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Development of E-Modules Based on Problem Based Learning Assisted by Flipbook on Environmental Change Material in High School to Improve Problem Solving Ability

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Abstract

The use of printed teaching materials in schools is less attractive to students and the ability to solve problems owned by students is relatively below average so that the basic competencies set have not been achieved. Advances in science and technology can be utilized to provide more varied teaching materials such as e-modules. The purpose of this study was to analyze the feasibility, practicality and effectiveness of e-modules in the learning process. The research design used is development (R&D) using the ADDIE model with the stages of analysis, design, development, implementation, and evaluation. The feasibility of e-modules is determined based on the validation of material experts and media experts. The practicality of e-modules is determined based on student responses and teacher responses. The effectiveness of e-modules is determined based on students' classical completeness and N-gain. The results showed that the material expert validation value was 90.27% (very feasible) and the media expert validation value was 92.85% (very feasible). The results of the e-module's practicality was that the teacher rated it as very practical. In the small-scale trial, all students rated practical. In the large-scale trial, 90.32% of students rated very practical and 9.68% of students rated practical. The effectiveness of the e-module was proven to be effective in improving students' problem solving ability with an N-gain of 0.61 with a medium category and a classical completeness of 93.33%.

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INTRODUCTION

The role of education in improving the quality of human resources and fostering a highly competitive generation cannot be underestimated. Schools as leading formal education institutions play an important role for various stakeholders in education to actively participate in its efforts. When schools are able to build an effective and appropriate learning system for students, they have the potential to develop students' skills and intelligence, which contributes to the education of the nation's young generation as a whole. In accordance with the 2013 curriculum, Biology subject matter has an object of study of living things and all aspects of life. The environment is one of the objects of studying biology at the high school level which is packaged in the Environmental Change material contained in KD 3.11 and 4.11. KD 3.11 analyses data on environmental changes, causes, and impacts on life, while KD 4.11 formulates ideas for solving environmental change problems that occur in the surrounding environment.

Muttaqin *et al.* (2019) argued that Environmental Change materials still use a global approach and have not discussed solving environmental change problems that are important to students in everyday life. Therefore, the Environmental Change material is only limited to memorisation rather than actual student understanding. This competency can be mastered by students by understanding the concept of solving problems contained in the Environmental Change material. This understanding is very important in studying biology because it requires students to be able to solve everyday problems (Isnaini *et al.,* 2016). 21st century education is required to emphasise critical thinking and problem solving, creativity, innovation, communication and collaboration (Germaine *et al.,* 2016). Based on these four perspectives, problem solving is known to be one of the priorities in education. Students are expected to be able to apply their skills to solve the problems they face by collecting, formulating and evaluating problems. However, educational environments are often not designed to teach these skills to students. Students often succeed in solving many problems but fail when the context of the problem changes slightly (Wibowo, 2015).

The role of teaching materials is very important in the learning process. A learning topic requires several teaching substances in accordance with the specified competency standards. Good teaching substances make the learning process more interesting (Pangestu, 2019). According to Kalsum et al., (2018), the use of teaching materials in the form of textbooks is less attractive to students so it is necessary to develop textbooks into digital form. Advances in information and communication technology can be used to make print modules into electronic modules or what are called E-modules. According to Oktavia *et.al.* (2018), the advantages of E-modules compared to ordinary print modules are that E-modules are more interactive and allow the appearance of images, audio, video, and animation.

Based on the results of interviews with SMA N 4 Pekalongan teachers, it is known that students who obtained scores above the KKM (≥70) were only 44.12% (15 out of 32 students), and those who had not reached the KKM (≥70) were 55.88% (17 out of 32 students). This is because most of the learning methods are lecture methods. Students are less active because learning is only teacher-centred learning (Puspita, 2019). Students only memorise the concept of the material without understanding it. The memorisation method is not very effective so that students only quickly remember what has been learned and also quickly forget in a short time. This makes it difficult for students to understand the concepts of Biology material (Sartono *et al.,* 2016).

This can be seen from some students who are less active in the learning process, do not complete assignments properly and students only memorise the concept of material without understanding it. Teaching materials used in schools are less varied so that student's ability to solve problems is not optimal. The use of teaching materials that are less supportive has an impact on not achieving the basic competencies in the material taught, especially in 3.11 analysing data on environmental changes, causes, and impacts on life, while KD 4.11 formulates ideas for solving environmental change problems that occur in the surrounding environment.

Based on the results of direct interviews with SMA Negeri 4 Pekalongan teachers, it is also known that the learning model used is still in the nature of learning. learning model used is still conventional. Based on the description above, it is necessary to develop an E-module on Environmental Change material for high

school students. The E-module is designed based on flipbook, consisting of cover, preface, table of contents, introduction, material description, and evaluation. This e-module will later be tested on high school students using the problem-based learning model. PBL-based e-modules are suitable as supporting media and main learning resources. PBL-based e-modules are thought to have several advantages. According to Lidinillah (2013), e-modules presented with the PBL approach offer several advantages, including: 1) improve students' problem-solving skills; 2) foster students' ability to develop their own knowledge through learning activities; 3) improve students' ability to evaluate their own learning progress; 4) foster students' scientific communication skills through discussion activities and presenting the results of their work; 5) reduce the learning load by eliminating irrelevant learning materials; 6) stimulate students' scientific activities during group work, 7) familiarize students with various sources of information, such as the internet, interviews, and observation activities; 8) overcome individual learning difficulties through collaborative group work.

E-module development can be done with the help of a flipbook presentation. The development of e-modules presented through flipbooks will provide a new learning atmosphere for students so that students will be interested in learning the material. According to Hamid & Alberida (2016), flipbook is a type of technological development to present an electronic book that is connected to the video link listed in it when touched on the video link and replicates the experience of flipping through pages like flipping through a physical book. By offering distinctive features and a wide variety of content, flipbooks have the ability to increase students' enthusiasm in learning the material. Wicaksono & Kuswanti (2022) explains that the use of flipbooks for learning on Human Excretory System material is very useful and practical. In line with Andini & Qomariyah (2022), stating that flipbooks as a media format are suitable for educational purposes. Their research highlights that both students and educators find flipbooks easy to use, and have a positive impact on the learning process. The consistency between these two studies reinforces the value of using flipbooks for an effective and engaging learning experience.

Based on the description above, it is necessary to develop an e-module on Environmental Change material based on problem-based learning assisted by flipbook. This is predicted to be an effective solution to improve problem-solving skills for students.

RESEARCH METHOD

The research was carried out at SMA N 4 Pekalongan in the odd semester of the 2022/2023 academic year. The type of research used is research and development (R & D). The aim of this research is to develop and validate learning media products. The development model used in this study is the ADDIE model from the Robert Maribe Branch, namely: analysis, design, development, implementation, and evaluation. The research population was all students of class X SMA N 4 Pekalongan and the sample of the research product trial was 15 students of class X-4 for small-scale trials and 30 students of class X-5 for large-scale trials. The product created and produced in this research is a e-modul for learning Enviromental Change material. The sampling technique used was random sampling technique. The data obtained through the distribution of validated questionnaires and their practicality as well as test questions used to determine the effectiveness of e-modul. The effectiveness of e-modul can be seen from the test results of student learning. The results of the effectiveness test were analyzed using the student learning completeness and N-gain calculation.

RESULTS AND DISCUSSION

The result of product development in this study is an E-module material on the Environmental Change based on problem based learning for high school students. The e-module developed is in the form of a flipbook that can be accessed easily via a link. The developed e-module consists of front cover, foreword, table of contents, introduction, materials, evaluation questions, bibliography, and answer keys.

E-Module Eligibility

Based on analysis results of the E-module validation instrument by material experts and media experts, it is known that the developed E-module is very suitable to be used for the learning process. The percentage results obtained from the two experts are already above 60%. The feasibility results of E-module by experts are presented in Table 1.

Table 1. E-Module Eligibility Results by Experts

Validator	Total Score	Score Percentage	Category
Material Expert	65	90,27%	Very Feasible
Media Expert	26	92,85%	Very Feasible

Material experts argue that the breadth of material in the E-module is very good, all components in the complete E-module and the developed E-module have used standard terms. The presentation of images and descriptions in the E-module is appropriate and the E-module developed in accordance with the KD and the characteristics of the material. In line with what was stated by Prabowo (2016) that e-modules are designed by presenting factual examples from the surrounding environment to help students understand the learning process. As per the assessment of the media expert, the E-module's cover design, particularly the choice of color for the module title, is highly effective due to its ability to create a strong contrast with the background color. Furthermore, the depiction of the E-module's content is praiseworthy for its capacity to accurately convey the essence of the subject, with precise and proportional representations of shapes mirroring reality.

E-Module Practicality

Based on the results of the analysis of the teacher response questionnaire to the E-module, it is known that the developed E-module is very practical to use for the learning process. The percentage score obtained from the teacher's response is above 60%. Based on the results of the analysis of teacher responses to the E-module on each indicator, it is believed that teachers strongly agree that the material contained in the E-module helps students achieve learning objectives, the appearance of the cover page and the combination of images and writing in Emodul attracts attention. The language, concepts and content of the E-module material are appropriate for the students' ability level. This is supported by Yastini *et al.,* (2018) that using a communicative approach, the language used in this e-module aims to help increase understanding for readers.

Based on the results of the analysis of student response questionnaires to the E-module in the small-scale test and large-scale test, the developed E-module is practical to use for the learning process. In the large-scale test 90.32% of students gave a very practical assessment. The results of student responses to the practicality of e-modules are presented in Table 2.

Table 2. E-Module Practical Results

Criteria	Small Scale		Large Scale	
	Total Students	Percentage	Total Students	Percentage
Very Practical	0	0%	26	90.32%
Practical	15	100%	4	9,68%
Practical enough	0	0%	0	0%
Less Practical	0	0%	0	0%
Not Practical	0	0%	0	0%

According to the results listed in Table 2 above, 90.32% of students gave a very practical assessment, while 9.68% of students rated the e-module as practical. Therefore, the e-module on Environmental Change material assisted by flipbook with PBL approach has been certified practical. This is evident from the percentage of students who gave practical assessments that exceeded the minimum target of 60%. In the process of checking the practicality of e-modules, there are four aspect factors, namely aspects of student interest in e-modules, aspects of delivering material content and presenting visual and media displays,

language aspects, and usability aspects. This is evidenced by the percentage of students who gave practical assessments that exceeded the minimum target of 60% (Sugiyono, 2016).

E-Module Effectiveness

The evaluation of the effectiveness of the e-module was carried out on a large-scale test. This large scale test was carried out on 30 students from class X-5. After the students' pre-test and post-test scores were obtained, the N-gain test and classical completeness test were then carried out. The N-gain test aims to determine whether there is an increase in student learning outcomes by knowing the difference between students' pre-test and post-test scores. Student learning outcomes after using problem-based emodules can be seen in Table 3.

Table 3. Students' Learning Outcomes

No	Data	Score		N-Gain	Category
		Pre-test	Post-test		
1	Lowest score	15	55	0,61	Medium
2	Highest score	90	95		
	Average	45,16	80,83		

The results of the N-gain test of 30 students who took part in the environmental change learning activities using problem-based e-module obtained an average pre-test score of 45,16 and a post-test score of 80,83. Based on the N-gain test, an N-gain score of 0.61 is obtained with a "medium" category. In addition to the N-gain test, the classical learning mastery test was also conducted to find out how many students succeeded in exceeding the KKM score after the e-module was applied in learning. Classical completeness is known from the number of students who can complete the material on environmental change by meeting the KKM score from the school, which is 70. Recapitulation of the results of the classical learning completeness can be seen in Table 4.

Table 4. The Classical Learning Completeness

No	Data	Score	Student Learning Completeness
1	Highest score	95	
2	Lowest score	55	
3	Average final score	80,83	93,3%
4	Number of students who exceed KKM	28	
5	Number of students who do not exceed KKM	2	

The average final score of students obtained 80,83 with students who successfully pass the KKM totaling 28 students and students who fail to pass the KKM are 2 students, so that the classical learning completeness obtained 93,3%. A learning is considered classically successful (classical completeness) if at least 85% of the number of students exceeds the KKM that has been determined based on the student's final score (Royani, 2017). Based on the student learning outcomes above, it can be stated that the problem-based e-module based on environmental change material is effective in improving problem-solving skills for students.

Oktavia et al. (2018) explained that e-modules are considered innovative because they are able to present comprehensive, interesting, interactive, and effective material in handling students' cognitive functions. In line with Suryanda et al. (2018), who concluded that the use of multimedia learning modules in mobile learning that can be accessed using electronic devices can improve student learning outcomes. The application of this problem-based e-module in its learning activities contains a PBL learning syntax. The PBL method used has a positive impact on students' problem solving skills and makes students active in learning because the learning activities present students to real problems in the environment so that students can improve students' understanding of the concepts and principles of the material being studied (Ionita & Simatupang, 2020). Research conducted by Qomariyah (2016) is also in line that PBL directly involves students in solving problems by utilising reasoning, real experience, and interpreting various concepts. Students are taught to be critical and analytical skills. The learning process prepares students to be

independent. PBL requires students to address and find solutions to real-world problems in a systematic step-by-step manner to gain information and skills related to the topic.

The acquisition of the average N-Gain value in the experimental class in the medium category indicates that the use of e-modules on Environmental Change material is effective for improving students' ability to solve problems. In line with Ule (2021), the average N-Gain which is in the middle or medium range, implies that the e-module is good and can be used to improve student learning outcomes in the experimental class. In line with Ndia et al., (2021), the average N-Gain obtained from classes treated with the use of e-modules is in the medium to high category, so the e-modules are effective. In line with the research of Wicaksono & Kuswanti (2022), the use of flipbooks for learning on Human Excretory System material is very useful and practical. In line with Andini & Qomariyah research (2022), stating that flipbooks as a media format are suitable for educational purposes. Their research highlights that both students and educators find flipbooks easy to use, and have a positive impact on the learning process. The consistency between these two studies reinforces the value of using flipbooks for an effective and engaging learning experience. In line with Soejana et.al., (2020), e-modules presented with the help of flipbooks have a positive impact in the form of increased learning outcomes in the experimental class.

CONCLUSION

E-modules based on problem-based learning assisted by flipbook are feasible to use in learning environmental change material based on the assessment results from material experts and media experts as well as student and teacher responses. E-modules based on problem-based learning assisted by flipbooks are practical to use in learning based on the results of student and teacher responses. E-modules based on problem-based learning assisted by flipbooks are also effective in improving student learning outcomes in the form of problem-solving skills based on the results of the N-gain test and classical learning completeness.

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