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DEVELOPMENT OF E-MODULES FOR PROBLEM-BASED SCIENCE MATERIALS IN CLASS IV OF SDN BUNULREJO 04 MALANG

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ABSTRACT

This research aims to produce and describe teaching materials in the form of problem-based science e-modules that are valid, practical and effective. This research is a type of research and development with the ADDIE development model, namely Analyze, Design, Development, Implementation, Evaluate. E-Module for problem-based science material which aims to make it easier for students to study independently, as well as helping students solve problems in science material. The research results show that the e-module was designed using the Canva application, containing science material from semester 1 to semester 2, as well as chapters 1 to chapter 8. Apart from that, it also contains learning outcomes, learning videos, room discussions, practice questions and evaluation questions. The e-module developed meets the criteria of being valid, practical and effective. The level of validity of the material from the e-module developed is 90% with the criteria "Very Valid". Meanwhile, the results of the assessment of the level of validity of the e-module media developed were 88.75% with the criteria "Very Valid". The teacher's assessment of the level of practicality of the e-module being developed was 97% in the "Very Practical" category. The results of the e-module effectiveness questionnaire by students or the student response questionnaire showed an e-module effectiveness level of 92.2%. The average Gain Score obtained was 0.65, which was included in the "Quite Effective" category.

Keywords: E-Modules, Problem-Based Science Materials, Elementary School

INTRODUCTION

Along with the times, science and technology are increasingly sophisticated and support new technologies. Technological advances have affected this life and cannot be avoided. (Mulyani & Haliza, 2021)This is because science and technology provide many benefits and make work easier. Technology in elementary school learning has often been utilized in the learning process. The benefits of using technology in learning are helping students (Kamsina, 2020)The benefits of using technology in learning are that it helps students (Kamsina, 2020), and can make students feel the benefits of technology because students can capture with various colors, image choices, sound and video. One form of technology is the use of e-modules as learning media (Widagdo, Haviluddin, Setyadi, Taruk, & Pakpahan, 2018). But apparently, the utilization of E-Modules in learning has not been maximized.

The most common problem that arises in learning is that most students do not understand problem-based problems. (Houghton, 2023). Most students always ask what the question means. In addition, teachers still use learning resources in the form of textbooks, learning videos and use contextual models, especially in social studies learning. (Simanjuntak, Hutahaean, Marpaung, & Ramadhani, 2021). The learning process of IPAS material, students are less enthusiastic because the teacher still uses manual teaching materials. (Lubis, Suryadarma, Paidi, & Yanto, 2022). This shows that there is a need for an innovative problem-based learning model that teachers need to do. (Wena, 2020). Problem-based learning can be started by presenting problems given to students that aim to get students to think about solving problems (Dewi & Septa, 2019). (Dewi & Septa, 2019). Problem solving ability aims to enable students to improve reasoning and critical thinking (Amin et al., 2021). (Amin, Degeng, Setyosari, & Djatmika, 2021). The problem-based learning model is very important to use in learning so that students can improve their critical thinking, reasoning, and problem solving skills. problem-based learning can be implemented in learning mathematics, Indonesian, Pancasila Education and IPAS. (Sari, Sumarmi, Utomo, & Astina, 2021). Therefore, it is important that e-modules are developed to help students be motivated to learn and enthusiastic in learning. With e-modules, students can make good use of cellphones and help students learn independently at home. (Zhafirah, Erna, & Rery, 2021). E-modules are equipped with learning models, one of which is a problem-based learning model.

E-modules are computer-based modules and contain fragments of questions that make students understand the material. (Ricu Sidiq & Najuah, 2020). E-modules include material, learning videos, practice questions and evaluation questions. (Lestari, Saidah, & Aliya Putri, 2022). The e-module format is tailored to the needs of teachers and students. (Widiastuti, 2021). The format used in e-modules includes learning materials, learning videos, practice questions and evaluation questions. (Hydayat & Ariani, 2022). E-modules can also include several learning models such as, discobery models, inquiry, pbl and others. (Wahyuni, Sari, & Hurriyah, 2020). E-modules that are developed based on problems intend to help students learn problem solving both in everyday life. (Feriyanti, Hidayat, & Asmawati, 2019). The problem-based learning model has been implemented in the 2013 Curriculum and the Merdeka curriculum.

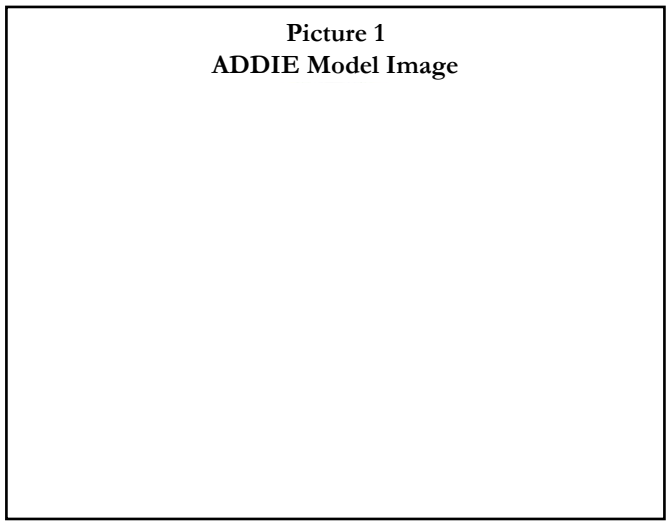
The development of e-modules has been reviewed by several researchers, (Zulkhi & Jannah, 2021). Based on the results of this study, the electronic module made using Pageflip Proficient 3D programmer has a generally good and attractive appearance, because it looks like a real book. With this Pageflip 3D application, it can make it easier for teachers to convey the material to be conveyed, and make it easier for teachers to display material in accordance with the existing environment so that learning objectives can be achieved in real terms. Salsabila & Syaban, (2022) The e-module developed contains material content, learning videos, types of exercise questions, evaluation questions and this e-module is in the form of hyperlinks and can be used on Android or IOS. (Sholichin, Razak, Lufri, & Irdawati, 2022) The e-module developed based on the "Page Flip" application contains appropriate material content. Of the two studies, there has been no research that develops e-modules with a discussion room. Therefore, the purpose of this study is to develop problem-based e-modules of IPAS material for fourth grade students of SDN Bunulrejo 04 Malang which are valid, practical, and effective.

METHOD

Research Design

This study uses the research and developmnet method by adapting the ADDIE model (Ghirardini, 2011). The ADDIE model is used to develop an effective problem-based E-module to be applied in learning social studies materials. The ADDIE model also focuses on learning objectives so that the products produced can achieve the learning objectives that have been set.

Picture 1
ADDIE Model Image



The following are the steps of the ADDIE model in problem-based learning e-module development research, namely 1) The Analysis stage is carried out by analyzing problems through observation, through tests of problem-solving skills on IPAS material, as well as interviews with fourth grade teachers and it has been found that students lack problem-solving skills on IPAS material, and students look less enthusiastic during IPAS lessons. 2) Determine the purpose of making modules, 3) analyze student problems by measuring the level of students' ability to solve problems in answering social studies questions, 4) Identify Available Resources, 5) Develop a Work Plan.

The Design stage is carried out to create an e-module design. The design stage includes determining the development team including the main developer (researcher), validator team of material experts and media experts, practitioners namely teachers and students (e-module users), determining the resources needed, and creating a storyboard of problem-based IPAS e-modules. At the Development stage, researchers carried out the realization of the product design. This stage is carried out by validation of experts, namely material and media experts related to the development of e-modules developed. The next stage is the Implementation of the e-module by conducting trials in small groups, namely the fourth grade class of SDN Bunulrejo 04 Malang. Furthermore, researchers conducted an evaluation to measure how far students' abilities in problem solving on IPAS material after using the e-module. The purpose of the evaluation stage is to see the quality or feasibility of the product and the learning process. This stage is a phase where the products that have been produced are valid, practical and effective, and it is expected that there will be an increase in the ability to solve problems in IPAS material.

Data Collection Techniques

The data collection techniques include: 1) Observations were made on March 6, 2021 by observing teachers during the learning process, facilities at school and student activeness during the learning process, 2) interviews with fourth grade teachers at SDN Bunulrejo 04 Malang to find out the use of learning resources in learning activities, as well as student responses to the implementation of learning activities, 3) questionnaires include a material expert validation questionnaire of 27 items, media experts of 20 items, and a teacher user practicality questionnaire of 30 items and a student effectiveness questionnaire of 14 items, and 4) documentation using a camera to take photos, pictures and videos during the research.

Subjects of research and development of problem-based learning e-modules are 1) Material Experts, consisting of one person as a validator on aspects of material and learning concepts, at least educated S3, experts in the field of social studies. 2) Media experts consisting of one person as a validator on aspects of learning media, at least educated S3. Expert in the field of technology 3) Class IV elementary school teacher users, have a minimum teaching experience of one year, have a minimum education of S1 majoring in teacher education. Teacher user subjects are grade IV teachers of SDN Bunulrejo 04 Malang, and 4) Fourth grade student users of SDN Bunulrejo 04 Malang as users of problem-based learning e-modules to find out student responses to the effectiveness of e-module products. The trial was carried out through two stages, namely a small-scale trial conducted on 6 students and a large-scale trial conducted on 23 students**.**

Data analysis techniques

The data analysis techniques used in this research include qualitative data analysis by describing the results of interviews with fourth grade teachers of SDN Bunulrejo 04 Malang then data reduction to find out the center of the problem that occurred at SDN Bunulrejo 04 Malang. Presentation of data, after selecting data, at the data presentation stage. Data is presented in descriptive sentences, so that it is better understood. Data verification. This stage is carried out repairing or checking the data, so that the data presented is valid in accordance with the original data. The second analysis is quantitative analysis with expert validity, practicality test, and effectiveness test.

DISCUSSIONS

Results

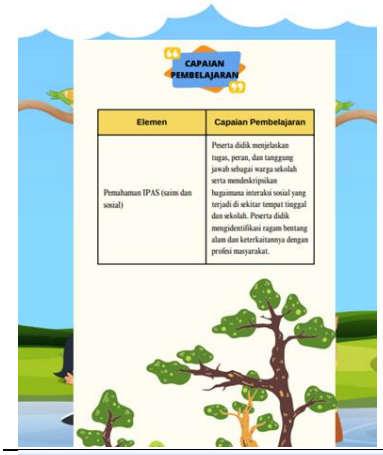
Results of Problem-Based E-Module Development

This developed teaching material is a teaching material in the form of a problem-based e-module of IPAS material made using the Canva application. In addition, this e-module is equipped with material coverage in the form of IPAS starting from semester 1 and semester 2, from chapter 1 to chapter 8. This e-module is equipped with several menus, namely material, learning videos taken from the Youtube application. Then there is a discussion room from the Jamboard application, practice questions and evaluation questions from the goegle form application. Then this e-module is also equipped with instructions for use to make it easier for users to use the e-module. The description of each display is as follows**.**

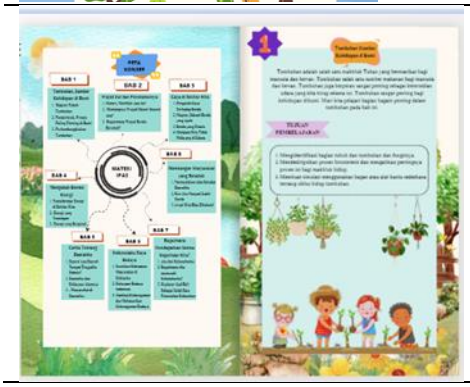
Table 1
IPAS E-module Development Results

IPAS E-module Illustration	Description
	**Home Page** On the home page, there is an e-module cover title "E-module IPAS Problem-Based Learning". The initial display has pictures of boys and girls that are adjusted to the characteristics of students. Then there is a description of the author's name, class, and semester.
	The next installment is the preface. The function of the preface in the e-module is to provide a little description of the e-module.
	The next display has a table of contents. The function of the table of contents is to provide an overview or outline to the reader regarding the subject matter contained in an e-module.

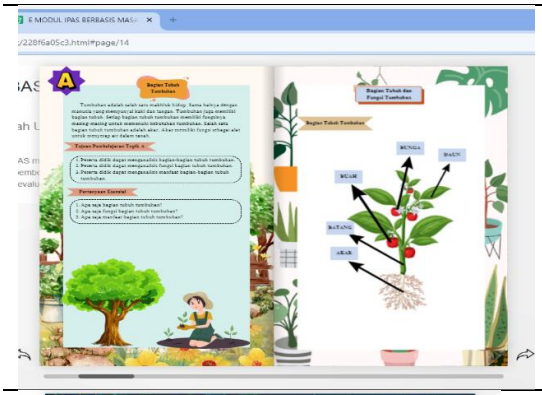
The problem-based IPAS e-module comes with instructions for use. The function of the instructions for use is to facilitate users in operating the e-module properly. In addition, the instructions for use are available in video form. The video tutorial can be accessed through the link provided.



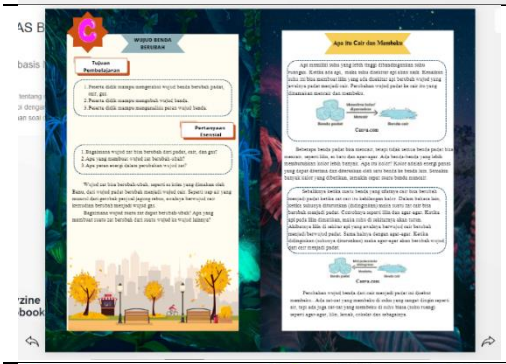
The next page contains learning outcomes. The function of learning outcomes is to inform readers that this e-module contains IPAS material coverage from chapter 1 to chapter 8.



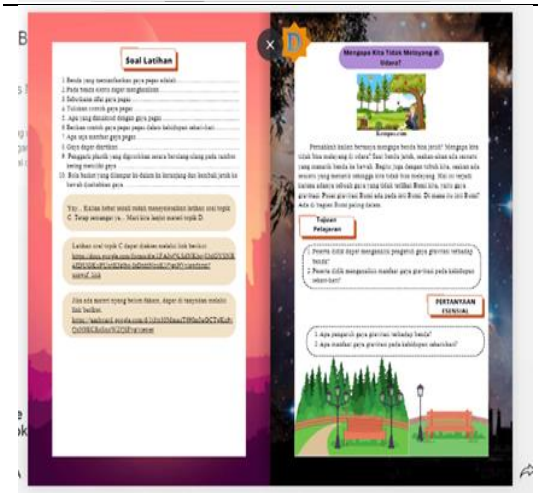
The next page contains a concept map. The concept map serves to provide an overview of the subthemes in chapter 1 to chapter 8.



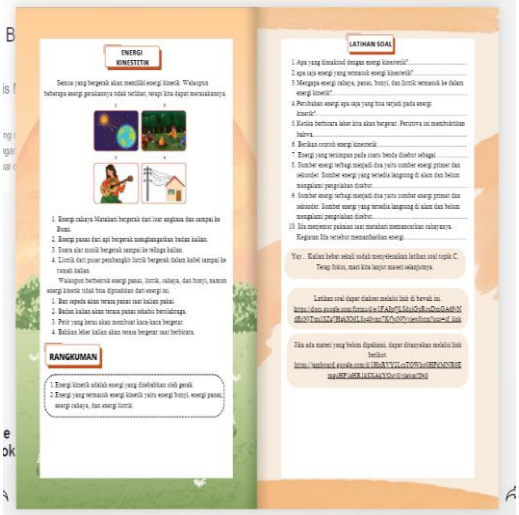
The next page has chapter 1 plants as a source of life. This chapter consists of 3 topics consisting of a. plant body parts, b. photosynthesis, c. plant reproduction. Each topic consists of learning objectives, triggering questions, learning materials, learning videos, discussion rooms and practice questions.



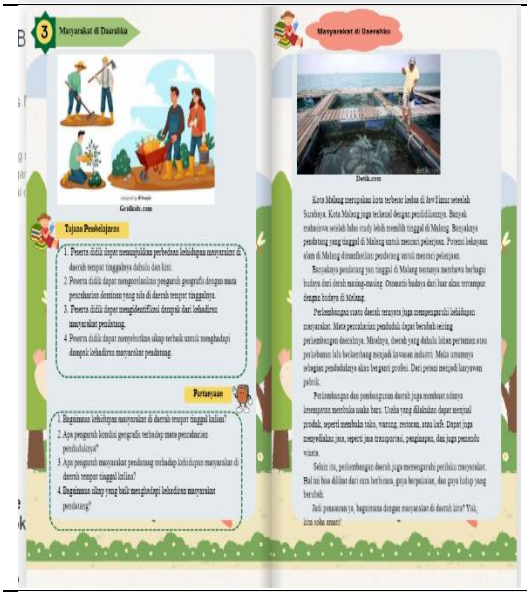
The next page is chapter 2. This chapter contains material on the Form of Substance and its Changes. In this chapter contains about mass, the form of matter, and the form of changing objects. Chapter 2 is equipped with learning objectives, triggering questions, materials, learning videos, discussion rooms and practice questions.



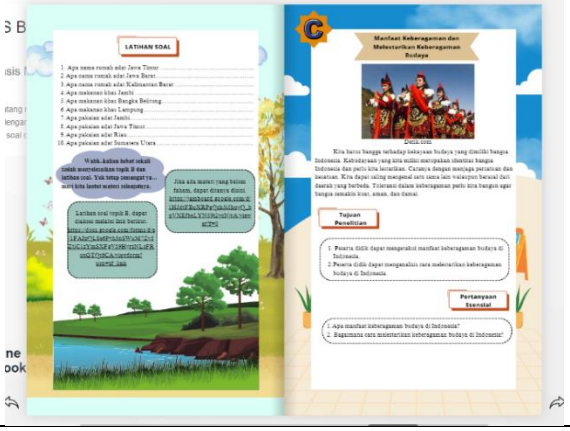
The next page contains chapter 3 Styles Around Us. This chapter explains about forces. There are 4 topics in this chapter, namely the effect of force on objects, magnets, elastic objects, and why we don't float in the air. This chapter is also equipped with learning objectives, materials, videos, discussion rooms and practice questions.



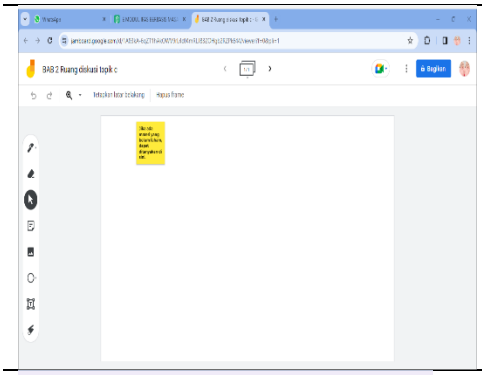
The next page has chapter 4 on Changing Forms of Energy. This chapter consists of 3 topics namely energy transformation around us, stored energy, and energy in motion. This chapter is also equipped with learning objectives, triggering questions, materials, learning videos, discussion rooms and practice questions.



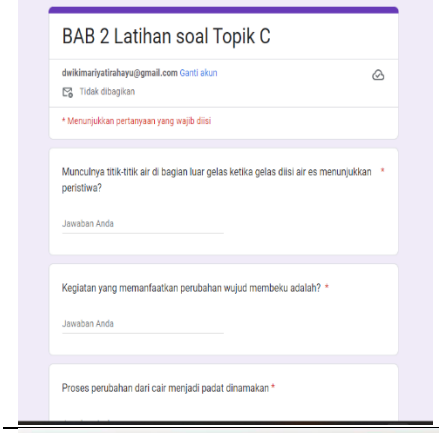
The next page is chapter 5 about My Regional Stories, this chapter contains stories that exist in each student's area. There are 4 topics in this chapter, namely, what the area used to be like, my area, its natural resources, the people in my area and protecting my place. This chapter is also equipped with learning objectives, triggering questions, materials, learning videos, discussion rooms and practice questions.



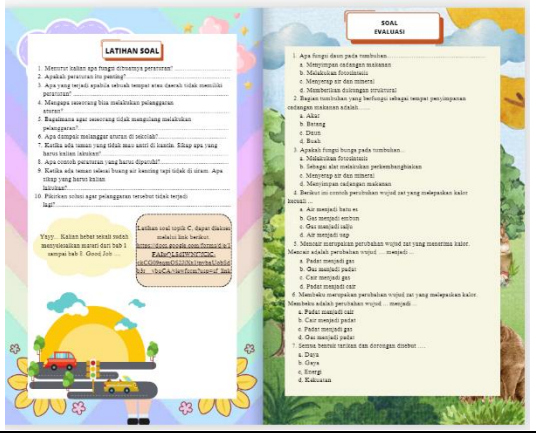
The next page is chapter 6 which discusses Indonesia's Rich Culture. This chapter explains the uniqueness of cultures in Indonesia, the richness of Indonesian culture, and the benefits of the diversity of Indonesian cultural preservation. This chapter is also equipped with learning objectives, triggering questions, materials, learning videos, discussion rooms and practice questions.



The discussion room uses the Jamboard application. The discussion room serves to help students to discuss if there is some material that has not been understood. The teacher becomes a facilitator.



Practice questions are found in each chapter and topic. Exercise questions serve to train students to understand the material presented in the e-module. Exercise questions are in the form of a *google drive*. Exercise questions are in the form of links that can be accessed.



The evaluation questions consist of 20 questions from chapter 1 to chapter 8. The evaluation questions are multiple choice. Evaluation questions are presented on *google drive*. The evaluation questions aim to determine the understanding ability of student participants in understanding chapters 1 to chapter 8.

Data Analysis of Problem-Based E-Modules

Tabel 2
Validity Test Results

No.	Indicator	Tse	Tsh	Description
1.	Material in accordance with learning outcomes	4	4	Strongly Agree
2.	Material in accordance with learning objectives	4	4	Strongly Agree
3.	The material presented is complete	4	4	Strongly Agree
4.	The material presented is clear	3	4	Agree
5.	The material presented is actual	3	4	Agree

6.	The material is presented systematically	4	4	Strongly agree
7.	The material presented is packaged in an interesting way	4	4	Strongly Agree
8.	The material presented is problem-based	3	4	Agree
9.	Questions are clearly formulated.	4	4	Strongly Agree
10.	Questions are presented in full	4	4	Strongly Agree
11.	Questions are based on theory and concept	3	4	Agree
12.	Answer key according to the question	4	4	Strongly Agree
13.	There is feedback on the results of the practice questions	3	4	Agree
14.	Evaluation is consistent with learning objectives.	4	4	Strongly Agree
15.	The language used is communicative	4	4	Strongly Agree
16.	The terms and statements used are precise and appropriate	3	4	Agree
17.	Easy to understand language	3	4	Agree
18.	Language appropriate to student characteristics	3	4	Agree
19.	E-modules do not run slowly	3	4	Agree
20.	E-modules are easy to use	4	4	Strongly agree
21.	E-modules can be run on various hardware specifications	4	4	Strongly Agree
22.	Comes with instructions for use	4	4	Strongly agree
23.	Comes with clear feedback	3	4	Agree
24.	The display used is attractive	4	4	Strongly agree
25.	Creative in expressing ideas	4	4	Strongly agree
	Total	90	100	
	Average	3.60	4	

Processed by researchers: 2024

From the data written, it has obtained the results that the product obtained gets a percentage of 90% from the material expert validation. Referring to table 3.5 with the predicate very valid or feasible to use without revision. Qualitative formative evaluation results are in the form of suggestions and criticisms. The criticism given is when in the writing there are many typos in the e module. While the advice given by the material expert is that in general the material in this learning media is good, already TPACK, but the concept map has not described the flow from simple concepts to the objectives of this learning media, the concept map should not describe the division of chapters.

Table 3
Data on Media Expert Formative Evaluation Results

No.	Indicator	Tse	Tsh	Description
1.	Cover Identity	4	4	Strongly Agree
2.	Attractive cover image	4	4	Strongly agree
3.	Clear cover lettering	4	4	Strongly agree
4.	Good cover color combination	3	4	Agree
5.	The writing can be read well	4	4	Strongly agree
6.	Good color combination	3	4	agree
7.	The animation used is interesting	3	4	Agree
8.	The animation used is not distracting	3	4	Agree
9.	Button works well	4	4	Strongly agree
10.	e-modules are not running slowly	3	4	Agree

11.	E-modules are easy to use	4	4	Strongly Agree
12.	E-modules can run on various hardware specifications.	3	4	Agree
13.	Comes with instructions for use	4	4	Strongly Agree
14.	Has a clear flow of use	3	4	Agree
15.	Comes with clear feedback	4	4	Strongly Agree
16.	Operation as directed	4	4	Strongly Agree
17.	The display used in the e-module is interesting	4	4	Strongly agree
18.	Creative in expressing ideas	3	4	Agree
19.	The sound used is not distracting	4	4	Strongly agree
20.	The video used by menrik	3	4	Agree
	Total	71	80	
	Average	3,55	4	

Processed by Researcher (2024)

From the data written, we have obtained the results that the resulting product gets a percentage of 88.75% from the media expert validation. Referring to table 3.6 with the predicate very valid or feasible to use without revision. The results of formative evaluation are qualitative in the form of suggestions and criticisms. The advice given by media experts is that problem-based e-modules of IPAS material can be used by grade IV elementary schools.

Practicality

Table 4
Teacher User Formative Assessment

No.	Indicator	Tse	Tsh	Description
1.	Cover identity is appropriate	4	4	Strongly Agree
2.	Attractive cover image	4	4	Strongly Agree
3.	Clear cover lettering	4	4	Strongly agree
4.	The color combination of the cover part is good	4	4	Strongly agree
5.	The e-module writing is correct	4	4	Strongly agree
6.	The images used are not distracting	3	4	Agree
7.	The animation used is not distracting	4	4	Strongly agree
8.	Appropriateness of design color with writing font	4	4	Strongly agree
9.	Interesting e-module design	4	4	Strongly agree
10.	The material used is in accordance with the CP	4	4	Strongly agree
11.	The material used is in accordance with the learning objectives	4	4	Strongly agree
12.	The material presented is complete	4	4	Strongly agree
13.	The material presented is actual	4	4	Strongly agree
14.	The material presented is packaged systematically	4	4	Strongly agree
15.	The material presented is packaged in an interesting way	4	4	Strongly agree
16.	The material presented is problem-based	4	4	Strongly agree
17.	The material presented meets the steps of PBL	4	4	Strongly agree
18.	The question formulated is clear	4	4	Strongly agree
19.	The questions presented are complete	4	4	Strongly agree
20.	Questions are in line with theory and concept	4	4	Strongly agree
21.	Answer key according to the question	4	4	Strongly agree

22.	There is feedback on the results of the practice questions	4	4	Strongly agree
23.	Evaluation is consistent with the question	4	4	Strongly agree
24.	The language used is communicative	3	4	Agree
25.	The terms and statements used are precise and appropriate	3	4	Agree
26.	Easy to understand language	4	4	Strongly agree
27.	Language in accordance with student characteristics	3	4	Agree
28.	E-modules do not run slowly	4	4	Strongly agree
29.	Young e-modules used	4	4	Strongly agree
30.	e-modules can run on various hardware specifications	4	4	Strongly agree
31.	Comes with instructions for use	4	4	Strongly agree
32.	Has a clear flow of use	4	4	Strongly agree
33.	Comes with clear feedback	4	4	Strongly agree
34.	The display used in the e-module is interesting	4	4	Strongly agree
35.	Creative in expressing ideas	4	4	Strongly agree
	Total	136	140	
	Average	3.40	4	

Processed by researchers: 2024

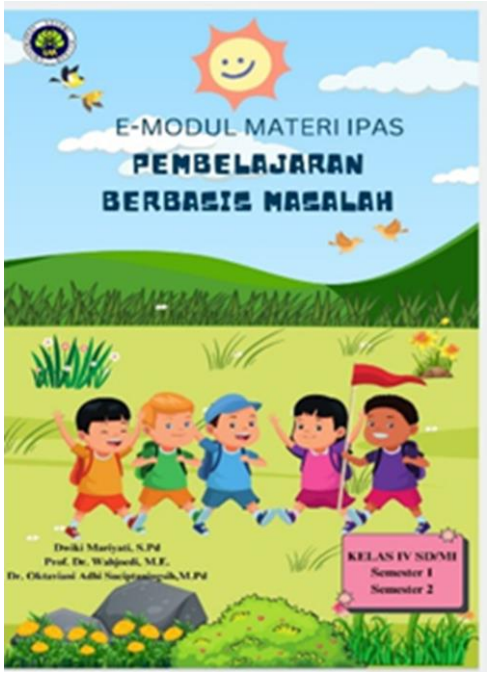
Formative evaluation is carried out aiming to find deficiencies or errors contained in the e-module of IPAS material and followed up before being used for trials on users, namely students. after the formative evaluation by the teacher has obtained a percentage result of 94%. Based on predetermined criteria, the problem-based IPAS e-module material gets a very practical category, or is suitable for use without revision.

Discussion

Development of Problem-Based E-Modules

Based on the results of the material experts and media experts described in chapter IV that the problem-based IPAS e-module material is declared very valid and feasible to use. E-modules can be declared valid if they meet the following indicators. The first indicator is the material in accordance with the learning outcomes. This is in accordance with Oktaviara & Pahlevi, (2019) that the e-modules developed have been systematically organized into certain learning units that aim to achieve learning outcomes. The second indicator is that the material is in accordance with the learning objectives. this is in accordance with the opinion of Cheva & Zainul, (2019) that e-modules are designed to help students master learning objectives. With the achievement of learning objectives, the learning process will be optimized and students will understand the material presented.

Picture 2
Cover image



According to (Pratama, Anggraini, Yusri, & Mufit, 2021) e-learning modules have several benefits, including (1) adding and expanding the horizons of the material presented in class. This opinion is in line with the third indicator, namely the material is presented completely. In the e-module designed, the material presented must be complete so that students understand the material better, with the presentation of complete material students add more new knowledge. The fourth indicator is that the material presented is clear. This is in accordance with the opinion of (Physical & Health, 2017) which explains that the material is presented clearly and in depth accompanied by learning videos, images, animations. Furthermore, the fifth indicator is the actual material presented. This is in line with the opinion of (Santosaet al., 2017) that the material presented in the e-module is actual which discusses current events. The purpose of presenting actual material is so that students do not miss knowledge and always update current knowledge.

The existence of problem-based IPAS e-modules can improve students in working together, reasoning, and can master the material according to learning objectives. Students can also learn to solve problems both and daily life or problems in learning.

Effectiveness of Problem-Based E-Modules

The response questionnaire is given to students which aims to see student responses during the learning process using e-modules. After students fill out the response questionnaire. After the e-module is implemented in the classroom, then the student

response questionnaire is analyzed using a response questionnaire. The results of the effectiveness of the student response questionnaire in class IV SDN Bunulrejo 04 Malang obtained a result of 92.2% with effective criteria. So seen from the results of the student response questionnaire get a very effective category.

Tests of students' ability to solve problem-based problems on IPAS material aimed at the effectiveness of using e-modules in the learning process and measuring tests of students' ability to solve problem-based problems on IPAS material. To measure the improvement of students' problem solving skills, researchers gave pretest questions with IPAS material before learning and gave postests with IPAS material after learning and using electronic modules. The results of the effectiveness of the e-module based on the test of students' ability to solve problem-based problems of IPAS material for grade IV students of SDN Bunulrejo 04 Malang obtained the average Gain Score obtained of 0.65% which is included in the moderately effective category.

CONCLUSSION

The results of this development research are in the form of valid, practical and effective problem-based IPAS e-modules. This research and development process produces products in the form of valid, practical, and effective problem-based IPAS e-modules. This research and development uses stages in the form of the ADDIE model. The process of making this problem-based IPAS material e-mule uses the Canva application. Images or icons in this e-module are taken from canva and google applications. Learning materials are taken from teacher's books and student books for class IV IPAS independent curriculum. Learning videos are taken from youube. The discussion room uses the Jamboard application, as well as practice questions and evaluation questions using the google form application.

The quality of problem-based IPAS e-modules is valid, practical and effective. Based on the results of the validity of the e-module can be seen from the results of the material expert validation which obtained a percentage of 90% with very valid criteria and is suitable for use without revision. While the results of the validity of the e-module from media experts obtained a percentage of 88.75% with very valid criteria and feasible to use without revision. The results of e-module practicality can be seen from the e-module practicality questionnaire by teachers who get a percentage of 97% with very practical criteria and are suitable for use without revision. The results of the effectiveness of the e-module can be seen from the student ability test from the pretest and post test with an N-Gain value of 0.65 with a fairly effective category. While the effectiveness results seen from the results of the student response questionnaire obtained a percentage of 92.2% with very effective criteria

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