to Gormally et al., (2015): (1) validly identifying scientific opinions; (2) tracing a variety of effective literature; (3) analyzing various research designs and their impact on findings/conclusions; (4) convert the data into a graphic form precisely; (5) solving problems using quantitative skills, including basic statistics; (6) understand and interpret basic statistics; (7) inference, prediction, and conclusion drawing based on quantitative data. These indicators are contained in three scientific competencies measured in science literacy. Here are three competencies that exist in science literacy skills according to PISA (2016): (1) Identifying phenomena scientifically, indicator 1; (2) Evaluating and designing scientific investigations; indicators 2 to 6; and (3) Interpreting scientific data and evidence, indicator 7.

E-modules integrated with guided inquiry learning guide students to carry out various activities, including observing, formulating problems and hypotheses, asking questions, planning experiments, using experimental tools and materials, and communicating. Each stage in guided inquiry is related to the lite ability of science constellations, so it is hoped that the developed e-modules

Conclusion

Based on the results of the research, it can be concluded that the guided inquiry-based e-module on the Interaction of living beings with the learning resources of the Telaga Ngebel environment has been feasible for use in learning based on validation results that show feasible and very feasible categories so that they can be used for the next stage of trials.

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