



Development of Environmental Pollution Electronic Module in Kudus Regency on Project-Based Learning (PjBL) for Junior High School Students

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Abstract

This study aims to analyze the characteristics, feasibility, and readability of the PjBL-Based Environmental Pollution E-module for Junior High School Students. The type of research conducted is Research and Development (R&D). The steps of this research include potentials and problems, data collection, product design, design validation, design revision, and small-scale product trials. The research instrument was in the form of a media expert questionnaire, material, and readability experts. The results show that the developed E-module has characteristics, namely the developed E-module with PjBL syntax, equipped with video. The developed e-module is suitable for use as a learning medium with an average percentage of media validation and material validation obtaining an average of 92.06%, each of which is in the very good category. The PjBL-Based Environmental Pollution E-module for Junior High School Students uses language that is easily understood by students so that students can understand the material. Based on the research, it can be concluded that the PjBL-Based Environmental Pollution E-module for Junior High School students has PjBL syntax and is equipped with a very decent supporting video and obtains very good criteria in the readability test and feasibility test in science learning.

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INTRODUCTION

The development and progress of technology is currently experiencing an increase, including in the field of education. In the 21st century, education is becoming increasingly important to ensure that students have learning and innovation skills, skills to use information technology and media and work, and survive using life and survival skills (Arifin, 2017).

Learning in the 21st century changes the view from teaching to learning, meaning that initially teacher-centered learning has changed to student-centered learning which will have a good impact on the quality of education (Pertiwi et al., 2018). This is in line with the change in learning policy from the 1994 curriculum to the 2013 curriculum which includes all subject matter, especially science subjects.

The area of Kudus Regency has a main problem in maintaining environmental cleanliness, namely environmental pollution which is directly faced by the people of Kudus Regency. Kudus Regency is a city that has a very high level of industrial growth and population growth. This rapid increase in the economy has led to the driving force of growth in Kudus Regency. This very rapid population growth causes problems, one of which is environmental pollution, including water pollution, air pollution, and soil pollution.

The results of interviews with science teachers at SMPN 2 Jati Kudus, there are facts that show that more than 90% of students have Android-based smartphones, and students use social media more often. The teacher also explained that students' creativity was still lacking and the teaching materials provided by the school were in the form of textbooks, and there was no use of smartphones and no use of computers as teaching materials in learning. Not all teaching materials provided are able to help students in the learning process. Students are lazy to read teaching materials because they look less attractive. Learning is still centered on the teacher and the learning model used is still conventional so that the teaching and learning process is dominated by the teacher and the students are less active. In addition, student participation in science learning is low, especially in environmental pollution (Ummayah & Dewi, 2021). Environmental Pollution is considered difficult for students because the scope of the material is wide, students' lack of interest in reading. The teacher also explains that to be able to explain environmental pollution material, the surrounding environment is needed so that students know about

environmental pollution material directly. Data from the results of the Daily Test (UH) on environmental pollution material shows that most of the seventh grade students have not reached the minimum competence criteria (KKM) so teachers must implement remedial measures to support students' scores that are still below the KKM. This condition shows that students need appropriate learning models and teaching materials that support learning. students' lack of interest in reading. The teacher also explains that to be able to explain environmental pollution material, the surrounding environment is needed so that students know about environmental pollution material directly. Data from the results of the Daily Test (UH) on environmental pollution material shows that most of the seventh grade students have not reached the KKM so teachers must implement remedial measures to support students' scores that are still below the KKM. This condition shows that students need appropriate learning models and teaching materials that support learning. students' lack of interest in reading. The teacher also explains that to be able to explain environmental pollution material, the surrounding environment is needed so that students know about environmental pollution material directly. Data from the results of the Daily Test (UH) on environmental pollution material shows that most of the seventh grade students have not reached the KKM so teachers must implement remedial measures to support students' scores that are still below the KKM. This condition shows that students need appropriate learning models and teaching materials that support learning. Data from the results of the Daily Test (UH) on environmental pollution material shows that most of the seventh grade students have not reached the KKM so teachers must implement remedial measures to support students' scores that are still below the KKM. This condition shows that students need appropriate learning models and teaching materials that support learning. Data from the results of the Daily Test (UH) on environmental pollution material shows that most of the seventh grade students have not reached the KKM so teachers must implement remedial measures to support students' scores that are still below the KKM. This condition shows that students need appropriate learning models and teaching materials that support learning.

One of the learning media needed to support learning is E-module. E-module is an electronic

module consisting of some content from text, images that can support learning (Herawati & Muhtadi, 2018; Sadikin & Hardianti, 2021). E-modules can explain scientific material that can make it easier for students to understand material that is very difficult to understand, so using E-modules will be interesting, and can increase students' interest and motivation (Islam & Falahkota, 2015).

The research used in this research is the Environmental Pollution E-module in Kudus Regency based on PjBL for Junior High School Students. The learning model that can support learning is the Project Based Learning (PjBL) model. The PjBL model is a learning model that provides opportunities for students to play an active and creative role in learning activities that will produce products. A learning model that can provide opportunities for students to explore their creativity is the PjBL model (Kristiani et al., 2017).

Based on the background of the above problems in science learning that has been described, it is necessary to conduct research on "Development of the Environmental Pollution E-module in Kudus Regency Based on PjBL for Junior High School Students". The PjBL-Based PjBL-Based Environmental Pollution E-module is an innovation that will train students to think creatively because this model produces projects that will be used as the final result in learning. The content of the E-module developed will be adjusted to the stages of the PjBL model, so that the learning process gives a different impression when using the PjBL-Based Environmental Pollution E-module in Kudus Regency.

METHOD

This research was conducted at SMP N 2 Jati Kudus. The time of this research was carried out in the even semester of the 2021/2022 academic year.

This research and development model uses a model from Sugiyono which consists of 10 steps. However, during the Covid-19 pandemic, researchers simplified and limited research into 5 stages, namely potential and problems, data collection, product design, design validation and design revision and small-scale product trials.

In this study, product validation was carried out by 5 media experts and material experts. Data collection methods in this study include documentation and questionnaires. Documentation method is used to obtain research supporting data. The questionnaire method was used to determine the validity or feasibility. The instruments in this study include: (1) The media

expert and material expert validation questionnaire was used at the design validation test stage; (2) The readability questionnaire was used after the design revision at the small-scale product trial stage.

RESULT AND DISCUSSION

The results obtained in this study include; (1) characteristics of the Environmental Pollution E-module in Kudus Regency based on PjBL; (2) the feasibility of the Environmental Pollution E-module in Kudus Regency based on PjBL; (3) Readability of the E-module on Environmental Pollution of Kudus Regency Based on PjBL.

Characteristics of the Environmental Pollution E-module

Characteristics are characteristics that distinguish or indicate an object or medium. The learning media developed in this study was in the form of an electronic module, namely the E-Module on Environmental Pollution in Kudus Regency Based on PjBL for Junior High School Students. The characteristics of E-modules according to the Directorate of Primary and Secondary Education (2012) are: (1) Self Instructional, (2) Self Contained, (3) Stand Alone, (4) Adaptive, (5) User Friendly, the second characteristic refers to Yulianto and the results readability test data.

The first characteristic according to the Directorate of Primary and Secondary Education is Self-Instructional, E-modules are able to make students learn independently. This development has fulfilled Self Instructional, namely there are learning objectives that are presented in learning activities, there are assignments, science info, summaries and evaluations. At the end of the E-module sub-chapter is equipped with an evaluation used to measure students' understanding of the material (Elvarita et al., 2020). This corresponds to Herawati & Muhtadi (2018) research that giving evaluations or practice questions can have an impact on understanding the concept. Self-Contained, the content in the E-module must cover all the material. This can be proven by the material presented in the E-module that has been adapted to basic competencies 3.8 and 4.8. Stand Alone, the developed E-module should stand alone as a complementary media not depending on other media. E-module developed using the FlipBuilder application. according to Asmi et al., (2018) which states that the advantages of the flipbuilder application are (1) it can open or turn

the pages of a book so that it is like reading a book; (2) this application is easy to make electronic books (E-modules); (3) The resulting E-modules are not only books, but are equipped with pictures and videos to support learning; (4) the resulting product can be published in HTML form. The developed e-module is packaged in HTML5 format which can be accessed online from a computer or laptop or smartphone. Adaptive, E-modules must be able to adapt to the development of science and technology. This is evidenced by the E-module which was developed in accordance with the Basic Competencies of the 2013 curriculum. User Friendly, the developed e-module should be friendly to its users in terms of ease of use and according to the developed e-module, it should use simple and easy-to-understand language. This is evidenced by the validation test on the media presentation aspect (easy to access media) which got a score of 95% and the readability test by students and teachers on the aspect (the language used in the E-module is simple and easy to understand) getting an average score of students 90%.

In the second characteristic, PjBL-based E-module refers to Yulianto. The results of the data from the media validation got an average score of 100%. The PjBL steps have 6 steps, namely: (1) In the first stage, namely determining the problem, at this stage the teacher asks questions and guides students to determine the problem, at this stage the teacher asks questions and guides students to determine questions about environmental pollution discourse and videos. Meanwhile, students watched environmental pollution videos; (2) In the second stage, namely making a project design, at this stage the teacher guides students to conduct an investigation of environmental pollution. Meanwhile, students compile a draft of environmental pollution investigation in the form of a poster containing ideas for overcoming environmental pollution; (3) In the third stage, namely making a schedule, at this stage the teacher guides students in compiling a schedule. Meanwhile, students arrange a schedule to design a project, (4) In the fourth stage, namely monitoring the progress of the project, at this stage the teacher guides in the investigation and checks the implementation of the project. Meanwhile, students carry out investigations; (5) In the fifth stage, namely assessing results, this development does not reach to assessing the results of student projects or student learning outcomes; (6) In the sixth or final stage, which is evaluating learning, at this stage the teacher reflects on the project assignments. Meanwhile, students conclude

environmental pollution through project assignments. at this stage the teacher guides in the investigation and checks the implementation of the project. Meanwhile, students carry out investigations; (5) In the fifth stage, namely assessing results, this development does not reach to assessing the results of student projects or student learning outcomes; (6) In the sixth or final stage, which is evaluating learning, at this stage the teacher reflects on the project assignments. Meanwhile, students conclude environmental pollution through project assignments. At this stage the teacher guides in the investigation and checks the implementation of the project. Meanwhile, students carry out investigations; (5) In the fifth stage, namely assessing results, this development does not reach to assessing the results of student projects or student learning outcomes; (6) In the sixth or final stage, which is evaluating learning, at this stage the teacher reflects on the project assignments. Meanwhile, students conclude environmental pollution through project assignments.

The third characteristic is the results of the teacher and student readability questionnaires. In the readability questionnaire assessed by the teacher, the average score was 90.62%, while the results of the readability questionnaire by students obtained an average of 85.93%. So it can be concluded that the readability aspect is included in the very good category. This statement is in line with the results of research from Friantini et al., (2020) which states that the E-module readability questionnaire has a very good category for the language component.

The fourth characteristic is that the E-module is equipped with a supporting video that can be played directly by clicking on the video. The material in the E-module is equipped with a supporting video that is in accordance with the material being studied. The video in the E-module aims to provide an overview to students and as a supporter of explanations related to the presentation of the material, so that students can understand the concepts of the material and can facilitate students in independent study.

The PjBL-Based Environmental Pollution E-module has several advantages including: This E-module has never existed before, this E-module can increase student interest because it is equipped with videos related to the material, easy to use online anytime and anywhere just. Another advantage of this E-module can also reduce the use of paper in the learning process(Laili, 2019).

Feasibility of the Environmental Pollution E-module

The data on the results of the feasibility or validity assessment of an E-module developed is based on an assessment by media experts and material experts, if the results of the expert's assessment get a score > 62.5% then the E-module feasibility assessment is said to be valid and feasible. In the assessment, each expert consists of 5 people including: 2 lecturers and 3 science teachers (see Figure 1)

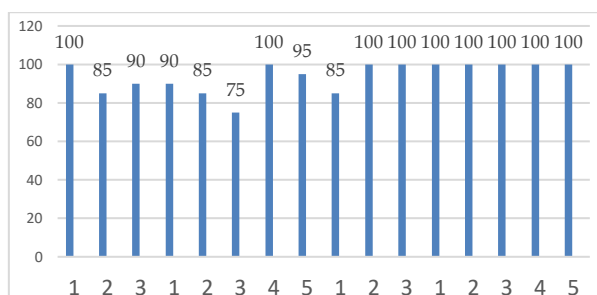


Figure 1. Aspects of E-module validation results by Media Experts (1 until 3 = general view; 1 until 5 = special view; 1 until 3 = media presentation; 1 until 5 = PjBL characteristics).

In the validation stage of the E-module Environmental Pollution in Kudus Regency Based on PjBL for Middle School Students by media validators (lecturers and science teachers), each validator provides an assessment on the media expert validation sheet. Based on the data from the assessment results, the average value obtained is 93.23% with very decent criteria. This shows that the developed E-module is in the very feasible category for use in small-scale trials (see Figure 2).

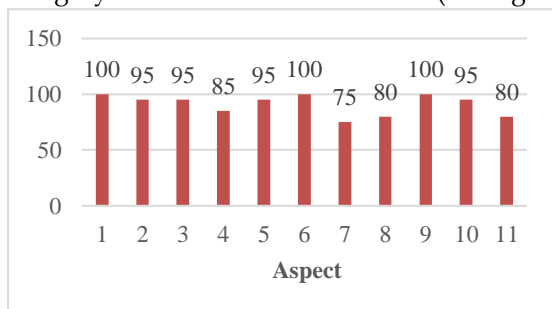


Figure 2. Aspects of E-module validation results by Material Experts

At the validation stage of the E-module Environmental Pollution in Kudus Regency Based on PjBL for Junior High School Students by material validators (lecturers and science teachers), each validator provides an assessment

on the material expert validation sheet. Based on the data from the assessment results from 11 aspects, the score is an average of 90.90% with the criteria very suitable for use in small-scale trials and is in accordance with Core Competencies (KI) and Basic Competencies (KD).

Based on the suggestions and inputs given by 5 validators, material experts and media experts, which have been revised by the author, this is used to improve the quality of the developed E-modules. The results of the suggestions and inputs given by the validator, improvements were made to the Environmental Pollution E-module of Kudus Regency Based on PjBL for Junior High School Students, it can be seen on Figure 4-11.

Readability of the E-module Environmental Pollution in Kudus Regency Based on PjBL.

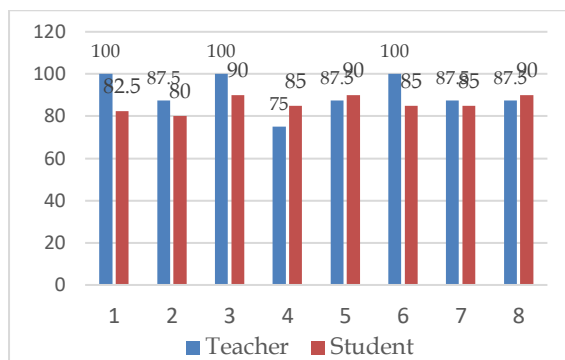


Figure 3. Readability Questionnaire Data

The data from the readability questionnaire aims to determine the legibility of an Environmental Pollution E-module in Kudus Regency Based on PjBL for Junior High School Students. The E-module readability questionnaire was given during the small-scale trial stage after the design revision stage. Readability questionnaires were given to science teachers and 10 grade VIII C students of SMP N 2 Jati Kudus who had received environmental pollution materials. Based on the average readability questionnaire conducted by students and teachers, the results were 88.28% with a very good category. The results of the E-module readability questionnaire on a small-scale trial obtained an average percentage of 10 students obtaining results of 85.93% including in the very good category, while the average readability questionnaire conducted by teachers obtained a result of 90.62% which included in the very good category. The results of readability in the very good category for students mean that students

understand the content of the E-module on Environmental Pollution in Kudus Regency Based on PjBL. The developed e-module has a language that is appropriate to the level of emotional maturity of junior high school students. Rosyidah et al., (2013) states that a good E-module uses a language that is appropriate to the developmental level of students, which will make it easier for students to understand the content of the material.



Figure 4. Improvements by changing the cover design of the E-module.



Figure 5. Improvements by replacing clear water pollution pictures.

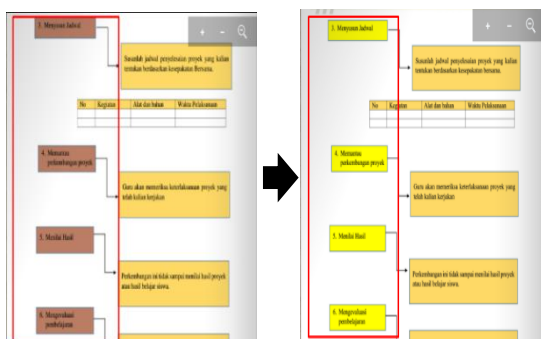


Figure 6. Fixed by changing the font color to a lighter one

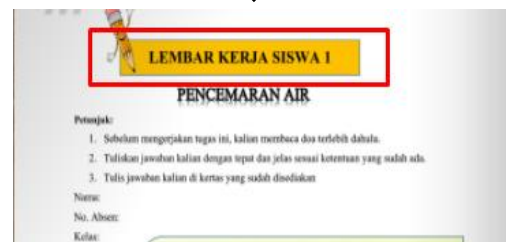


Figure 7. Fixed by changing the font color to a lighter one.

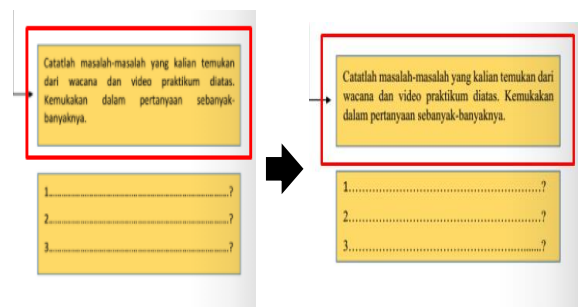


Figure 8. Improvements by changing the font type from the original Calibri font to Times New Roman

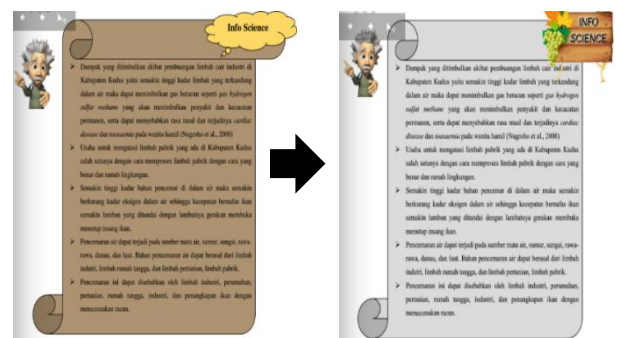


Figure 9. Improvements by changing the info science design to make it more attractive

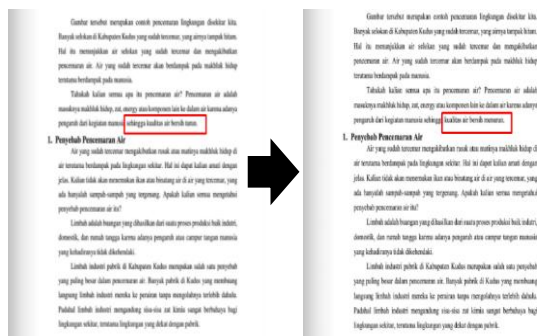


Figure 10. Correction by replacing the appropriate sentence.

CONCLUSION

E-module Environmental Pollution of Kudus Regency Based on PjBL that has been developed is attractive and has characteristics in the form of E-modules compiled based on the PJBL syntax, E-modules according to the Directorate of Primary and Secondary Education, and E-modules that have been developed equipped with supporting videos that can be played directly. The developed e-module uses an easy-to-understand language. The validation carried out by media expert validators and material experts stated that the PjBL-Based Environmental Pollution E-module developed by the researcher was very suitable for use in the learning process in class VIII C SMP N Jati Kudus. Readability of the PjBL-Based Environmental Pollution E-module by junior high school students and teachers stated that the Kudus Regency-based PjBL Environmental Pollution E-module uses language that is easily understood by students, so that it can make students understand the material.

E-module Environmental Pollution of Kudus Regency Based on PjBL can be used as a guide for teachers in developing E-modules with other materials. This research has only reached the stage of testing small-scale products because in Kudus Regency there are still cases of COVID-19. This research can be used as a reference to test the effectiveness of further research.

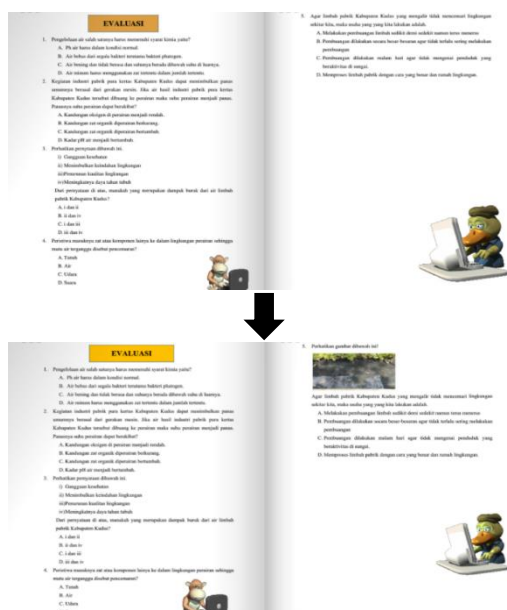


Figure 11. Improvements by adding images that match the material

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