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Development of Problem-Based Learning-Based E-Modules Using Adobe Flash Professional CS6

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Abstrak: Based on data analysis from observations and interviews with science teachers at SMPN 22 Padang, it can be seen that the student learning process is still passive, and students' interest and motivation in learning are still lacking. Textbooks are the main teaching materials used by both teachers and students. These problems make it difficult for teachers to carry out the learning process, causing students to have difficulty understanding the learning material. This study aims to produce an e-module based on problem-based learning using Adobe Flash Professional CS6 which is valid, practical, and effective for class VIII SMP students. This type of research is design and development research that uses the Plomp development model. The research data were obtained from validity, practicality, and effectiveness tests. Based on the results of the study, showed that the e-module based on problem-based learning had a validity value of 84.24% with very valid criteria based on the validator's assessment. The results of the practicality assessment by the teacher are 90.68% and the results of the practicality assessment by the students are 87.72% with very practical criteria. Problem-based learning-based e-modules that have been developed have effectiveness with very effective categories in terms of competency assessment in the cognitive domain, affective domain, psychomotor domain, and student learning activities.

Keywords: E-Modul; Problem-Based Learning; Research Development

Introduction

The learning process is a process that includes interactions that occur between teachers and students and between classmates and their environment. The interaction must be arranged to achieve the best results based on the learning objectives applied (Lufri, 2007). Learning that needs to be created by teachers in schools is active, innovative, creative, effective, and fun learning so that it can describe the whole learning process that involves students actively participating during the learning process to maximize learning outcomes.

Based on the researcher's observations and the results of an interview with a science teacher at SMPN 22 Padang, the information obtained is that students tend to be passive in the learning process. This is because when the teacher explains the learning material and asks a question, students tend to be silent so no one wants to ask questions during learning. Student learning activity is also still lacking because it is influenced by students themselves who are not ready to learn.

Students find it difficult to learn the concepts of the respiratory system and the excretory system in humans. This is because both of these materials contain some material that is abstract concepts such as processes that occur in the body such as the respiratory process and processes in the excretory system, making it difficult for students to observe and understand. The results of the questionnaire given, it is known that as many as 67% of students have difficulty understanding the concepts of the respiratory system and the excretory system. Teachers and students cannot visualize the material process of the respiratory system and excretory system in humans so it has an impact on student learning outcomes.

The implementation of the learning process used by teachers and students is in the form of textbooks and student activity sheets (known as LKS), but in its application, it uses student activity sheet. Based on the

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results of the student problem questionnaire, showed that as many as 70% of students answered that the presentation of the textbook used was less attractive and less varied so it had not facilitated students in the learning process. This has an impact on the lack of motivation and interest of students to learn, especially in terms of reading, so students are more waiting for an explanation of the material from the teacher than students looking first through learning materials. In this case, the factors that need to be developed are teaching materials that are on the characteristics of students and the learning objectives to be achieved so that the quality of learning becomes better. According to Akbar and Razak (2019), innovation is needed to create teaching materials that can improve learning based on the characteristics and needs of students.

Based on the problems experienced by teachers and students in the learning process, it is necessary to have teaching materials. One of the teaching materials that can improve learning activities and student learning outcomes in the learning process is by developing teaching materials in the form of modules. Modules are teaching materials that can explain learning materials clearly to students. Modules are teaching materials that are designed and packaged systematically in the form of the smallest learning unit based on a certain curriculum (Fradila et al., 2021). Along with the rapid development of technology, encouraging the replacement of print technology with computer technology in the form of electronic modules (e-modules).

E-modules are digital teaching materials that are compiled and presented in an electronic format (Pramana et al., 2020). The advantages of e-modules compared to other print media are that they are more interactive, easily accessible, can display images and animations, can improve the quality of learning itself and can be used repeatedly.

If the e-module is included with the learning model it will be more effective. The problem-based learning model is one of the learning models that can improve learning outcomes. The problem-based learning model is a learning model designed to help students acquire important knowledge in problem-solving, develop their learning models, and participate in teams. According to Munurut Hasanah, Alberida, and Rahmi (2018), problem-based learning can provide active learning conditions for students to solve a problem using the stages of the scientific model, enabling students to learn knowledge about these problems and the skills to solve them.

Utilizing technological advances with the help of the Adobe Flash Professional CS6 software application is one solution to increase activeness, interest, and motivation to learn, thereby increasing student learning outcomes in the learning process with problem-based learning e-modules. Adobe Flash Professional CS6 is an application for making interactive learning media that is easy and can be used by everyone. According to Madcoms (2012) Adobe Flash Professional CS6 is software that can support interactive learning. Interactive learning materials with Adobe Flash Professional CS6 software can combine text, images, and animations and have the ability to interact with users.

Method

The Plomp development model was used in the design and development of this research. The Plomp development model has three stages: (1) preliminary research, (2) development or prototype, and (3) assessment (Plomp & Nieveen, 2013). Validity is carried out at the development or prototype stage. The validation stage uses the Plomp model as follows.

a. Prototype I Development Stage

The prototype begins with the creation of an e-module product based on problem-based learning using the Adobe Flash Professional CS6 application program, followed by designing an e-module storyboard based on the results of preliminary research. Self-evaluation is used to evaluate prototype I, which includes revising the e-module that has been designed using a checklist to check for errors that can still be found in prototype I and then revising it. Furthermore, the prototype II development stage was carried out.

b. Prototype II Development Stage

At the development stage of prototype II, validation was carried out with experts or experts (expert review) to obtain a valid problem-based learning-based e-module. Aspects that have been validated include constructing aspects, content aspects, graphic aspects, and linguistic aspects.

c. Prototype III Development Stage

Furthermore, the practicality test was carried out by a small group evaluation. At this stage of prototype III development, six students with different abilities (high, medium, and low) were evaluated. The small group practicality test aims to see the practicality of problem-based learning-based e-modules on respiratory and excretory systems.

d. Prototype IV Development Stage

Prototype IV is the result of a revision of prototype III. Prototype IV will proceed to the assessment stage by conducting a large group trial (field test).

Result and Discussion

The results of the initial investigation are used as a guide in developing problem-based learning-based e-modules using Adobe Flash Professional CS6 software applications. Here are the results of this development stage:

1. Development or Prototyping Stage

The prototype I Development Results

Making prototype I started by making storyboards for problem-based learning-based e-modules. This was followed by product development based on problem-based learning e-modules with the Adobe Flash Professional CS6 software program, starting with designing a systematic presentation of material and learning objectives to be achieved which were divided into several learning activities and guided by KD 3.9 and KD 3.10 in the 2013 Curriculum.

Figure 1. E-Module Cover Display

Prototype II Development Results

After prototype I was revised, then prototype II was carried out through formative evaluation by experts in the form of an assessment of the validity of the e-module based on problem-based learning using the Adobe Flash Professional CS6 software application. Assessment of expert validation (expert review) is based on an evaluation of four aspects: construct aspects, content aspects, graphic aspects, and linguistic aspects. The assessment instrument used an e-module validity questionnaire based on problem-based learning. Table 1 shows the results of the e-module validation based on problem-based learning.

Table 1. Validation Results of Problem Based Learning E-Module Based on Validator

Rated Aspect	Validation Value (%)	Criteria
Construct Aspect	83.33	Very Valid
Content Aspect	7778	Valid
Graphical Aspect	80.00	Valid
Language Aspect	95.83	Very Valid
Overall Value	84.24	Very Valid

Based on Table 1, it can be concluded that the requirements for the validity of the e-module module based on problem-based learning based on construct aspects, content aspects, graphic aspects, and linguistic aspects have been met, with an overall score of 84.24% very valid. This means that the problem-based learning-based e-module developed has good quality and can be used for the next stage. According to Afriadi, et al (2019), a very valid product shows suitability, meaning, and usefulness of the product. In line with Fortuna, et al (2021) the validity of a product is used to determine the extent to which the developed product meets the validity criteria based on expert judgment.

Based on the results of data analysis from the constructed aspect, problem-based learning-based e-modules have a value of 83.33% with very valid criteria. It is known that problem-based learning-based e-modules as teaching materials were developed that met the constructed aspect because they were designed to operate properly, the instructions for use were appropriate, the material was systematically described according to the concept, and could improve learning activities and student learning outcomes. According to Afriadi, et al (2019), teaching materials are adapted to user instructions, and the presentation of the material is arranged systematically so that users can easily understand the material. This is to the research of Diantari et al., (2018) which states that the ease of use of e-modules will make it easier for students to access teaching materials independently.

The validation results from the content aspect with a value of 77.78% with valid criteria. Problem-based learning-based e-modules were found to be valid in the content aspect because they met the material criteria that were adjusted to the expected achievement of learning indicators, e-modules that contained important concepts in the respiratory system and excretory system materials, as well as concepts that were difficult to understand. visualized are made in the form of images and videos as well as animations, making it easier for students to understand the learning material. The presentation of images in the module, according to Oktarina et al., (2018) aims to make it easier for students to understand the images displayed so that the images displayed can clarify the concepts of the material that students must understand. The learning process will be more interesting and interactive with the existence of e-modules that can convey messages through pictures and videos so that the material presented is easier to understand by students (Husniah, 2018).

The validation results on the graphic aspect evaluated by the expert or expert are stated at 80.00% with valid criteria. In the graphic aspect, problem-based learning-based e-modules are very valid because they meet the criteria, namely images and videos by the

explanation or concept of the material, have clear visuals, and are of the appropriate type and size so that they are easy to see and understand to read. In addition, the layout and function of the buttons match the material and have an attractive overall design. Thus, the graphic aspect is expected to be able to clarify concepts that are still abstract in their entirety and can be visualized, so that students understand the learning material. This is in line with Sintia and Violita (2020) that the module has easy-to-read writing, images that can improve students' understanding, and colors that attract students' learning interest.

The results of the subsequent validation of the language aspect obtained a value of 95.83% categorized as very valid. This means that problem-based learning-based e-modules are developed properly and correctly by Indonesian Spelling (EBI). The description of the material delivered in written form has been assessed as communicative, effective, and efficient as well as the use of good and correct language so that the e-module can be understood well by students. According to Oktarina et al. (2018), the linguistic aspect of the sentence structure module used is Enhanced Spelling (EYD) and is simple, clear, unambiguous, and communicative.

Prototype III Development Results

The third prototype development stage carried out was the practicality test of the e-module which was developed through small group evaluation. At this stage, six students with different abilities were evaluated, namely low, medium, and high. The practicality test aims to see the practicality of the e-module. The results of the practicality data analysis of small group evaluations can be seen in Table 2.

Table 2. E-Module Practical Test Results in Small Groups

Rated Aspect	Validation Value (%)	Criteria
Ease of Use	79.76	Practical
Learning Time Efficiency	79.17	Practical
Benefit	80.95	Practical
Average	78.96	Practical

Based on the results of the small group evaluation test in the table. 2, it can be concluded that the overall average is 78.96% with practical criteria. This shows that the e-module developed is usable and practical, so it does not need to be revised. Can be used with a large group trial phase (field test).

Prototype IV Development Results

Prototype IV is the same as prototype III. This is because at the practical test stage for small groups, there was no revision, Prototype IV continued to the assessment phase by conducting large group trials or field tests.

2. Assessment Phase

The results of the assessment stage were obtained from the results of practical tests for teachers and students on problem-based learning-based e-modules. In addition, it is also obtained from the results of the effectiveness test which includes the cognitive domain, affective domain, psychomotor domain, and student learning activities.

Practical E-module by Teacher

The results of the average value of problem-based learning-based practical data analysis of e-modules by teachers can be seen in Table 3.

Table 3. Practicality Test Results by Teachers

Rated Aspect	Validation Value (%)	Criteria
Ease of Use	92.86	Very Practical
Learning Time Efficiency	87.50	Very Practical
Benefit	91.67	Very Practical
Average	90.68	Very Practical

Based on the results of the teacher's practicality in the table. 3, that the practicality assessment given by the teacher to the e-module shows an average practical value of 90.68% with very valid criteria. The practical aspects that were evaluated were ease of use, the efficiency of learning time, and benefits. All of these aspects have met the practical criteria of problem-based learning-based e-modules for teachers. With this, it can be concluded that the practicality test for teachers of problem-based learning-based e-modules is very practical to use in the learning process. According to Plom & Niven (2013), what is called a practical category is a product that is developed that can be used, the product can be used, is easy to use, and is by research objectives.

The practicality of E-modules by Students (Field test)

The results of the analysis of the e-module practicality test in the large group (field test) can be seen in Table 4.

Table 4. Practical Test Results by Students

Rated Aspect	Validation Value (%)	Criteria
Ease of Use	88.95	Very Practical
Learning Time Efficiency	85.16	Very Practical
Benefit	89.06	Very Practical
Average	87.72	Very Practical

Based on the results of the students' practicality in the table. 4, it is known that the average practical value of the problem-based learning-based e-module developed for students gets an average practicality score of 87.72% with very practical criteria. This shows that the results of the practicality test of the developed e-module are very practical for students to use in the learning process.

Based on the results of the ease of use aspect, it appears that there are no obstacles in using problem-based learning-based e-modules. This shows that the e-module is easy to use, easy to follow commands in the e-module, navigation buttons can function properly, easy to understand instructions for use, uses easy-to-understand language, easy-to-read font type and size, and easy-to-understand images. and videos presented on the e-module. Thus, the ease of use of e-modules shows a good response from students. According to Rosmawanti et.al., (2020), the use of e-modules makes it easier for students to understand the material in the lesson.

Cognitive Domain Competency Assessment

Cognitive learning outcomes in this study can be obtained through a final test in the form of a written test with objective questions (multiple choice) given to students at the end of the meeting in the learning process. The average results of the analysis of students' cognitive domain competencies can be seen in Table 5.

Table 5. Results of the Average Competence in the Cognitive Domain

Class	Average	Category
Experiment	85.50	Very good
Control	78.08	Good

Based on Table. 3 it can be seen that the average cognitive competence of the experimental class is higher than the average of the control class. The average value of the experimental class is 85.50 and the average value of the control class is 78.08. The experimental class was given treatment using an e-module based on problem-based learning, while the control class was given no treatment. Furthermore, to analyze the data, the data was tested with the results of hypothesis testing (t-test). based on the results of the t-test, it is known that the significance value of students' cognitive learning outcomes is 0.001. This shows that the significance value is 0.001 < 0.05, which means that H_1 is accepted.

Based on the results of hypothesis testing conducted on the learning outcomes of the cognitive domain in the experimental class and the control class, shows that there is a significant effect on the learning outcomes of the two classes. This shows that the use of e-modules based on problem-based learning in the learning process has a positive influence on learning outcomes in the cognitive domain of students. According to Wirawan, et al (2017) which states that e-modules can improve student learning outcomes so that they are suitable for use to support the learning process. E-modules are considered innovative because they can provide complete, interesting, interactive teaching materials and carry out good cognitive functions (Oktavia, et al., 2018).

Affective Domain Competency Assessment

The average results of the analysis of students' affective domain competencies during the learning process can be seen in Table 6.

Table 6. Results of the Average Competence in the Affective Area

Class	Average	Category
Experiment	86.39	Very good
Control	82.00	Very good

Data in Table. 4, it can be seen that the average value of the affective domain competence of the experimental class students is higher than the control class. The average value of the experimental class is 86.39 in the very good category, while the average value of the control class is 82.00 in the very good category. Furthermore, the Mann-Whitney test was carried out, it was found that the significance value of the assessment of the students' affective domain was 0.001. This shows that the significance value is 0.001 <0.05, which means that hypothesis H_1 is accepted.

Based on students' affective learning outcomes, the results of the Mann-Whitey test in the experimental class and control class showed that there were significant differences in affective learning outcomes for the two classes. This shows that the use of e-modules can familiarize students to behave with scientific attitudes in the learning process so that it has a positive impact on students' affective learning outcomes. According to Aziz et al., (2014) problem-based learning, of which can make students participate in independent learning to solve problems, be able to work together in learning, and work in teams well.

Psychomotor Domain Competency Assessment

The average results of the psychomotor domain competency analysis of students during the learning process can be seen in Table 7.

Table 7. Results of the Average Competence in the Psychomotor Area

Class	Average	Category
Experiment	86.85	Very good
Control	78.50	Good

Based on Table 5. It can be seen that the average value of the psychomotor competence of the experimental class students is higher than the control class with an average of 86.85 and 78.50. Furthermore, hypothesis testing for psychomotor competence was carried out using the Mann-Whitney test. Based on the hypothesis test with the Mann Whitney test on student learning outcomes in the psychomotor domain, it was found that 0.000 < 0.05. This indicates that H_1 is accepted.

Psychomotor learning outcomes of students in the experimental class and control class show that there are significant differences between the two classes. This shows that the use of problem-based learning-based e-modules on students' psychomotor competence has a positive impact on psychomotor learning outcomes in the learning process of the two classes. This is due to the use of e-modules in the learning process that guides and directs students in carrying out discussion tasks, enabling students to easily develop their psychomotor skills. Israfiddin, et al (2016) stated that problem-based learning models can improve students' communication skills so that students are more active and enthusiastic in responding to lessons. This is by Hanafi and Samsudin (2012) who stated that interactive skills, easy access, and fun are some of the advantages provided by electronic learning materials.

Assessment of Learning Activities

The results of the average value of student learning activities can be seen in Table 8.

Table 8. Results of the Average Competence in the Affective Area

Class	Average	Category
Experiment	94.23	Very active
Control	79.73	Active

Data in Table. 6, it can be seen that the average value of student learning activities in the learning process takes place. The result of the average value of the experimental class is 94.23 with very active criteria, while the average value of the control class is 79.73 with active criteria. The results of the hypothesis test (t-test) are known that the significance value of student learning activities is 0.009. This shows that the significance value is 0.009 < 0.05, which means that the hypothesis is accepted.

Based on the results of the student learning activity scores in the experimental class and the control class, shows that there is a significant difference in student learning activities in the two classes. Student learning activities are related to the learning materials used in the form of e-modules that include text, and images, and there are learning videos that support the learning process. This proves that the use of e-modules based on problem-based learning has a positive effect on student learning activities. According to Ayu, Lufri & Sumarmin (2018), it is shown that the use of biology modules equipped with problem-based learning-oriented worksheets can increase students' oral and written activities and stimulate students' thinking power. Discussing in groups will make students better understand the lessons being followed.

Conclusion

Based on the results of the research that has been done, the following conclusions are obtained. The problem-based learning-based e-module that has been developed has a validity value of 84.24% with very valid criteria based on the validator's assessment of the constructed aspect, content aspect, graphic aspect, and language aspect. Problem-based learning-based e-modules that have been developed based on practicality with an assessment of aspects of ease of use, aspects of learning time efficiency, and aspects of benefits, seen from the practicality assessment by teachers 90.68% with very practical criteria and practicality assessment by students 87.72% with very practical criteria. Problem-based learning-based e-modules that have been developed have effectiveness with very effective categories in terms of competency assessment in the cognitive domain, affective domain, psychomotor domain, and student learning activities.

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